Volume XXV, Nr. 2, 2019



CENTER OF PROMOTING HEALTH EDUCATION AND MOTIVATION FOR PREVENTION IN DENTISTRY CENTER FOR CONTINUOUS MEDICAL EDUCATION

REDUCE ȘI AJUTĂ LA PREVENIREA PROBLEMELOR GINGIVALE ÎN 4 SĂPTĂMÂNI PENTRU A ÎNTRERUPE CICLUL GINGIVITEI



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Dental Hygienist

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Detection of plant miR166a in liver of mice after oral feeding



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Abstract

Documented seven years ago, dietary cross-kingdom delivery of plant microRNAs (miRNA) followed by cross-kingdom regulation of gene expression has since been a subject of vivid debate. Here we investigated the putative intestinal absorption of one of the most abundant and stable small RNAs in plants, after gavage administration of total RNA extracts of *Linum Usitatissimum* and the LNA-synthetic mature microRNA form of miR-166a. Quantitative real-time PCR analysis of liver samples harvested 12 hours after gavage confirmed that plant mir166a from total RNA extracts can be detected in mice after oral ingestion at significant higher levels than its synthetic form. Additional studies are required to determine whether or not plant exogenous miRNAs could pass through the GI in sufficient quantity in order to regulate endogenous gene expression.

Keywords: plant microRNA, cross-kingdom transfer, LNA, RT-PCR.

INTRODUCTION'

MicroRNAs (miRNAs) are a class of non-coding, single-stranded RNA, approximately 19–24 nucleotides long, involved in in post transcriptional regulation of gene expression through interaction (mostly) with 3'UTR of target mRNAs [1] Since their discovery in 1999 in Caenorhabditis elegans [2], over 35.000 miRNAs in 271 species have been described, according to miRBase release 22 (March 2018, <u>http://www.mirbase.org/</u>).

MiRNAs have been identified in plants and animals, the main differences between the two kingdoms being related to their methylation level and the mechanism of action upon target mRNA. Plant miRNAs are methylated at their 3'ends by HEN1 (, while most animal miRNAs are unmethylated [3]. Plant miRNAs bind with perfect or near-perfect complementarity to their targets, while in animals the binding is mostly by imperfect complementarity. [4] Perfect/near perfect complementarity interaction is followed by target mRNA degradation mostly by direct cleavage while partial complementarity is followed by inhibition of mRNA translation [5]. Of note, miRNA-mRA interaction takes place at the level of 3'UTR in animals, while in plants all segments of miRNAs can participate in the interaction with the miRNA [6]. A single miRNA has the ability to recognize and bind to hundreds of different mRNAs, and one target mRNA contains binding sites for and interacts with multiple miRNAs, allowing them to play a decisive role in a wide range of biological processes and diseases. [7,8]

Our daily diet provides essential nutrients and constituents required for survival and growth, but also for health promotion and disease prevention [9]. Plant bioactive secondary metabolites such as tanins, polyphenols and alkaloids used in herbal medicine have been known for centuries for their therapeutic role in various diseases. [10] However, despite the intense research effort, the molecular mechanisms behind these therapeutic actions are still not understood. Recently, a research group provided evidence indicating that plant miRNAs may survive for several hours in the mammalian gut and subsequently enter the blood stream, further targeting and modulating the expression of mammalian target genes. [11] These unexpected findings of cross-kingdom miRNA communication opened an entirely new avenue for understanding the (therapeutic) effect of plants on vertebrate physiology and pathology. [12] However, these findings were hard to reproduce experimentally and faced a reasonable skepticism in the scientific community. Several papers followed, challenging the findings of Zhang et all., raising further questions regarding the ability of food miRNAs (free or packaged into exosomes) to survive the action of digestive enzymes and cross the gut barrier into animal circulation [13-15]

In order to enter mammalian circulation and eventually reach key organs, such as the liver, dietary plant miRNAs have to overcome multiple obstacles. First, once in the mammalian GI tract, the exogenous miRNAs will have to overcome phagocytosis, degradation by numerous digestive enzymes and a low pH environment. The high level of stability seems to be related to two different mechanisms: 1. plant miRNAs are 2'-O-methylated and this modification protects them against peroxidation; 2. Exogenous miRNAs may be encapsulated into and thus protected by different carriers such as exosomes, microvesicles, RNA-binding proteins (e.g. nucleophosmin 1), high-density lipoproteins (HDL) and Ago-2. [16]

Aim and objectives

Here we investigate the hypothesis that if surviving digestion, free microRNAs can cross the gut barrier into portal circulation. For this purpose, we fed adult male mice by gavage with miR-166a (one of the most stable and abundant microRNA in plants) either purified (together with other miRNAs) from flax, either synthesized using LNA (locked

nucleic acids) nucleotides (resistant to nuclease action). We show that liver (the filter of portal circulation) samples harvested 12 hours post-gavage contain significant higher amounts of plant miR166a, irrespective of the form of miR166a administered (isolated from plants of synthetic). We concluded that when administered in high doses, food miRNAs can indeed pass gut barrier into blood stream and reach organs, although the role of those dietary miRNAs in mammals physiology and pathology remains under debate.

MATERIAL AND METHODS

Plant materials and total RNA extraction

We used commercially available brown flax seeds (Linum usitatissimum L., family Linaceae) that were laid on o filter paper cushion soaked with distilled water and placed in a germination chamber at room temperature for 24 h. Total RNA was extracted using miRVana miRNA isolation kit from Ambion. The quality of the plant RNA extracted was checked using the Agilent 2100 Bioanalyzer and samples with RNA Integrity Number RIN<8 were discarded.

Preparation of synthetic miRNA

The LNA synthetic miR-66a (5'-UCGGACCAGGCUUCAUUCCCC-3) and LNA scrambled polynucleotide (5'- UCACCGGGUGUAAAUCAGCUUG-'3) were purchased from Exiqon and dissolved in RNAse free PBS Ph=7.4

Animal procedures

All animal experiments were approved by the Ethics Committee of University of Medicine and Pharmacy "Victor Babes", Timisoara. All animals (3-months old males of a mixed genetic background) were kept on a 12:12 hours light/dark cycle and fed *ad libitum* a regular chow (Cantacuzino Institute, Bucharest). We designed three experimental lots: control lot – animals gavaged 12ul scrambled LNA, total RNA lot - animals gavaged 14ul total RNA extracted from *Linum usitatissimum* (flax), and miR-lot – animals gavaged 10ul synthetic LNA-miR-166a (Table 1).

Lot No of animals		Content of gavage administration	Concentration ng/µl	Total volume µl	
Ι	3	LNA scrambled miR	113,3	100	
II	3	Total plant RNA	100	100	
III	3	LNA mir-166a	132	100	

Table 1. Experimental design

Tissue collection and RNA purification

Twelve hours after gavage, mice were euthanized by cervical dislocation and liver samples (approximate 15mg) harvested and immediately immersed in RNA later and stored at -80°C until further use.

RNA was purified using the Ambion miRVana miRNA isolation kit accoding to the accompanying protocol. The quality of the RNA extracted was checked using the Agilent 2100 Bioanalyzer; all samples have RIN>8.

Analysis of miR166a level in liver tissues by RT-PCR

For miR-66a quantification, cDNA was synthesized from 10ng of RNA using the cDNA Synthesis kit for RT-PCR (Thermofisher) and PCR amplification was performed using a dedicated Taqman microRNA assay (Thermofisher). The relative fold changes of miR-166a expression was calculated using the delta delta Ct method using U6 snRNA as endogenous control.[17]

RESULTS

Based on available data, we selected the highly conserved plant miRNA, miR166a, which is highly expressed in various plants, including Linum usitatissimum (flax), usually consumed for its health benefits [18-20]. In order to test the effect of intestinal digestion of microRNAs upon intestinal transfer, we also used synthetic LNA-miR-166a, known for their resistance to degradation due to the extra bridge connecting oxygen in 2' with carbon in 4'.

We designed 3 experimental lots. The control lot, with mice fed LNA-scrambled miR166a, that has the same composition as the miR166a, but the nucleotides are placed in a random order. The linseed total microRNA lot was fed total RA extracted from germinated flax seed and the LNA lot, with mice fed LNA miR-166a. We reasoned that if a naked microRNA would escape degradation, it might be absorbed, then reach portal circulation and get filtered by the liver. To verify our hypothesis, mice liver samples were collected 12 hours after gavage intervention and RNA extracted; the results are depicted in *Figure 1*.

All liver tissues were analyzed for miR-166a expression using Taqman qRT-PCR and deltadelta Ct method. All reactions were performed in triplicates and changes in expression levels assessed for significance by Student heteroscedastic, twin-tails t-test (*Figure 2*). Our experiment demonstrated a significant difference in microRNA recovery between samples.



Figure 1. Concentration of total RNA isolated from mice liver



Figure 2. Fold change expression of mir166a, calculated by $\Delta\Delta$ CT method

DISCUSSIONS

Despite the few observations of trans-kingdom microRNA transfer, there are multiple mechanistically aspects that remain unexplained and which bring into question the validity and mere existence of this transfer. One of these aspects brings into question the ability of naked microRNA to cross the gut barrier into the circulation. To date, microRNAs from plant based-diets have been difficult to detect in blood and tissues of mammals after a single serving.

In the present study, we chose to focus on naked microRNAs and selected miR-166a, a highly conserved plant miRNA and strongly quasi-ubiquitously expressed in plants [21]. We chose to work with *Linum usitatissimum* (flax), a medicinal plant known for its possible influence on mammal metabolism and for its high content of miR-166a in all the plant tissues [19].

We asked whether exogenous plant miRNAs can survive digestion and enter the blood stream. For better intake, all RNA probes were given by oral-gavage. Twelve hours after a single dose-feeding of total plant RNA, liver levels of mir166a in mice were significantly elevated by 1,6-fold (p=0.015) compared to control lot. N ext, we aimed to evaluate the impact of digestive enzyme upon miRNA and gavaged the mice with synthetic, LNA-based miR166a. Interestingly, the liver expression of miR166a was again unregulated but at a lower level (fold change = 1.4) and insignificant from a statistical point of view when compared to control lot (p=0.282). This suggests that either the synthetic, rigid miR-166a is less absorbed in the intestine compared to the native form, or the native plant microRNAs is better protected from digestion than their corresponding synthetic forms.

We also noticed that the difference between total RNA group and LNA-miR groups is highly significant statistically (p < 0.001), even though the fold changes are very close. The rather high expression (Ct around 32) of miR-166a in the control group might suggest that either the qRT-PCR assay is not specific, or, the food is contaminated with unprocessed/low processed plant diet. We favor the second hypothesis, the cross-contamination from diet, since our mice chow is rich in soy (*Glycine max*), where gma-miR166a (sharing the same sequence with miR166a from flax), is one of the most abundant microRNA. It is thus plausible that the detection of plant miRNA in the liver is due to the prolonged contact with this specific miRNA.

Contamination by sources such as non-dietary environmental plant matter also presents a risk of false positives. This hypothesis is sustained by the fact that the level of LNA synthetic mir166a was significantly lower, when in fact methylene bridge between the 2'-O and the 4'-C atoms makes them resistant to endo- and exonucleases. [22] The LNA backbone theoretically confers a higher sensitivity for detection by in situ hybridization or qRT-PCR. Also, these synthetic oligonucleotides can be detected in low doses in plasma for weeks after administration making them suitable to be long-acting modulators. [23][24]

Moreover, to verify whether a physiological dose of total plant RNA was achieved in our experiment, we compared the dose given to mice with the equivalent in humans. Based on estimated exposures to plant-derived RNAs from food consumption, an individual (daily intake should be somewhere in between 30-40g) would have to consume 600g of flaxseed, in order to achieve these results [25]. This suggests that the presence of exogenous miRNAs in mammals' circulation upon oral ingestion is a highly dose-dependent phenomenon. In fact, several research articles supporting cross-kingdom transfer were criticized for lack of relevance in the feeding regimen in mouse studies. This was also the case in the experiment conducted by Zhang et al. in which a 55 kg person should eat around 33 kg of cooked rice/day just to achieve the same levels of RNA intake [26]. In other words, the apparent regulation of LDLRAP1 seen in mice would never occur in humans. In summary, these results provide another evidence that indeed a cross-kingdom transfer is possible, but despite ingesting high levels of plant-derived and synthetic miRNA, the systemic levels of exogenous miR166a is below any concentrations that could be relevant for gene regulation.

Evidence for				Evidence against			
Year	Source origin	miRNAs	Ref.	Year	Source origin	miRNAs	Ref.
2012	rice	miR168a	[11]	2012	Soy, corn, rice	miR168a	[39]
2014	Tomato,rice, corn,cabbage, etc	miR 172	[27]	2013	rice	miR168a	[40]
2014	milk	miR-29b, miR-200c	[28]	2013	Various fruits	miR156, miR160, miR166, miR167, miR168, miR172	[41]
2015	Honeysuckle	miR 2911	[29]				
2015	Watermelon juice	Many miRNAs	[30]				
2015	Synthetised miRNAs	miR34a	[31]	2013	Various fruits	miR156a, miR159a, miR169a	[42]
2016	Spinach,cauliflow er, broccoli, etc	miR2911	[32]	2014	Various fruits	miR156a, miR167a, miR168a	[43]
2016	cabbage	miR160, miR2673	[33]	2014	Broccoli sprouts	miR167a, miR824	[44]
2016	Synthetised miRNAs	miR159	[34]	2015	milk	miR375	[45]
2016	Strawberry fruit	miR168	[35]	2015	Synthetised miRNAs	miR143, miR145	[31]
2017	Maize	Many miRNAs (including miR166a)	[36]	2016	milk	miR-29b,miR- 200c	[46]
2017	Cabbage	miR2911	[37]	2016	Polen	miR156a, miR277a,	[47]
2017	Varoius plants	miR451	[38]	2018	corn	miR156a, miR164a, miR167a	[48]

Table 2. evidence pro and against cross-kingdom communication

Finally, we provide an overview of the evidence for and against a significant role for dietary miRNAs in influencing gene expression. Dietary miRNA transfer appeared to be an attractive candidate to explain several unsolved mysteries in nutritional science. Following Zhang's article, several studies have confirmed or infirmed that exogenous, dietary plant miRNA can be taken up into the bloodstream

and delivered to tissues in mammals. (Table 2)

A lot of supporting cross-kingdom transfer studies have focused on miR2911, a honeysuckle-derived miRNA, mainly because miR2911 was not degraded during the plant boiling process.[29] The high stability of this particular plant miRNA seems to rely on its unique sequence. Interestingly, in all studies that supported the cross-kingdom hypothesis, plant miRNAs were claimed to be encapsulated in exosomes or other carriers. Next, the liberated naked miRNAs were delivered via blood stream to various tissues cells where they could modulate target gene expression. Accumulating evidence suggests that edible plant-

derived exosome-like nanoparticles (EPDELNs) can be absorbed in the mammalian GI tract and reach circulation.[49] However, more details are needed in order to elucidate the molecular mechanism underlying the uptake and action of plant-derived miRNAs.

On the other hand, some follow-up studies generated contradictory results. In an attempt to validate the positive results regarding dietary miRNAs (the case of Zhang et all, miR168a from rice and miR-29b, miR-200c from milk) and their role in gene regulation, direct replications of those studies have been made. Unfortunately, little or no exogenous miRNAs were detected in the blood or liver of mammals after oral ingestion. Further analyses suggested that contamination could be the reason behind the high level of plant microRNA reads in animal tissues. [43]

In choosing the right miRNA, one should consider several important factors: food processing and level of intake, degradation by the GI tract, passing across the intestinal barrier, stability in circulation and assimilation by tissues such as the liver, but also the concentration of that specific miRNA in plants.

CONCLUSIONS

Our results suggest that when administered in high quantity through gavage, plant miR166a may survive in the GI tract of mice, get absorbed and enter the portal circulation. Only after ingesting high quantities of exogenous microRNA, the systemic levels of miR166a may reach the tissue concentrations that could be relevant for gene regulation. Interestingly, liver changes in miR166a concentration is significantly higher after total RNA gavage compared to the LNA, rigid miRNA form, suggesting that GI digestion might not play a significant role in limiting the absorption of dietary miRNAs. Overall, miRNA transfer from plants to mammals after oral ingestion remains a fascinating field of research, much of which is not yet sufficiently explored.

REFERENCES

- 1. Bartel DP, MicroRNAs: Genomics, Biogenesis, Mechanism, and Function, Cell, Vol. 116, January 23, 2004, 281-297.
- 2. Lee RC, Feinbaum RL, Ambros v, The C. elegans Heterochronic Gene lin-4 Encodes Small RNAs with Antisense Complementarity to &II-14, Cell, Vol.
- 3. Zhang B, Pan X, Cobb GP, Anderson TA, Plant microRNA: a small regulatory molecule with big impact, Dev Biol. 2006 Jan 1;289(1):3-16. Epub 2005 Dec 1. 75, December 3, 1993, 843-854.
- 4. Ameres SL, Zamore PD. Diversifying microRNA sequence and function. Nat Rev Mol Cell Biol 2013; 14:475–88.
- 5. Axtell MJ, et al.: Vive la différence: biogenesis and evolution of microRNAs in plants and animals. Genome Biology 2011, 12:221.
- 6. Y. Kurihara, Y. Watanabe, Arabidopsis micro-RNA biogenesis through Dicer-like 1 protein functions, Proc. Natl. Acad. Sci. U. S. A., 101 (2004), pp. 12753-12758
- Perge P, Nagy Z, Decmann Á, Igaz I, Igaz P. Potential relevance of microRNAs in inter-species epigenetic communication, and implications for disease pathogenesis. RNA Biol. 2017;14(4):391– 401.
- 8. Bartel DP. MicroRNAs: target recognition and regulatory functions. Cell. 2009;136(2):215–33.
- 9. Liu RH. Health-promoting components of fruits and vegetables in the diet. Adv Nutr. 2013;4(3):384S-92S.
- 10. Li Z., Xu R., Li N. MicroRNAs from plants to animals, do they define a new messenger for communication? Nutrition & Metabolism (2018) 15:68
- 11. Zhang L, Hou D, Chen x, et al., Exogenous plant MIR168a specifically targets mammalian LDLRAP1: evidence of cross-kingdom regulation by microRNA, Cell Research (2012) 22 :107-126.

- 12. Sala-Cirtog M, Marian C, Anghel A, (2015). New insights of medicinal plant therapeutic activity the miRNA transfer. Biomedicine & Pharmacotherapy, 74, 228-232.
- 13. Weber JA, Baxter DH, Zhang S, et al., The microRNA spectrum in 12 body fluids, Clin Chem. 2010; 56(11):1733-1741
- 14. Zhang, Y., Wiggins, B. E., Lawrence, C., Petrick, J., Ivashuta, S., and Heck, G. (2012). Analysis of plant-derived miRNAs in animal small RNA datasets. BMC Genomics 13:381
- 15. Dickinson, B., Zhang, Y., Petrick, J. S., Heck, G., Ivashuta, S., and Marshall, W. S. (2013). Lack of detectable oral bioavailability of plant microRNAs after feeding in mice. Nat. Biotechnol. 31, 965–967.
- 16. Redis RS, Calin S, Yang Y, You MJ, Calin GA, Cell-to-cell miRNA transfer: from body homeostasis to therapy, Pharmacol Ther. 2012 Nov;136(2):169-74.
- 17. Pfaffl MW. A new mathematical model for relative quantification in real-time RT-PCR. Nucleic Acids Res. 2001;29:e45
- 18. G.Neutelings et Identification and characterization of miRNAs and their potential targets in flax al.Journal of Plant Physiology 169 (2012) 1754–1766
- 19. Gorshkov O, Chernova T., Mokshina N., Gogoleva N., Suslov D. et al, Intrusive Growth of Phloem Fibers in Flax Stem: Integrated Analysis of miRNA and mRNA Expression Profiles, Plants (Basel). 2019 Feb 19;8(2)
- 20. Barvkar VT., Pardeshi VC, Kale SM, Qiu S, Rollins M et al, Genome-wide identification and characterization of microRNA genes and their targets in flax (Linum usitatissimum): Characterization of flax miRNA genes, Planta. 2013 Apr;237(4):1149-61
- 21. Li X., Xie X., Li J., Cui Y., Hou Y., Zhai L, et all, Conservation and diversification of the miR166 family in soybean and potential roles of newly identified miR166s, Li et al. BMC Plant Biology (2017) 17:32 DOI 10.1186/s12870-017-0983-9
- 22. Straarup et al. Short locked nucleic acid antisense oligonucleotides potently reduce apolipoprotein B mRNA and serum cholesterol in mice and non-human primates. Nucleic Acids Res. 2010 38(20):7100-11.
- 23. Hagedorn P.H., Persson R., Funder E.D., Albæk N. Diemer S. L., Hansen D.J. et al, Locked nucleic acid: modality, diversity, and drug discovery, Drug Discovery Today, Volume 23, Issue 1, January 2018, Pages 101-114
- 24. Roberts J., Palma E., Sazani P., Arum H., Cho M. and Kole R., Efficient and Persistent Splice Switching by Systemically Delivered LNA Oligonucleotides in Mice, MOLECULAR THERAPY Vol. 14, No. 4, October 2006
- 25. Petrick JS, Brower-Toland B, Jackson AL, Kier LD. 2013. Safety assessment of food and feed from biotechnology-derived crops employing RNA-mediated gene regulation to achieve desired traits: a scientific review. Regul Toxicol Pharmacol 66: 167–76
- 26. Witwer K.W, Hirschi K.D., Transfer and functional consequences of dietary microRNAs in vertebrates: Concepts in search of corroboration, Bioessays 36: 394–406.
- 27. Liang, G., Zhu, Y., Sun, B., Shao, Y., Jing, A., Wang, J., et al. (2014). Assessing the survival of exogenous plant microRNA in mice. Food Sci. Nutr. 2, 380–388.
- 28. Auerbach, A., Vyas, G., Li, A., Halushka, M., and Witwer, K. (2016). Uptake of dietary milk miRNAs by adult humans: a validation study. F1000Res 5:721.
- 29. Zhou, Z., Li, X., Liu, J., Dong, L., Chen, Q., Liu, J., et al., Honeysuckle encoded atypical microRNA2911 directly targets influenza A viruses. Cell Res., 2015, volume 25, 39–49.
- Liang H., Zhang S., Fu Z., Wang Y., Wang N., Liu Y. et all, Effective detection and quantification ofdieteticallyabsorbed plant microRNAs inhuman plasma, Journal of Nutritional Biochemistry 26 (2015) 505–512
- 31. Mlotshwa S, Pruss GJ, MacArthur JL, Endres MW, Davis C, Hofseth LJ, et al. A novel chemopreventive strategy based on therapeutic microRNAs produced in plants. Cell Res. 2015;25(4):521.
- 32. Yang, J., Hotz, T., Broadnax, L., Yarmarkovich, M., Elbaz-Younes, I., and Hirschi, K. D. (2016). Anomalous uptake and circulatory characteristics of the plant-based small RNA MIR2911. Sci. Rep. 6:26834.
- 33. Pastrello, C., Tsay, M., Mcquaid, R., Abovsky, M., Pasini, E., Shirdel, E., et al. (2016). Circulating plant miRNAs can regulate human gene expression in vitro. Sci. Rep. 6:32773.
- 34. Chin AR, Fong MY, Somlo G, Wu J, Swiderski P, Wu X, et al. Cross-kingdom inhibition of breast cancer growth by plant miR159. Cell Res. 2016;26(2):217.

- 35. Cavalieri D, Rizzetto L, Tocci N, Rivero D, Asquini E, Si-Ammour A, et al. Plant microRNAs as novel immunomodulatory agents. Sci Rep. 2016;6:25761.
- 36. Luo, Y., Wang, P., Wang, X., Wang, Y., Mu, Z., Li, Q., et al. (2017). Detection of dietetically absorbed maize-derived microRNAs in pigs. Sci. Rep. 7:645.
- 37. Yang J, Kongchan N, Primo Planta C, Neilson JR, Hirschi KD. The atypical genesis and bioavailability of the plant-based small RNA MIR2911: bulking up while breaking down. Mol Nutr Food Res. 2017;61(9)
- 38. Wang W, Hang C, Zhang Y, Chen M, Meng X, Cao Q, et al. Dietary miR-451 protects erythroid cells from oxidative stress via increasing the activity of Foxo3 pathway. Oncotarget. 2017;8(63):107109.
- 39. Zhang, Y., Wiggins, B. E., Lawrence, C., Petrick, J., Ivashuta, S., and Heck, G. (2012). Analysis of plant-derived miRNAs in animal small RNA datasets. BMC Genomics 13:381
- 40. Dickinson, B., Zhang, Y., Petrick, J. S., Heck, G., Ivashuta, S., and Marshall, W. S. (2013). Lack of detectable oral bioavailability of plant microRNAs after feeding in mice. Nat. Biotechnol. 31, 965–967.
- 41. Witwer, K. W., Mcalexander, M. A., Queen, S. E., and Adams, R. J. (2013). Real-time quantitative PCR and droplet digital PCR for plant miRNAs in mammalian blood provide little evidence for general uptake of dietary miRNAs: limited evidence for general uptake of dietary plant xenomiRs. RNA Biol. 10, 1080–1086.
- 42. Snow, J. W., Hale, A. E., Isaacs, S. K., Baggish, A. L., and Chan, S. Y. (2013). Ineffective delivery of diet-derived microRNAs to recipient animal organisms. RNA Biol. 10, 1107–1116.
- 43. Tosar, J. P., Rovira, C., Naya, H., and Cayota, A. (2014). Mining of public sequencing databases supports a non-dietary origin for putative foreign miRNAs: underestimated effects of contamination in NGS. RNA 20, 754–757.
- 44. Baier SR, Nguyen C, Xie F, Wood JR, Zempleni J. MicroRNAs are absorbed in biologically meaningful amounts from nutritionally relevant doses of cow Milk and affect gene expression in peripheral blood mononuclear cells, HEK-293 kidney cell cultures, and mouse livers–3.J Nutr. 2014;144(10):1495–500.
- 45. Title, A. C., Denzler, R., and Stoffel, M. (2015). Uptake and function studies of maternal milkderived microRNAs. J. Biol. Chem. 290, 23680–23691. doi
- 46. Auerbach, A., Vyas, G., Li, A., Halushka, M., and Witwer, K. (2016). Uptake of dietary milk miRNAs by adult humans: a validation study. F1000Res 5:721
- 47. Masood M., Claire P. Everett, Stephen Y. Chan & Jonathan W. Snow (2016) Negligible uptake and transfer of diet-derived pollen microRNAs in adult honey bees, RNA Biology, 13:1, 109-118
- 48. Mico, V.; Martin, R.; Lasuncion, M.A.; Ordovas, J.M.; Daimiel, L. Unsuccessful detection of plant microRNAs in beer, extra virgin olive oil and human plasma after an acute ingestion of extra virgin olive oil. Plant Foods Hum. Nutr. 2016, 71, 102–108.
- 49. Xiao J., Feng S., Wang X., Long K., Luo Y., Wang Y., et all., Identification of exosome-like nanoparticle-derived microRNAs from 11 edible fruits and vegetables, 2018, PeerJ 6:e5186.

The Prospects of Treatment in Medication-Related Osteonecrosis of the Jaw



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Abstract

Osteoporosis is known to be an age-related condition, commonly met on elderly people, that represents one of the most important causes in orthopedic traumatology. Osteonecrosis associated with jaw medication (MRONJ) is considered to be a therapy-resistant entity. Both Denosumab and bisphosphonates are associated with development of osteonecrosis of the jaw and are also approved in the treatment of postmenopausal osteoporosis in the cases of women that develop increased risk of fracture, in the same time being approved for treatment of bone loss that is proved to be associated with cancer. While applying conservative and surgical treatment due to recommendations, there have been recorded variable rates of success, raising either awareness and experience regarding MRONJ, hinting that surgical therapy may stop disease progression, thus allowing a histological diagnosis of osteonecrosis. Dentoalveolar surgery is known to represent a high risk factor in cases of developing MRONJ. The best current estimate towards patients exposed to oral bisphosphonates in case of developing ONJ after tooth extraction is 0.5%.

Keywords: osteonecrosis, osteoporosis, bisphosphonates

INTRODUCTION

Osteoporosis is known as an age-related condition being, mostly on elderly people, one of the most important causes in orthopedic traumatology. Most often there are involved the following bones: vertebra, hips and also forearms. Usually, there is no symptomatology available on the site until the bone breaks down. The most usual medication used in the prevention of osteoporotic fractures of the bones are bisphosphonates (BPs), known as an antiresorptive medication with two types of administration, oral or intravenous.

MRONJ is represented as the exposure of necrotic bone either on the maxillary bone or mandible, that has sure enough persisted rather more than about eight weeks in cases of patients that have taken oral or intravenous bisphosphonates, meanwhile disposing no history of radiation therapy on the head and neck area.

Osteonecrosis is known as a vascular supply interruption, but either an avascular necrosis, and therefore, inhibition of angiogenesis might just not be surprising in the least, guiding so to the hypothesis in pathophysiology of ONJ.

Medication-related osteonecrosis of the jaw is a counter incident that may turn off the cure of primary disease, and at the same time having a notable impact over the patient's life quality.

Medication-related osteonecrosis of the jaw became one of the most important problems that are nowadays affecting the quality of life for patients that suffer from osteoporosis or also cancer on different areas of the human body and at the same time have treatments involving bisphosphonates, increasing so the rate of morbidity.

Treatment methods for MRONJ, being them either surgical or even nonsurgical are still controversial, without having any agreement about electing the method that would be able to provide the better outcome and should accordingly be registered.

The latest position paper that has been inflicted in 2014, had a recommendation from the Special Committee appointed by the American Association of Oral and Maxillofacial Surgeons in order to change the nomenclature of BRONJ to medication-related osteonecrosis of the jaw. This change has been very well received because of the reason that not quite long after, many other antiresorptive medication [receptor activator of nuclear factor-kappa B ligand (RANKL) inhibitors] and also anti angiogenic therapies apart from BPs did have been considered in the treatment of the cases diagnosed with osteonecrosis areas.

METHODS AND MATERIALS

Intravenous bisphosphonates represent antiresorptive medications used in order to treat cancer-related conditions also including hypercalcemia of malignancy, skeletal-related events (SRE) that are associated with bone metastases in the circumstances of solid tumors like prostate cancer and lung cancers, as well for management of lytic lesions of multiple myeloma. Whereas the potential for bisphosphonates in improving cancer-specific survival still remains controversial, these had a significant positive effect for patients with advanced cancer that involve the skeleton.

Oral bisphosphonates represent the treatment of osteoporosis and them are usually used for treating osteopenia as well. There are also other less common conditions where are used, such as Paget's disease of bone, and osteogenesis imperfecta. The mostly used however for osteopenia and osteoporosis.

Antiresorptive drug related ONJ (ARONJ) is recently known to be a concept adapted and also recommended by the 2008 American Dental Association (ADA) Council on Scientific Affairs. The American Dental Association council have introduced the requirement that all cases that are related to the administration of antiresorptive agents to be termed antiresorptive agent-induced ONJ. By involving this circumstance, the recommendation surely encompasses all antiresorptive drugs that are able to cause the development of ONJ. Nowadays many patients are under treatment with antiresorptive or antiremodeling agents accordingly like hormonal replacement therapy or selective estrogen receptor modulators, calcitonin (direct inhibitor of osteoclasts), BPs, or the monoclonal antibody (eg, denosumab).

Angiogenesis inhibitors are known to interfere with the new blood vessels formation by attaching to signaling molecules and disrupting so the angiogenesis-signaling cascade. These medications have truly demonstrated their efficiency in treating gastrointestinal tumors, renal cell carcinomas and neuroendocrine tumors.

In September 2004, Novartis, the manufacturer of Pamidronate (Aredia®) and zoledronic acid (Zometa®), have notified doctors in order to label these products, warning about the possibility of providing the development of osteonecrosis of the jaws. In 2005 then appeared a bigger broader drug class warning for the same complication because of bisphosphonates side effects, including the oral preparations. Nowadays appeared other antiresorptive agents and also novel anti-cancer drugs that could lead to the development of jaw osteonecrosis.

MRONJ risk among cancer patients - Duration of medication therapy as a risk factor for MRONJ

In order to survey the risk of necrosis among patients that have been or are exposed to a medication, we have to know the same risk in patients that have not been exposed either to antiresorptive or antiangiogenic medications.

Regarding the medication-related factors, there have been distinguished two important elements. The first one is represented by therapeutic indications (osteoporosis or malignancy) and the second one reveals the type of medication (BPs and non-BPs). Zoledronate is known as an intravenous BP that can inhibit osteoclast activity, and are used for treating different conditions such as osteoporosis, high blood calcium and also for bone breakdown due to cancer and Paget's disease of bone. Denosumab, a monoclonal antibody, is known as a RANKL inhibitor belonging to the category of non-BPs medication that is supposed to be used for treating different conditions, and otherwise bone replacement in cases of primary tumors or metastases, due to its ability to prevent osteoclast development.

Bisphosphonates have been used all over the world as antiresorptive agents for improving the management of skeletal related events in cases like osteoporosis, neoplasia, hypercalcemia of malignancy, Paget disease, fibrous dysplasia and osteogenesis imperfecta. Bisphosphonates were directly proportional linked to the development of osteonecrosis. The currently accepted theory for the development of osteonecrosis is amidst both direct and indirect effects regarding bone turnover via apoptosis of osteoclasts. BP is known to be the synthetic analogue of inorganic pyrophosphate, that contains a phosphorus carbonphosphorus (PCP) backbone and also a variable side chain (nitrogen or nonnitrogen), elements that can determine the potency toward inhibition of bone resorption. BPs that failure a nitrogen functional group such as etidronate, clodronate or tiludronate, condense in order to form the nonhydrolyzable analogue of ATP, turning into a compound which inhibits ATP dependent intracellular enzyme and so resulting in osteoclast cell death. On the other side, the nitrogen-containing BP like pamidronate, ibandronate, alendronate, zoledronate, risedronate, are stopping the activity of farnesyl diphosphate synthase, an element that represents a key enzyme in the mevalonate pathway. By inhibiting this enzyme it is creating an intracellular deficiency of both geranylgeranyl diphosphate and farnesyl diphosphate, which represend required elements for prenylation of small signaling proteins with GTPase activity. At the end of this process, the results will consist in dysfunctional osteoclasts and eventually apoptosis. The nitrogen containing BP is known to have a higher potency and so it is surely more effective in therapeutic management of skeletal-related events in cancer, but meanwhile results in a higher risk of osteonecrosis. Zoledronic acid is with no doubt the most potent BP (500–1000 times more potent than pamidronate) and it has also been the first drug approved for use in all solid tumors with bone metastasis such as breast cancer, prostate, multiple myeloma, and lung cancer. The main risk factor is represented by intravenous bisphosphonates exposure in the setting of managing malignancy for ARONJ, whereas treatment with oral version of them is considered to be a therapy with a considerably lower risk for ARONJ. The accepted theory of this happening is because intravenous administration of bisphosphonates results in a higher skeletal accumulation which is caused by the affinity for high mineral-binding and is certainly related with earlier assault of osteonecrosis than oral bisphosphonates.

Denosumab is an antiresorptive agent which can inhibit osteoclast-mediated bone resorption. In the same time, Denosumab has US Food and Drug Administration approval for being used in the treatment of osteoporosis and skeletal-related events (SREs) in cases of patients suffering of cancer. Denosumab has different pathway of action than bisphosphonates, by being a human monoclonal antibody (immunoglobulin G2) that has the ability to inhibit receptor-activated nuclear factor KB ligand (RANKL) by simulating the effect of osteoprotegerin on RANKL. RANKL has an important role to play in bone remodeling. As described, it is a cytokine expressed on many cells including osteoblasts, bone marrow stomal cells, and immune cells. It does plays a vital role in osteoclast cell function, activation, and differentiation and so decreases bone turnover. Because of the fact that RANKL is expressed on the subset of T and B cells, the possibility that denosumab may be immunosuppressive seems to appear. In the FREEDOM that is the abbreviation of Fracture Reduction Evaluation of Denosumab in Osteoporosis every 6 Months trial of 7000 patients with osteoporosis, a significant reduction of fractures in the treatment group happened. For all that, no cases of osteonecrosis have been observed. Denosumab increases bone mass density in a significantly mode, by reducing osteoclast numbers or other parameters of bone turnover, where are included levels of the bone resorption marker serum C-telopeptide. By the way, reduced turnover significantly increases bone mass density. In addition to osteonecrosis of the jaws, there exist other adverse effects associated with denosumab, effects that are including hypocalcemia, pancreatitis, and severe infection.

The differences between bisphosphonates and denosumab

Both the ones mentioned above are associated with development of osteonecrosis of the jaw and are approved for treating postmenopausal osteoporosis in women that develop increased risk of fracture and also for treatment of bone loss that is associated with cancer. Denosumab presents several advantages that include better tolerability, relieve of subcutaneous injection, and not the last, the decreased incidence of nephrotoxicity compared to bisphosphonates. Regarding the period of half-life, denosumab has a major advantage compared with bisphosphonates, with a shorter half-life of 25.4 days in comparison with 10 to 12 years for the other bisphosphonates. In a second phase trial, denosumab abolished bone resorption markers, also including urinary collagen type I cross-linked N-telopeptide (NTx) over not more than 24 hours after initial dose and did also present a greater reduction of these markers by 74%, meanwhile bisphosphonates treated patients had about 63%. Denosumab has thus a shorter half life and is therefore reversible. Its way of being eliminated is via the immunoglobin clearance pathway in the reticuloendothelial system, fact that makes it less nephrotoxic and promotes it possibly the drug of choice for renal patients or diseases, such as renal cell cancer and prostate cancer.

DISCUSSIONS

EPIDEMIOLOGY

Since 2003, osteonecrosis of the jaws has been reported as one of the major side effect of bisphosphonates treatment. Official studies reported a rate of incidence for osteonecrosis from a population-based study about 0.8% to 1.5% for intravenous bisphosphonates and 0.01% to 0.04% the oral ones. Nevertheless, dental extractions or trauma may significantly increase the risk of developing osteonecrosis from 1 in 10,000 and 1 in 100,000 to a risk of 1 in 300. It is known the thing that 60% of cases occurred after a tooth extraction or other dentoalveolar surgery, and in the opposite group the remaining cases, which happened to appear spontaneously. It is also estimated that the incidence of osteonecrosis in patients with malignancy has a range of 1% to 10%. The oncologic doses that include bisphosphonates are 10 to 12 times higher than osteoporosis doses, being usually given together with steroids. For zoledronate the cumulative effect was higher compared with pamidronate, involving 1% versus 0% risk, respectively, within the first year, and then 21% versus 4% risk, respectively, over 3 years of treatment. The estimated incidence of osteonecrosis for patients receiving intravenous bisphosphonates for malignant disease ranges from 0.8% to 12%, thing that reflects over 900 times higher than the same of the general patient with osteoporosis. In a study of risk of developing osteonecrosis among patients with different types of cancer such as breast cancer, prostate cancer or multiple myeloma, the International Myeloma Association study submitted that patients with cancer with multiple myeloma have been more likely liable to develop osteonecrosis than breast or prostate cancer. In a retrospective cohort study by Tennis and colleagues, the incidence of osteonecrosis in the cancer cohort group arrived to 5.3% among intravenous bisphosphonates and 0.15% in the osteoporosis group that were administrated oral bisphosphonates. Patients with multiple myeloma revealed an incidence of 4.5 times than patients suffering of breast cancer. Among patients suffering of cancer, the incidence of osteonecrosis was reported as 3.8%, 2.5%, and 2.9% for multiple myeloma, breast cancer, and prostate cancer. In cases of patients diagnosed with cancer and treated with bisphosphonates, the incidence rates for osteonecrosis were related directly to the length of exposure to the drug, history of dental procedures and the number of treatment cycles, and the last but not the least important thing, the method of delivery intravenous or oral.

Local factors

1. Operative treatment

Dentoalveolar surgery is considered a high risk factor in cases of developing MRONJ. Many studies reported that between patients with osteonecrosis, tooth extraction is the most common predisposing event that ranges from 52 % to 61% of patients.

The majority of clinicians and patients in the same time want to know which is the risk of developing ONJ after tooth extraction or either dentoalveolar procedures like dental implant placement or periodontal procedures. The best current estimate among patients exposed to oral bisphosphonates in case of developing ONJ, after tooth extraction is 0.5%.

Amidst cancer patients that developed MRONJ, pre-existing inflammatory dental disease like periodontal disease or periapical pathology represent a risk factor between 50% of the cases.

Management Strategies for Patients Treated with Antiresorptives or Antiangiogenics

1. Prevention of MRONJ

The implementation of dental screening for patients before beginning the antiresorptive therapy have highly reduce the risk of developing ONJ between several studies when there is a comparison to a retrospective period for patients who definitely had no kind of dental preventive measure.

Treatment planning for patients who may be prescribed antiresorptive or antiangiogenic therapy must include examination of the oral cavity and a radiographic assessment when indicated. It is significant to identify acute infections and possible potential sites of infection in order to prevent future sequelae that would probably be exacerbated once drug therapies begin. Considerations during the clinical and radiographic assessment includes: patient motivation and education regarding dental care, chlorhexidine rinses, tooth mobility and periodontal disease, presence of root fragments, periapical pathology, edentulism, and also denture stability.

The AAOMS Position Paper on Bisphosphonate-Related Osteonecrosis of the Jaw, revised in 2009, recommended interruption of oral bisphosphonates 3 months prior to and also 3 months following to invasive dental surgery – systemic conditions permitting.

In 2011 the ADA Council on Scientific Affairs have revised their prior recommendation of a drug holiday and suggested that patients that are receiving lower cumulative doses of bisphosphonate for less than 2 years may continue antiresorptive therapy during the invasive dental treatment.

A. Patients about to initiate intravenous antiresorptive or antiangiogenic treatment for cancer therapy

After evaluating systemic conditions allowance, the initiation of antiresorptive therapy may be delayed until dental health is optimized. This decision must be taken towards the dentist and other specialists involved in the health care of the patient.

B. Patients about to initiate antiresorptive treatment for osteoporosis

Before beginning the treatment, patients should be educated regarding the potential risks of MRONJ in order that the antiresorptive therapy is likely to go beyond 4 years of treatment.

C. Asymptomatic patients receiving intravenous bisphosphonates or antiangiogenic drugs for cancer

The maintenance of good oral hygiene and dental care very important to prevent dental disease that may also require oral surgery. All procedures that involve directly the bone, should be avoided. The placement of dental implants must also be avoided in the oncology patients that are receiving either intravenous antiresorptive therapy or antiangiogenic medications.

D. Asymptomatic patients receiving antiresorptive therapy for osteoporosis

Patients tha receive antiresorptive therapy for osteoporosis have also an increased risk for developing MRONJ, but a much smaller degree than those treated with intravenous antiresorptive therapy. MRONJ can develop sometimes spontaneously or after minor trauma. Generally, these patients have less severe manifestations of necrosis and do respond quicker to stage specific treatment regimens. Elective oral surgery does not appear to be avoided for this group. Patients have to be adequately informed of the very small risk that is less than 1% of compromised bone healing. The risk of developing MRONJ in case of administration of oral bisphosphonates, appears to increase when duration of therapy exceeds 4 years.

If systemic conditions permit, clinicians can stop administrating oral bisphosphonates for a period of two months before oral surgery and also three months after it, so to decrease the risk of MRONJ. The motivation for this approach is taken because of extrapolated data that presents fluctuations of osteoclast function due to bisphosphonate therapy, fact that the most recent studies show the improved outcome of MRONJ treatment with drug cessation.

1. Patients that have taken oral bisphosphonates for less than four years and do just have no clinical risk factors, there is no need of any alteration or delay if the planned surgery is quite necessary. This fact includes all common procedures for oral, maxillofacial and periodontal surgery. 2. Patients who have taken oral bisphosphonates for less than four years but have also taken either corticosteroids or antiangiogenic medications in the same time, the prescribing provider may be contacted in order to consider the interruption of oral bisphosphonate for at least two months before oral surgery, only if systemic conditions permit.

3. In case of patients who have taken oral bisphosphonates, for more than four years with or without any other concomitant medical therapy, the prescribing provider should also be contacted to consider about the discontinuation of the antiresorptive for minimum two months prior to oral surgery, only if systemic conditions permit.

CONCLUSIONS

Drug medication used for treating patients suffering of cancer, present a high risk of causing complications such as MRONJ that does adversely affect the quality of life. Oral surgery is considered to be a high risk factor in developing MRONJ. Most of specialized studies reported that amongst patients suffering of osteonecrosis, tooth extraction seemed to be the first common predisposing event that frames from 52 % to 61% of patients

Otherwise, this is difficult, invasive and in the same time expensive to treat. An easier solution would be represented by dental screening and dental treatment where needed before beginning the drug therapy, can far and away reduce the risk of MRONJ.

An innovative collaboration, involving cross health board lead to MRONJ risk reduction pathway, that has been developed and has also been shown to work smoothly beyond the organisations. This study of patients reported high levels of complacency regarding MRONJ preventive pathway. A reduction in dependence on secondary care services and reduction on perturbations in oncology treatment programs happened shortly after.

After all above, MRONJ risk reduction pathway provides convenient access to dental care on cases of patients that present high risk after the beginning of the treatment, into an absolutely robust clinical governance framework.

REFERENCES

- Hayashida, S., Soutome, S., Yanamoto, S., Fujita, S., Hasegawa, T., Komori, T., ... Ueda, N. (2017). Evaluation of the Treatment Strategies for Medication-Related Osteonecrosis of the Jaws (MRONJ) and the Factors Affecting Treatment Outcome: A Multicenter Retrospective Study with Propensity Score Matching Analysis⁺. Journal of Bone and Mineral Research, 32(10), 2022–2029.
- 2. Ristow, O., Otto, S., Troeltzsch, M., Hohlweg-Majert, B., & Pautke, C. (2015). Treatment perspectives for medication-related osteonecrosis of the jaw (MRONJ). Journal of Cranio-Maxillofacial Surgery, 43(2), 290–293.
- 3. Muthukrishnan, A., Al-Ismail, S., Bertelli, G., & Browne, P. (2017). MRONJ risk reduction pathway 360 degree survey. British Dental Journal, 222(5), 386-390.doi: 10.1038/sj.bdj.2017.225 MRONJ risk reduction pathway 360 degree survey
- 4. Ruggiero, S. L., Dodson, T. B., Fantasia, J., Goodday, R., Aghaloo, T., Mehrotra, B., & O'Ryan, F. (2014). American Association of Oral and Maxillofacial Surgeons position paper on medication-related osteonecrosis of the jaw--2014 update. Journal of Oral and Maxillofacial Surgery, 72(10), 1938–1956.
- 5. Uyanne, J., Calhoun, C. C., & Le, A. D. (2014). Antiresorptive drug-related osteonecrosis of the jaw. Dental Clinics of North America, 58(2), 369–384.
- Ruggiero SL, Drew SJ. Osteonecrosis of the jaws and bisphosphonate therapy. J Dent Res 2007; 86:1013–21
- 7. Freiberger JJ. Utility of hyperbaric oxygen in treatment of bisphosphonaterelated osteonecrosis of the jaws. J Oral Maxillofac Surg 2009;67(Suppl 5): 96–106

- 8. Reszka AA, Rodan GA. Bisphosphonate mechanism of action. Curr Rheumatol Rep 2003;5:65–74
- 9. Rogers MJ, Gordon S, Benford HL, et al. Cellular and molecular mechanisms of action of bisphosphonates. Cancer 2000;88:2961–78
- 10. Van den Wyngaert T, Huizing MT, Vermorken JB. Bisphosphonates and osteonecrosis of the jaw: cause and effect or a post hoc fallacy? Ann Oncol 2006; 17:1197–204
- 11. Brown-Glaberman U, Stopeck AT. Role of denosumab in the management of skeletal complications in patients with bone metastases from solid tumors. Biologics 2012;6:89–99
- 12. Fleisher KE, Jolly A, Venkata UDC, et al. Osteonecrosis of the jaw onset times are based on the route of bisphosphonate therapy. J Oral Maxillofac Surg 2013;71(3):513–9
- 13. Silva-Fernandez L, Rosario MP, Martinez-Lopez JA, et al. Denosumab for the treatment of osteoporosis: a systematic literature review. Rheumatalo Clin 2013;9(1):42–52.
- 14. Bridgeman MB, Pathak R. Denosumab for the reduction of bone loss in postmenopausal osteoporosis: a review. Clin Ther 2011;22(11):1547–59
- 15. Steger G, Bartsch R. Denosumab for the treatment of bone metastases in breast cancer: evidence and opinion. Ther Adv Med Oncol 2011;2(5):233–43
- 16. Lacey DL, Boyle WJ, Simonet WS, et al. Bench to bedside: elucidation of the OPG-RANK-RANKL pathway and the development of denosumab. Nat Rev Drug Discov 2012;11(5):401–19
- 17. Ruggiero SL. Bisphosphonate-related osteonecrosis of the jaw (BRONJ): initial discovery and subsequent development. J Oral Maxillofac Surg 2009; 67(Suppl 5):13–8.
- 18. Khosla S, Burr D, Cauley J, et al. Bisphosphonate-associated osteonecrosis of the jaws: report of a task force of the American Society for Bone and Mineral Research. J Bone Miner Res 2007;22:1479–91.
- 19. Marx RE. Pamidronate (Aredia) and Zoledronate (Zometa) induced avascular necrosis of the jaws: a growing epidemic. J Oral Maxillofac Surg 2003;61: 1115-7
- 20. Ruggiero SL, Mehrotra B, Rosenberg TJ, et al. Osteonecrosis of the jaws associated with the use of bisphosphonates: a review of 63 cases. J Oral Maxillofac Surg 2004;62(5):527–34
- 21. Wang J, Goodger NM, Progel MA. Osteonecrosis of the jaws associated with cancer chemotherapy. J Oral Maxillofac Surg 2003;61:1104–7
- 22. Dimopoulos M, Kastritis E, Moulopoulos LA, et al. The incidence of osteonecrosis of the jaw in patients with multiple myeloma who receive bisphosphonates depends on the type of bisphosphonate. Blood 2005;106:637 [American Society of Hematology Annual Meeting Abstracts].
- 23. Bamias A, Kastritis E, Bamia C, et al. Osteonecrosis of the jaw in cancer after treatment with bisphosphonates: incidence and risk factors. J Clin Oncol 2005;23:8580–7
- 24. Wimalawansa SJ. Insight into bisphosphonate-associated osteomyelitis of the jaw: pathophysiology, mechanisms and clinical management. Expert Opin Drug Saf 2008;7:491–512
- Tennis P, Rothman KJ, Bohn RL, et al. Incidence of osteonecrosis of the jaw among users of bisphosphonates with selected cancers or osteoporosis. Pharmacoepidemiol Drug Saf 2012;21:810–7
- 26. Gliklich R, Wilson J. Epidemiology of bisphosphonate-related osteonecrosis of the jaw: the utility of a national registry. J Oral Maxillofac Surg 2009;67(4):850–5.
- 27. Woo SB, Helllstein JW, Kalmar JR. Systemic review: bisphosphonates and osteonecrosis of the jaws. Ann Intern Med 2006;144:753–6
- 28. Hellstein J W, Adler R A, Edwards B et al. Managing the care of patients receiving antiresorptive therapy for prevention and treatment of osteoporosis: Executive summary of recommendations from the American Dental Association Council on Scientific Affairs. J Am Dent Assoc 2011; 142: 1243–1251

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The role of ultrasound in the treatment of gingivitis in an early stage



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Abstract

Gingivitis is a gingival inflammation caused in general by a bacterial infection. Gingivitis appears as an inflammatory reaction of the gums to the action of the bacteria due to the bacterial plaque build up. The factor responsible for the accumulation and spreading of the bacterial plaque is the inadequate dental and oral hygiene. The objective of this paper is to emphasize the positive role of ultrasound scaling in the gingivitis treatment. In order to reach this objective we have chosen adult patients who have gingivitis in an early stage.

Keywords: Gingivitis, biofilm, ultrasound scaling, clinical cases

INTRODUCTION

Gingivitis is a gingival inflammation caused in general by a bacterial infection. Gingivitis appears as an inflammatory reaction of the gums to the action of the bacteria due to the bacterial plaque build up. The factor responsible for the accumulation and spreading of the bacterial plaque is the inadequate dental and oral hygiene. In this disease the gum is red, inflammated and bleeding easily when brushing or even spontaneously. Gingivitis may be reversible through daily brushing, the use of dental floss and a periodic professional hygienization performance by the dental hygienist. There is no loss of bone or periodontal tissue in gingivitis which is why it is very important to treat gingivitis in the early stage (1).

Scaling with ultrasound vibrations is one of the most effective procedures to treat gingivitis. The ultrasound vibrations have properties with direct applicability in the treatment of gingivitis. Water together with the reduced vibrations remove the biofilm and calculus and reduce the number of bacteria at the level of the gum. The elimination of the bacteria is very important for the treatment of gingivitis (2).

The optimum application of the prevention measures was the object of the study of Lightner and its partners. In a study carried out over a period of 4 years, these have proved that the performance of the scaling with ultrasound vibrations and professional brushing in a session of 40 minutes once every 3 months leads to an obvious reduction of the gingival inflammation (3). The studies carried out by Loewdal together with his partners prove that the instructions given to the patients for a correct oral hygiene and the performance of the ultrasound scaling have lead to the reduction of the symptoms given by gingivitis (4).

The gum is one of the soft tissues which cover the oral cavity. It is the tissue at the level of the cervical part of the tooth and consists of 3 types: marginal, adherent and interdental (5). In case of a healthy and sick periodontal structure, the gingival sulcus contains bacteria. In a state of periodontal health, the microbial flora is represented by gram-positive bacteria, mostly species of Actinomyces and Streptococcus and gram-negative bacteria which are in a smaller proportion (6).

The color of the marginal and adherent gum is generally described as being pale pink and is caused by the vascularization, widths and degree of epithelial keratinization and the presence of cells containing melanin. The color varies from one person to another and is connected to the skin pigmentation. The adherent gum is limited by the adjacent alveolar mucosa through a weel defined mucogingival line. In the gingival inflammation, the color of the gum is red-purple.

The dimension of the gum corresponds to the total amount of the cellular and intracellural elements and their vascularization. The modification of the dimensions is a common parameter of the ginvitis when the marginal gum appears to be increased in volume (7).

The outline or form of the gum varies considerably and depends on the form of the teeth and their alignment on the arch, the dimension of the interproximal contact area and the dimension of the vestibular and oral gingival embrasure. The marginal gum surrounds the tooth under the form of a collar and forms a smooth and straight surface along the teeth.

The form of the interdental gum is given by the contour of the proximal surface of the tooth and the localization and form of the gingival embrasure. The interdental papilla has a pyramidal shape in the frontal area and is more flat in the molar area (5, 6).

The gums are firm and resilient, closely attached to the alveolar bone, except for the mobile free edge. The texture of the gum is presented under the form of "orange peel" at the level of the adherent and interdental gum and smooth and shiny at the level of the marginal gum. The aspect of "orange peel" disappears with the inflammation of the gum.

The position of the gum refers to the level where the edge of the gum is attached to the tooth (level of epithelial adhesion). When the tooth erupts in the oral cavity, the gingival edge and sulcus are found at the level of the crown but as the tooth erupts, this is moved closer to the root, towards the cemento-enamel junction (8).

The contributory factors of gingivitis are: white matter and tartar; the dental staining given by the consumption of certain food retain the bacteria and demineralisez the enamel; the gingival stains given by the root canals, metal works; cavity lesions at the level of the package; inadequate root canals; incorrect prosthetic treatments; occlusal factors: teeth crowding, reversed toothing, indentations which cause dental migrations (9).

The factor responsible for the accumulation and spreading of the bacterial plaque is the inadequate dental and oral hygiene. Gingivitis may be reversible through daily brushing, the use of dental floss and a periodic professional hygienization performance by the dental hygienist. There is no loss of bones or periodontal tissue in gingivitis which is why it is very important to treat gingivitis in the the early stage in order to prevent periodontitis (10).

Studies show that in 48 hours from the formation of the biofilm, a sufficient number of pathogene bacteria may be formed in order to trigger gingivitis. The reversible gingivitis which is developed in 48 hours as of the formation of the biofilm will be transformed in an active process through which the host releases antibodies, neutrophils, lymphocytes, macrophages in the adjacent tissue (11, 12, 13).

The tartar is present in most adults at supra- and sub-gingival level and is the result of the biofilm calcification and expholiated epithelial cells. The mineral ions responsible for these originate in the saliva and crevicular fluid, additionally the tartar contains bacterial residues mixed in a mineral deposit, mainly calcium phosphate. The studies have shown that supra-gingival tartar also has unmineralised areas which contain bacteria. The endotoxins are released slowly at the level of the tartar in the adjiacent soft tissue where they may become destructive for the surrounding soft and hard tissues (14).

From an epidemiologic point of view, the prevalence share of the gingivitis in white non hispanic people is 50% of the population and in Mexican Americans is 63% of the population. It is possible that this survey is undervalued due to the fact the gingivitis in the early stage does not present clinical symptoms such as pain and remains undetected (14, 15, 16).

The signs and symptoms of gingivitis may include: red or red-purple colour gum; painful gum at touching; bleeding at the level of the gum caused by brushing; halitosis; gums inflammation; sensitive gums (5). The lymphocytes T are predominant in the early stage gingivitis, and the plasma cells appear in the advanced staged. At the level of the gums tissue, the local reaction is not a consequence of the presence of bacteria in the plaque but of the results occurring following the metabolization of the bacterial plaque (17).

In the survey, the gingival bleeding occurs before other clinical visual signs of the inflammation, being a more objective clinical sign than all the others. The gingival bleeding is caused by the alterations at the level of the gum, the capillary vasodilatation respectively and the presence of the sulcular epithelium ulcerations.

The modification of the colour of the gum represents an important clinical sign of the presence of gingival inflammation. The gum becomes erythematosus, red when the blood flow is increased and the gingival keratinisation is reduced. The chronical gingival inflammation modifies its consistency, the gum becomes either oedematous or fibrous (5, 18, 19). In the gingival inflammation the "orange peel" texture disappears, the gum being shiny or fibrous. The chronic gingivitis starts with a discreet hypertrophy of the interdental, marginal gums or both. Then, together with the evolution of the inflammatory process, the gingival edge is rounded with the plane, decapitated interdental gum. The position of the gum is at the level of the cemento-enamel junction in gingivitis and in periodontitis the level

of the epithelial insertion is moved along the root, resulting in a loss of adherence. Consequently, in gingivitis there is no loss of epithelial adherence (5, 20).

The ultrasound instruments have been used in dentistry ever since the 1950s. They were initially used to cut teeth but were very soon used to remove the tartar deposits at the level of the teeth. The ultrasound vibrations are also used in endodontic, implantology and many other branches of dentistry (30). The instruments' loops with ultrasound vibrations were initially under the form of a drill and later were adjusted in order to easily remove bacterial plaque and tartar. The shape of the loop is generally curved towards the top in order to allow the penetration in the difficultly accessible areas at the level of the teeth (30).

The cooling with water is necessary because heat is produced and also to remove the residues from the area in order to improve the visibility and the occurrence of cavitation. Although the adding of chemical additives was attempted in order to improve the ultrasound scaling efficiency, the clinical studies have shown that this has not brought any advantage until now (31, 32).

Aim and objectives

The objective of this paper is to emphasize the positive role of ultrasound scaling in the gingivitis treatment. In order to reach this objective we have chosen adult patients who have gingivitis in an early stage.

The criteria of inclusion in the study were: the presence of tartar, inflammated and highly sensitive gingival tissue, gingival bleeding, presence of overflowing marginal parts of the roots, the presence of cement excess in orthodontic cementations, obtaining the written consent of the patients.

The exclusion criteria were: patients with pacemaker, patients with respiratory risk; patients with transmissible diseases, which may be spread through the aerosols of the scaling device.

MATERIAL AND METHODS

This study was carried out over a period of 6 months and involved a number of 32 patients with gingivitis in an early stage. The patients are young adults with ages between 18 and 30 years. The medical history and endo-oral clinical examination were performed in order to give the diagnosis of gingivitis.

The medical history has contained a series of questions related to the reason of presentation, the history of the disease, the personal general and local antecedents and the family medical history. The endo-oral clinical examination consisted of the presence and symptoms of the gingivitis, these being: red colour gum, painful gum when touching, gingival bleeding caused by brushing, halitosis, gingival inflammation, sensitive gum.

In order to evaluate the efficiency of the three forms of hygienization in case of gingivitis in an early stage, a final medical history was performed at the end of the 6 months period.

The patients included in the study were photographed before and after the performance of the ultrasound vibrations scaling, then they were professionally brushed and where necessary, an abrasive powder cleaning - air flow was also used. 8 of these patients have used the Philips Sonicare Diamond Clean ultrasound electric toothbrush, eight patients have used the Dr. Mayer GTS2080GR electric sonic toothbrush and 16 patients have used traditional toothbrushes for the oral hygiene and have been subject to ultrasound vibrations scaling and air flow. The patients were monitored during the use of the toothbrush and reevaluated after a period of 6 months in order to notice its efficiency.

The patients were shown the correct technique of brushing and additional hygienization methods (the use of dental floss, mouthwash) in order to have an adequate oral hygiene.

The ultrasound vibrations scaling device used was U600 LED Woodpecker, the professional toothpaste Kerr SuperPolish was used for the professional brushing and the EMS Air-Flow Classic prophilaxis powder was used for air flow.

RESULTS

After 6 months from the beginning of the use of the Philips Sonicare Diamond Clean ultrasound electric toothbrush the 8 patients have shown improvements regarding the gingival inflammation and gingival bleeding which were significantly reduced but the tartar was not reduced, consequently they needed an ultrasound scaling. The probing showed the bleeding was highly reduced in comparison to the initial situation. (Fig. 1 and 2).



Figure 1. a-the initial evaluation; b-final assessment after 6 months



Figure 2. a-the initial evaluation; b- final assessment after 6 months

8 of the 32 patients included in the study have used the Dr. Mayer GTS2080GR sonic electric toothbrush. In the following imagines you may notice the condition of the gums at the initial evaluation and the final evaluation after 6 months, but after the performance of the ultrasound scaling because at these patients the tartar was not also removed with the help of the electric toothbrush.



Figure 3. a- the initial evaluation; b- final assessment after 6 months



Figure 4. a-the initial evaluation; b-final assessment after 6 months

After 6 months from the initial evaluation during which the 8 patients have used the Dr.Mayer GTS2080GR sonic electric toothbrush, the results are not satisfactory, the inflammation was slightly reduced, the tartar is present and the probing showed bleeding. As in the case of the first 8 patients, these patients also required ultrasound scaling.

16 patients included in the study have used traditional toothbrushes for the purpose of oral hygiene and underwent an ultrasound scaling and air flow. In the following imagines you may notice the condition of the gums at the initial evaluation and the evaluation after 1 month from performing the ultrasound vibrations scaling. (Fig. 5, 6, 7 and 8).



Figure 5. a-the initial evaluation; b-final assessment after 1 month



Figure 6. a-the initial evaluation; b-final assessment after 1 month



Figure 7. a-the initial evaluation; b-final assessment after 1 month



Figure 8. a-the initial evaluation; b-final assessment after 1 month

The last 16 cases were subject to the scaling from the beginning which has helped with the treatment of the gingivitis in an early stage, by removing the bacterial plaque, the inflammation and tartar. These have been evaluated and photographed after 1 month from the treatment and monitored for 6 months. They no longer showed gingival inflammation, sensibility at probing. The efficiency of the ultrasound scaling was also confirmed with the help of the probing when the patients no longer showed bleeding. After 6 months, these have not showed gingival inflammation or bleeding at the probing, just little tartar at the level of the lingual surface of the lower incisors. The results were good due to the fact that the patients have understood the importance of the performance correct brushing and adequate oral hygiene twice a day.

DISCUSSIONS

The bacterial plaque and tartar represent the determining factors of gingivitis. A correctly performed oral hygiene helps prevents the occurrence of bacterial plaque and tartar, but not entirely. As the study carried out points out, the ultrasound scaling represents the best prevention and treatment method of the gingivitis in an early stage because it is clearly superior to the toothbrushing when it comes to the removal of the bacterial plaque and especially the tartar. These aspects are also confirmed by other studies in the field.

Zimmer and his partners have compared two sonic toothbrushes (Sonicare and WaterPik Sonic Speed) with a manual toothbrush in a study which included 36 teenagers and adults. Each participant has used sequentially each type of toothbrush for a period of two weeks, with a period of two weeks without brushing between the types of toothbrushes. Both sonic toothbrushes have proved superior results in the removal of bacterial plaque and gingivitis prevention in comparison to the manual toothbrush (35).

In a study over a period of six months, the use of a sonic toothbrush was compared to the use of an electric toothbrush (Sonicare and Braun Oral-B) by 66 patients, of which 54 have completed the study and it was found that the removal of the supragingival bacterial plaque was increased with the use of the sonic toothbrush. Additionally, după after six months, the reduction of the gingival inflammation has reached 31.9% for the sonic toothbrush and 18.1% for the electric toothbrush. The electric toothbrush proved to be more efficient in the reduction of the gingival bleeding and the sonic one in the reduction of the inflammation and bacterial plaque (36).

A recent study has proved that the sonic toothbrush (Spinbrush Sonic) has reduced the bacterial plaque by 88.9% in comparison to the traditional toothbrush (37). By comparing the manual toothbrushes with the electric and sonic ones it was proved that the sonic and electric toothbrushes offer a superior removal of the interdental plaque. Another study has proved that the use of a rotating-oscillating toothbrush leads to a superior removal of the plaque and a better control of the gingivitis in comparison to the manual toothbrushing (38).

Consequently we can state that the electric and sonic toothbrushes are superior to the manual toothrbrushes when it comes to the oral cavity hygiene but they also have their

deficiencies, the ultrasound scaling being necessary once every 6 months in order to prevent the gingivitis occurrence.

Either manual or performed with the help of a sonic or electric toothbrush, the toothbrushing must be performed correctly, twice a day. This helps maintain the oral health but, regardless of the type of toothbrush or toothpaste used, the tartar deposits sooner or later and the teeth are stained from different colored food or drinks. Consequently, the best method of removing the tartar and reduce the bacterial plaque index remains the scaling performed once every 6 months at a dental practice.

CONCLUSIONS

Gingivitis is the nonstructive form of periodontal disease which means that, if it discovered on time, it is completely reversible and does not leave behind permanent modification of the gingival tissues. For this reason, the correct toothbrushing and the visit to the dental hygienist is highly important.

Due to the fact that in most cases the gingivitis does not cause pain, there are patients who ignore it or are not aware of its existence. For this reason, the regular visits to the dental practice are mandatory. In the absence of treatment, the gingivitis may evolve towards periodontitis, a destructive form of periodontal disease which irreversibly affects in time both the gum and the periodontal ligaments, and the surrounding bone.

The main prevention method of the gingivitis is the performance of a correct oral hygiene. The dental hygienist has the necessary knowledge to teach the patients how to brush their teeth correctly. Also, the additional means of oral hygiene are recommended.

Regardless how correct the oral hygiene is, we cannot remove all the bacterial plaque, especially the tartar, which is why it is necessary to perform an ultrasound scaling every 6 months which offers the best results in the reduction of the bacterial plaque index, the tartar, the gingival inflammation and bleeding.

REFERENCES

- 1. American Academy of Periodontology. The pathogenesis of periodontal diseases (position paper). J Periodontol 1999;70:457-70.
- 2. American Academy of Periodontology. Diagnosis of Periodontal Diseases (position paper). Chicago, Ill: The American Academy of Periodontology; April 1995.
- 3. Armitage GC. Development of a classification system for periodontal diseases and conditions. Ann Periodontol 1999;4:1-6.
- 4. Ramfjord SP. Maintenance care and supportive periodontal therapy. Quintessence Int 1993;24:465-71.
- 5. Onisei D.et al., Paradontologie, Ed. Victor Babeş, Timişoara, 2015.
- 6. Page RC. Gingivitis. J Clin Periodontol 1986;13:345-59.
- 7. Holmstrup P. (1999) Non-plaque-induced gingival lesions. Ann Periodontol. 1999 Dec;4(1):20-31.
- 8. Socransky SS, Haffajee AD. Microbiology of periodontal disease. In: Lindhe J, Karring T, Lang NP, eds. Clinical Periodontology and Implant Dentistry. 4th ed. Oxford, England: Blackwell Publishing Ltd; 2003:106-149.
- 9. Newman MG, Takei HH, Carranza FA, eds. Carranza's Clinical Periodontology. 9th ed. Philadelphia, Pa: WB Saunders Company; 2001:96-167.
- 10. Willmann DE, Harris NO. The role of dental plaque in the etiology and progress of periodontal disease. In: Harris NO, Garcia-Godoy F, eds. Primary Preventive Dentistry. 6th ed. Upper Saddle River, NJ: Pearson Prentice Hall; 2003:73-91.
- 11. Ranney RR, Debski BF, Tew JG. Pathogenesis of gingivitis and periodontal disease in children and young adults. Pediatr Dent 1981;3:89-100.

- 12. Pannuti CM, Mattos JP, Ranoya PN, Jesus AM, Romito GA, Lotufo RFM. Clinical effect of a herbal dentifrice on the control of plaque and gingivitis. Pesq Odontol Bras 2003;17:314-8.
- 13. Quigley GA, Hein JW. Comparative cleansing efficiency of manual and power brushing. J Am Dent Assoc 1962;25:26-9.
- 14. Saxer UP, Menghini G. The effect of two toothpastes on plaque and gingival inflammation. J Clin Dent 1995;6:154-6.
- 15. Triratana T, Rustogi KN, Volpe AR, DeVizio W, Petrone M, Giniger M. Clinical effect of a new liquid dentifrice containing triclosan/copolymer on existing plaque and gingivitis. J Am Dent Assoc 2002;133:219-25.
- 16. Axelsson, P. and Lindhe, J.: The effect of a preventive programme on dental plaque, gingivitis and caries in school children, JPeriodontol, 1:126-138, 1974.
- 17. Greene, J. C.: Oral hygiene and periodontal disease, Am JPub Hlth, 53:913-922, 1963.
- 18. Russell, A. L.: Epidemiology of Periodontal Disease, Int Dent J, 17:282-296, 1967.
- 19. Ramfjord, S. P., Emslie, R. D., Greene, J. C., Held, A. F. and Waerhaug, J.: Epidemiological studies of periodontal disease, Am j Pubj Hlth, 58~:1713-1722, 1968.
- 20. H., Anerud, A., Boysen, H. and Smith, M.: The natural history of periodontal disease in man --The rate of periodontal destruction before 40 years of age, d Periodontol, 49:607- 620, 1978.
- 21. Nyman, S., Rosling, B. and Lindlie, J.: Effect of professional tooth cleaning on healing after periodontal surgery, d Clin Periodontol, 2:80-86, 1975.
- 22. Kelstrup, J. and Theilade, E.: Microbes and periodontal disease, d Clin Periodontol, 1:15-35, 1974.
- 23. Hughes TP, Caffesse RG. Gingival changes following scaling, root planing and oral hygiene A biometric evaluation. J Periodontol 1978;49:245-52.
- 24. Van Dyke TE, Tohme ZN. Periodontal diagnosis: evaluation of current concepts and future needs. J Int Acad Periodontol. 2000;2:71-78.
- 25. Fowler EB, Breault LG, Cuenin MF. Periodontal disease and its association with systemic disease. Mil Med. 2001;166:85-89.
- Lamster IB. Current concepts and future trends for periodontal disease and periodontal therapy. Part 1: etiology, risk factors, natural history and systemic implications. Dent Today. 2001;20:50-55.
- 27. Williams RC. Periodontal disease: the emergence of a new paradigm. Compend Contin Educ Dent. 2001;22(2 specissue):3-6.
- 28. Macedo RG, Verhaagen B, Rivas DF, Versluis M, Wesselink P, et al. (2014) Cavitation measurement during sonic and ultrasonic activated irrigation. J Endod 40: 580-583.
- 29. Asadoorian J, Botbyl D (2015) Dental hygienists' perception of preparation and use for ultrasonic instrumentation. Int J Dent Hyg 13: 30-41.
- 30. Felver B, King DC, Lea SC, Price GJ, Damien Walmsley A (2009) Cavitation occurrence around ultrasonic dental scalers. Ultrason Sonochem 16: 692-697.
- 31. Walmsley AD, Lea SC, Felver B, King DC, Price GJ (2013) Mapping cavitation activity around dental ultrasonic tips. Clin Oral Investig 17: 1227-1234.
- 32. Derdilopoulou FV, Nonhoff J, Neumann K, Kielbassa AM (2007) Microbiological findings after periodontal therapy using curettes, Er: YAG laser, sonic, and ultrasonic scalers. J Clin Periodontol 34: 588-598.
- 33. Forgas-Brockmann LB, Carter-Hanson C, Killoy WJ (1998) The effects of an ultrasonic toothbrush on plaque accumulation and gingival inflammation. J Clin Periodontol 25: 375-379.
- 34. Goldman HM (1974) Effectiveness of an ultrasonic toothbrush in a group of uninstructed subjects. J Periodontol 45: 84-87.
- 35. Zimmer S, Fosca M, Roulet JF. Clinical study of the effectiveness of two sonic toothbrushes. J Clin Dent. 2000;11(1):24–7.
- 36. Bader HI, Boyd RL. Comparative efficacy of a rotary and a sonic powered toothbrush on improving gingival health in treated adult periodontitis patients. Am J Dent. 1999;12(3):143–147.
- 37. Robinson PJ, Maddalozzo D, Breslin S. A six-month clinical comparison of the efficacy of the Sonicare and the Braun Oral-B electric toothbrushes on improving periodontal health in adult periodontitis patients. J Clin Dent. 1997;8(1 Spec No):4–9.
38. Murray PA, Boyd RL, Robertson PB. Effect on periodontal status of rotary electric toothbrushes vs. manual toothbrushes during periodontal maintenance. II, Microbiological results. J Periodontol. 1989;60(7):396–401.

Overdenture by magnetic systems



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Abstract

The idea of using magnetic systems to maintain and stabilize mobilizable dentures has been constantly concerned with prosthetists for nearly 50 years. Steady progress has been made in the quality of the alloys used, mainly due to the concern of Japanese and American researchers. Disadvantages, mainly consisting of corrosion of the magnet in contact with the oral environment, coloring of neighboring areas and loss of magnetic properties, have been removed by enveloping the magnets in a very thin layer of synthetic resin or non-corrosive metal (chromium, titanium). Clinical trials have been conducted that have shown that there is no negative effect of the magnetic field on adjacent structures.

The magnetic attachment is a retentive appliance of removable partial dentures. As new materials and technology have become available, magnetic attachment devices have become increasingly sophisticated, making them a viable option for controlling unfavorable lateral forces in the retention of removable prostheses. Various types of magnetic attachments are now available for a wide range of clinical applications [1].

The paper follows the appreciation in overdenture on teeth with magnetic systems, the equilibrium and functionality conditions offered to prostheses, as well as the treatment used. This article presents rehabilitation of a case with tooth supported maxillary overdenture by Magfit attachments.

Keywords: overdenture, magnetic system, balance, functionality

INTRODUCTION

The problem of reduced vertical space occurs in all overdentures. The size of this space, located between the occlusal and mucosal plane, determines the maximum size of the prosthetic restoration.

Overdentures is indicated in subtotal edentulous, when there are still 2 to 3 remaining teeth. These teeth are used to anchor special systems on which the denture will be supported. Similarity with the total prosthesis is high in relation to the stages of manufacture and the materials used. But the benefits are related to the retention, stability, and greatly increased comfort due to special systems. Overdenture can also be performed on dental implants if the patient chooses this treatment solution.

During treatment, overdentures raises a number of difficulties in achieving prosthetic goals and resolving cases with increased difficulty [2,3]. Prosthetic treatment in the subtotal edentulous aims at restoring the functions and preserving the structures of the oral cavity, in the conditions of maximum imbalance of the prostheses, by the possibilities offered by the last teeth, for increasing the quality of life of these patients, usually elderly people [4,5].

All overdentures, which is anchored on the front teeth, presents both a risk of fracture and aesthetic problems. Maintenance, vertical space and support are key factors in the success of prosthetic treatment. Retaining frontal teeth under overlapping creates an aesthetic problem due to alveolar bone oversize. Reducing the base from above these teeth affects resistance of the prosthesis. No matter how much as the base of the prosthesis is reduced, the upper lip will appear slightly rounded and the teeth will be see a little longer. Sometimes we can shorten the incisive edge a little. Patients should be informed from the outset about the expectations and limitations of this prosthetic treatment. If the patient is stressed or is going through a more difficult period, treatment will not begin until we can be sure of his full agreement and collaboration.

For removable partial dentures, retentive appliances are essential. The prototype of the magnetic attachment was completed in 1991, and it has been continuously improved and modified thereafter, based on the development of new magnetic materials and the advancement of new technology [1].

The use of magnetic systems in overdenture is a treatment alternative with multiple advantages in improving prosthesis balance and functionality as well as maintaining support structures [6,7].

Magnets can be used to maintain skeletized prosthesis, but also acrylic partial prostheses, as long as there are periodontal and endodontic healthy outstanding teeth. Generally, magnets are used in clinical situations with few remaining teeth, ideally distributed bilaterally, ideal canines or premolars to ensure optimum balance conditions of the prosthesis, but just as well can be used on one root. Generally no more than 4 magnets are used in a prosthesis.

The magnet is attached to the mucosal part of the prosthesis. A metal plate made of a magnetizable alloy is fixed on the support tooth. It is important that the two surfaces coincide perfectly to achieve the maintaining guaranteed by the manufacturer. Unlike most friction-retaining systems, magnets are self-limiting. The magnetic attraction force begins to occur at a distance of about 3 mm between the magnet located in the prosthesis and the keeper on the support tooth.

Aim and objectives

Considering that it is necessary to try to offer patients an alternative to the extraction of the last teeth as well as a middle path between the simple total denture and prosthesis on

implants, we will continue to show how to use magnets in an attempt to persuade our colleagues both the simplicity and the advantages of the method.

MATERIALS AND METHODS

Over time, the qualities of the magnets have improved considerably, so today they have developed advanced magnetic systems with special qualities [8]. There are known and used today in the world a number of types of magnetic systems, such as: Hyper Slim, Dyna System, StecoTitaniMagnetics, Magna Cap, Microplant, produced by firms Hitachi, Dyna, Steco, Magnacap.

The magnetic system used by us in overdenture is MAGFIT, a system developed and produced for the Toyota Group by Aichi Steel Corporation in 1992 [9]. The company has developed a new generation of magnets, called the MAGFIT series, powerful magnetic systems without corrosion problems, whose performance continues to improve (Figure 1). The MAGFIT series comprises two large lines: magnetic tooth systems and implant systems.



Figure 1. MAGFIT magnetic systems and their evolution from the point of view of design and size (www.implantium.co.uk)

Magnetic systems for natural teeth are composed of two parts: the magnetic pill (internal magnet), which is applied to the denture or implant, and the keeper (made of magnetized alloy which is attracted to the magnetic pill), being the element applied to the remaining tooth (Figure 2). The magnetic pill and keeper are designed to form a closed magnetic circuit to produce maximum retention force. To protect magnet from corrosion, the outer portions are hermetically sealed by laser welding.



Figure 2. Magnetic system (www.magfit.jp)

The materials used to make the magnetic system are: magnetic material of the pill is the NdFeB alloy (Neodymium, Iron, Boron), and the keeper, the outer part of the pad and the other parts of the assembly are made of AUM 20, a soft magnetic stainless steel. There are three types of keeper: prefabricated and directly applied to the root canal, the movable one (with screw) and the one made in the laboratory by casting. The appearance of the keeper's occlusal area may be flat or dome-shaped, round or elliptical (Figure 3).



Figure 3. The appearance of keeper's occlusal surface (www.magfit.jp)

The study was conducted on a 79 years old female patient who agreed to the treatment, shooting and inclusion of the case in one study. The clinical examination showed the presence of the molar 17 and the front teeth 13, 11, 21 and 23 in the form of radicular scrap, the remaining teeth after fixed anterior prosthesis (Figure 4). At the radiological examination we found a good implantation of the canines (Figure 5). It was decided to extract the incisors and apply two symmetrically placed magnetic systems (Magfit DX600), respectively in the two canines, as well as maintaining the molar. It was explained to the patient the need for mobilizable prosthesis, following the perception and agreement for the proposed treatment.



Figure 4. Intraoral condition at maxillary



Figure 5. Radiographs at teeth 13, 23

The roots on which the magnets will be applied are properly treated endodontically. The remaining crown part is usually quite low in height, in which case the keeper will be fixed by casting into a radicular device to prevent it from detaching. This device also has the role of protecting the root because it is known that the roots remaining under the prostheses are lost relatively quickly through the caries and / or the periodontal disease. The support tooth must not have a root surface smaller than that of the magnet used. Magnets of a size proportional to the root section surfaces of the pillars and the vertical space will be selected (Figure 6).



Figure 6. Correlation of magnet type with vertical space (www.magfit.jp)

Depending on the retention value, these are of several ways: MAGFIT RK type S with 800gf retention value, type L with 800gf retention value and DD with 800gf retention value, DAG type MAGFIT with retention value between 400 and 1000gf, MAGFIT EX with retention value of 400 and 600gf and type MAGSOFT S with 500 gf and L type with 750 gf (Figure 7).



Figure 7. Indications of different models of magnetic systems MAGFIT, depending on outstanding teeth and retention value (www.magfit.jp)

The radicular device is cast from a magnetizable alloy (noble or semi-noble) with a lower melting point than the actual keeper delivered by the manufacturer and will have a thickness of 1.2-1.5 mm, which makes the magnet to reach less than 3 mm. In the case of a particularly restrictive vertical space, one can also take advantage of the space inside the root perimeter in the coronary chamber. This reduced size recommends magnetic systems to be used in clinical situations with very low vertical space, which are practically the smallest retention systems between extracoronary ones. The surface of the root device must be flat and perfectly smooth to ensure intimate contact with the magnet. To facilitate the subsequent positioning of the magnet, some manufacturers offer a slightly larger pill than this, which can be positioned above the keeper on the work pattern.

After impression of prosthetic field (Figure 8) on the work model is done the wax layout of the root device in which the prefabricated keeper is incorporated. After casting (Figure 9), testing and adaptation, the keepers are permanently cemented on the canine roots with glass ionomer cement (Figure 10). Keepers were placed parallel to the occlusal plane.



Figure 8. Impression of the prosthetic field



Figure 9. Devices with built-in keepers



Figure 10. Cementation of devices with builtin keepers

The prosthesis is made using the known classical method. Occlusal record rims were made (Figure 11), and the jaw relationship (vertical and centric) was transfer and recorded (Figure 12).



Figure 11. Vertical occlusal dimension determination



Figure 12. Transfer and record the jaw relationship with the facial arc

Bilateral balanced teeth arrangement was carried out for the patient and trial denture was evaluated for centric, vertical relation, esthetics, form and phonetics. After a satisfactory try-in, the maxillary denture was made, and it was applied and adjusted in the oral cavity. All the interceptive occlusal contacts were eliminated before fixing the magnetic assembly. Magnets were kept on the top of keeper, so to coincide with both central axes, and self-cure acrylic resin was filled into the space left for magnetic assembly in the impression surface of upper jaw overdenture. The patient was asked to occlude till curing of the resin. Excess of resin was removed, the occlusion was checked to remove the interceptive occlusal contacts, and denture was inserted (Figure 13). Post insertion instructions were given to the patient and periodic follow-up was done.



Figure 13. Final fit and adjustment of the prosthesis in the oral cavity

RESULTS

The magnetic anchoring system allows easy movements of the denture without overstressing the tooth abutment, which makes him act as a force breaker. Considering that in subtotal edentulous the prosthesis rests predominantly on mucosal and on bone support, there will be a degree of movement of it. The magnet returns the denture in the correct position after minimal displacement. This stability of the denture creates the patient a state of comfort and relaxation.

Mastication and phonation have been satisfactory since the accommodation period. Obtaining a good prosthesis with a good balance to allow for a good masticatory efficiency has been achieved, comfort and preservation of the physiognomy appearance have brought the smile back to the lips of the patient.

During the evaluation and control at 6 months, it was found the good preservation of the magnetic systems, the normal appearance of the oral cavity structures and the functionality of the prosthesis.

DISCUSSIONS

Magnets can be used successfully whenever we decide that we can keep dental roots under partial or total prosthetics, especially if patients are likely to have problems with the biological integration of prostheses, patients at the first mobilisable prosthesis. Also we can use magnets when we have a difficult prosthetic field with atrophied alveolar bone or absent tuberosities. There are typically useful for patient with restricted interocclusal space, can also accommodate a moderate divergence of alignment between two or more abutment and dissipate lateral functional forces.

The preservation of remaining root structure and alveolar bone covering them with denture has been used since many years. Tooth-retained overdentures transfer occlusal forces to the alveolar bone through the periodontal ligament of the retained tooth roots and thereby prevent bone resorption. Applications of magnets in overdenture technique has been widely used in dentistry in the field of prosthodontics, as they can be manufactured in small dimensions as retentive devices for complete denture, removable partial dentures, obturators and maxillofacial prosthesis [10].

Magnetic attachments on teeth and implants may be used to improve stability, support, and retention of removable prostheses. Various forms of magnetic attachments are available, divided according to the design, the mechanical properties of the attachments, and the clinical indication. Recently developed attachment systems are small and promise improved retentive capacity, while existing magnetic attachments continue to be technologically modified and improved [11].

Various types of appliances, such as clasps, telescope crowns, and attachments, have been used. They are requested to work effectively to control the movement of dentures, though the mechanism and function of the retention are different among each other. However, while these appliances work effectively, the abutment teeth are suffering from great stress and sometimes break down due to overstress. In other words, retentive appliances have a positive effect to retain the denture effectively and a negative effect to bring stress on the abutment teeth. How to reduce the negative effect is the most important consideration for designing partial dentures [1].

The magnetic attachment has been used clinically for more than 25 years, and its advantages and disadvantages are mostly clarified. It is now recognized in general that the magnetic attachment is a useful retentive appliance for removable partial prosthesis. Taking clasps and telescope crowns or mechanical attachments as the first and second generation of denture retentive appliances respectively, the magnetic attachment can be regarded as the third generation [1].

Apart from the time (quite briefly) spent by the practitioner to get familiar with the use of magnets, they have virtually no contraindication. Advantage of intra oral magnets include easy incorporation into the denture involving simple clinical and technical procedures, ease of cleansing, ease of placement for both dentist and patient [12].

CONCLUSIONS

Magnetic systems offer very good conditions of balance and functionality, because the remaining teeth are small (2-4), placed bilaterally. Patients are satisfied with the functionality of the prostheses [13].

They can be used on roots whose implantation has been greatly reduced and does not allow the use of another retention system, provided there is no apical or periodontal pathology that requires tooth extraction.

The magnetic anchorage system of mobile prostheses is an alternative to friction-based mechanical systems (staple type, telescope, bar). Magnetic systems prove to be effective, with a quality-price ratio in favor of the patient [12,14].

The true causes of failure of overdentures with magnetic attachment are improper selection of attachments, failure to develop proper denture base extension and border seal, and for mandibular bases, failure to cover the retromolar pad [15].

Magnetic prosthesis is a simple, easy-to-use method in clinical practice. Preservation of remaining root and alveolar bone by overdenture concerned the dentists over time, as shown by the literature [16-21]. By overdenture, occlusal forces are transmitted all over the prosthetic field uniformly, thereby reducing resorption. Using magnetic systems, especially when mechanical systems are contraindicated due to poor prosthetic field (large coronary destructions, DVO low, few teeth remaining) magnets gives them a special place in dental practice. The success of the tooth-supported overdenture treatment depends upon the proper attachment selection for the particular case which include available buccolingual and inter arch space, the amount of bone support, opposing dentition, clinical skill personal preferences, maintenance problems, cost and most important being patient's motivation.

Magnet retained overdenture preserving natural teeth has better proprioception and satisfaction. Also is psychologically beneficial as the patient had not undergone extraction [22]. This system has successfully rehabilitated the patient when compared to overdenture with implants, when cost and time factors were considered.

For elderly patients, it can be a viable alternative of treatment and because of the ease with which the prosthesis is positioned on the prosthetic field. The purpose of a prosthetic treatment is to restore the functions of the masticatory apparatus. The patient should be well informed about the treatment, otherwise he will often be confused, unsatisfied and uncooperative [23-24].

The reduced use of magnetic systems in the current practice of the dental office is mainly due to the lack of knowledge and familiarization of dentists, the increase in the cost of the denture, and the low addressability caused by the mentality of extracting the last teeth in the subtotal edentulous.

REFERENCES

- 1. Minoru A, Shiau YY. New Magnetic Applications in Clinical Dentistry. Quintessence Books; 2004
- 2. Păuna M, Preoteasa E. Aspecte practice în protezarea edentației totale. Ed Cerma; 2005
- 3. Hutu E, Păuna M, Constantinescu MV, Bodnar V, Țâncu AM. Edentația totală. Ed. Național; 2002
- 4. Preoteasa E. Aspecte clinice și terapeutice la edentați total cu modificări ale statusului oral. Ed Carol Davila; 2005
- 5. Preoteasa E, Muntianu LS, Meleşcanu M, Țâncu AM. Evaluarea diagnostică a gradului de dificultate a edentatului total. Medicina Stomatologică. 2004; 8(4):23-29
- 6. Ionescu A. Tratamentul edentației parțiale cu proteze mobilizabile. Ed Național; 2001
- 7. Preoteasa E, Muntianu LS. Considerente asupra supraprotezării mobile mandibulare. Medicina stomatologică. 2005; 9(1):15-16
- 8. Tegawa Y, Kinouchi Y. Dental magnetic attachment: toward third generation devices. IEEE Trans Biomed Eng. 2008; 55(3):1185-90

- 9. Magfit. Full Product Line-Up. Catalogue Aichi Steel
- 10. Anupam P, Anandakrishna GN, Vibha S, Suma J, Shally K. Mandibular Overdenture Retained by Magnetic Assembly: A Clinical tip. J Indian Prosthodont Soc. 2014; 14(Suppl 1):328–333
- 11. Laird WRE, Grant AA, Smith G. Magnetic retention units for overdentures. J Oral Rehabil. 1983; 10:481-488
- 12. Gillings BR. Magnetic denture retention systems: inexpensive and efficient. Int Dent J. 1984; 34(3):184-97
- 13. Țâncu AMC, Preoteasa E. Supraprotezarea pe magneți prin metoda directă. Studiu de caz. Romanian Journal of Stomatology. 2010; 56(2)
- 14. Preoteasa E. Sindromul combinației. Partea I. Aspecte clinice și epidemiologice. Medicina stomatologică. 2004; 8(5):42-47
- 15. Mensor MC. Attachment fixation for overdentures. Part I. J Prosthet Dent. 1977; 37(4):366-373
- 16. Gillings BR. Magnetic retention for complete and partial overdentures. Part I. J Prosthet Dent. 1981; 45:484-91.
- Riley MA, Walmsley AD, Harris IR. Magnets in prosthetic dentistry J Prosthet Dent. 2001; 86:137-42
- Smith GA, Laird WR, Grant AA. Magnetic retention units for overdentures. J Oral Rehabil. 1983; 10:481-8
- Rutkunas V, Mizutani H. Retentive and stabilizing properties of stud and magnetic attachments retaining mandibular overdenture. An in vitro study. Stomatol Baltic Dent Maxillofac J. 2004; 6:85-90
- 20. Rissin L, House JE, Manly RS, Kapur KK. Clinical comparison of masticatory performance and electromyographic activity of patients with complete dentures, overdentures, and natural teeth. J Prosthet Dent. 1978; 39(5):508-511
- 21. Carreiro AFP, Guerra CMF, Moraes SLD, Neto AF, Torres EM. The use of a magnetic attachment in a removable partial denture of a patient with periodontal tissue loss. Int J Dent. 2009; 8(4): 215-219
- 22. Upadhayaya V, Yadav A, Jain P, Kushaldeep K. Prosthetic Rehabilitation in a Partially Edentulous Patient with Magnetic Dentures. J Interdiscipl Med Dent Sci. 2017; 5(4): 221. DOI: 10.4172/2376-032X.1000221
- 23. Popovici RA, Podariu AC, Rusu LC, Porumb A, Todor L, Motoc O, Levai MC. Leadership in dental health services. Medicine in Evolution. 2016; XXII(4):578-584
- 24. Todor L, Domocoș D, Matei RI, Popovici-Muț AM, Todor SA, Lucan A, Todor BI, Scrobotă I, Cuc A, Porumb A. Restoration of upper anterior teeth morphology in case of dental attrition. Case presentation. Medicine in Evolution. 2018; XXIV(2):174-181

Retrospective study of lower third molar pathology



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Abstract

The lower third molar is tributary to the pathology of any other tooth, but it has also its own pathological, individual inheritance. Lower third molar, or wisdom tooth, have the most variable dimensions and forms, and hardest accessibility during the therapeutic treatment. The etiology of affections of the third mandibular molar varies according to the variety of existing conditions. The lower third molar region is an important region for the stomatological practice, since it presents a great amount of pathological processes related to the development and eruption of the third molar, thus having a considerable number of surgical interventions.

Keywords: lower third molar, pathology, eruption, mandibular

INTRODUCTION

The place intended to be occupied by the lower wisdom tooth corresponds to an anatomical region found in the posterior zone of the oral cavity, between the second lower molar and the mandibular ramus, extending medially to the floor of the oral cavity, and laterally up to the oral vestibule. Inferiorly, the region penetrates the skeletal plane constituted by the mandible in the retromolar region. Superiorly, its level varies depending on the level of eruption of the third molar, being able to extend up to the molar occlusal plane [1-4].

Thus described, this region is related to the gingival-alveolar dental mandible, buccal, parotidmesseteric, paralingual space, submandibular, pterygomandibular, pterygopharyngeus and tonsillar regions [1].

The place occupied by the lower third molar is flanked by muscular inserts at various levels of the mandible bone: buccal - internal pterigoidian, bucopharingian, milohioidian; jugal - the temporal, the masseter, the buccinator (Figure 1). These well-represented and very strong muscular formations, which play an essential role in the dento-maxillary functions, resonate whenever the third molar presents complications, participating in them, enriching the symptomatology and sometimes making the diagnosis difficult, and almost always the therapeutic solution. Thus we recall trismus and migratory abscess to prove muscular participation in paramolar pathology.



Figure 1. The external and internal surface of the mandible

Knowing that the milohioidian muscle is attached to the milohioidian line the relations of the line with the third molar apex are very important and conditioned by three factors: the height of the mandible body; the anterior-posterior length of the alveolar process; the length of the three molar roots.

Usually the apexes of the third molar are below the milohioid crest; therefore an abscess will appear below the floor of the oral cavity in the submandibular region. Because the alveolar process is of a small length, the third molar is entirely in the ascending branch or its distal portion is in contact with the anterior rim of the upward ram. Having this topographic anatomy, access to the third molar in surgical maneuvers is difficult.

Relationships of the root of the third molar with the mandibular canal are also important in the dental clinic, as there may be situations when the bone lamellae defining the mandible can have serious defects and the relationship is between the contents of the canal and the periapical tissue. As a consequence of this situation is the acute pain, neuralgic, after the extraction of the third molar or in the periapical inflammation.

Disease associated with third molar teeth may be clinically obvious or occult. Although tooth pain is commonly associated with third molars, patients will frequently present with nebulous complaints of headache, "pressure," or pain that is not readily attributable to the teeth. In many of these scenarios, clinical examination will not be able to definitively attribute the symptoms to the third molars [5-7].

Pericoronitis, an inflammatory condition associated with the soft tissue around a partially erupted third molar, commonly occurs when a lower third molar tooth cannot erupt fully and remains partially covered by a soft-tissue operculum because of its position in the jaw. It has been suggested that the teeth most likely to develop pericoronitis are vertically positioned lower third molars at or near the level of the occlusal plane [8–11] but pericoronitis is also seen in a high percentage of orthodontically treated cases with mesioangular position of the lower third molars [12]. In some cases, pericoronitis may be chronic and painless with only intermittent symptoms, but is often acutely recurrent in a specific individual [13-15]. Mandibular third molar pericoronitis may be associated with more underlying periodontal inflammatory disease in young adults when compared with a similar population without pericoronitis [6,7,16,17].

Aim and objectives

The aim and objectives of this retrospective study are to evaluate the incidence of lower third molar pathology. This was analysed based on different factors such as: gender, age, type of pathological condition. This study was based on an analysis of the cases that addressed to the Cranio-Maxillo-Facial Surgery Clinic in Timisoara over 4 years. The identification of the existing relationships between different situations and their frequencies can help us provide a statistic analysis of this number of cases.

MATERIALS AND METHODS

In this study, a retrospective analysis was performed from a total of 950 patients that were admitted in the Cranio-Maxillo-Facial Surgery Clinic from Timisoara, between the period January 1996 - December 1999. The type of study was longitudinal, based on the information provided by consultation registers, focusing on representative variables: age, gender, type of affection (according to diagnosis in the registers). Of all 950 patients with affections of lower third molars, 416 were males (44%) and 534 females (56%), most of them from urban areas (Table 1).

	TOTAL PATIENTS	FEMA	LE GENDER	MALE GENDER		AGE OF	AGE IN
YEAR	NUMBER	No.	%	No.	%	WOMEN	MALE
1996	249	147	59	102	41	16-60	13-82
1997	242	126	52	116	48	10-75	16-88
1998	221	111	50	110	50	15-54	17-65
1999	238	150	63	88	37	16-63	16-88

Table 1. Distribution of patients by gender

Pathology related to the third mandibular molar was quite balanced as a distribution at the level of the two hemiarcades, with a slight preponderance for the left one, being very rare in both hemiarcades at the same time (Table 2).

YEAR	TOTAL	LOWER	ARCA RIGHT		ADE		No. patients with	
	PATIENTS	THIRD			LE	LEFT b		both affected M3
	NUMBER	MOLARS	No.	%	No.	%	No.	%
1996	249	255	120	47	135	53	6	2,3
1997	242	242	119	49	123	51	-	-
1998	221	229	110	48	119	52	8	3,4
1999	238	246	122	49	124	51	8	3,2

Table 2. Distribution of lower third affected molars

We have encountered ten kinds of diseases of the lower third molar or caused by it. In the order of their frequency we listed them in Table 3.

NO.	TYPE OF DISEASE	1996	1997	1998	1999	CASES
1	pericoronaritis	87	53	64	70	274
2	total inclusion	56	71	63	69	259
3	osteitis	32	42	24	24	122
4	abscess	32	26	21	25	104
5	difficult eruption	13	16	13	14	56
6	partial inclusion	13	16	11	14	54
7	radicular rest	8	8	9	10	35
8	alveolitis after tooth extraction	4	6	9	7	26
9	follicular cyst	2	3	7	5	17
10	ameloblastom	2	1	0	0	3

Table 3. Affections in lower third molar

If we take into account the two types of inclusion (total and partial), it goes to first place in the pathology of the lower three molar. We made this observation because, in most statistics on pathological conditions related to the inferior third molar, inclusion is generally incriminated.

RESULTS

The age at which the disorders on third mandibular molar occurred is between 10 and 75 years for women, respectively 13 to 88 years for men. Gender concerns show slightly higher figures for women (56% of the annual average), with a peak in 1999 (63% vs. 37%).

Topographically hemiarcades are sensibly equally affected, with slight dominance on the left (the annual average is 51.75%). Simultaneous damage to both arcades is rare.

Percentage distribution by years of the affections of the lower third molar is represented in Figure 2.



Figure 2. Percentage distribution of the affections of the lower third molar by years

DISCUSSIONS

There has been much discussion in the literature regarding the prevalence of the lower third molar pathology. Third molar interferes with the fixed prosthetic treatment plan (crown). Retained third molar tooth interferes with removable prosthetic treatment plans.

There are problems associated with malpositioned third molars such as ectopic positioning due to supra-eruption with altered occlusion plan.

Impacted third molars are the most common developmental conditions that affect humans. The area in which this molar is formed and develops is rich in different anatomical structures: bone, nerves, muscles, glands, etc. Illnesses of adjacent anatomical formations amplifies the symptomatology, makes treatment more difficult and causes complications.

Pathologic manifestations may be divided into soft-tissue conditions (primarily pericoronitis), conditions affecting hard tissues of teeth, and lytic lesions of bone.

Ample peer-reviewed literature has reported the flora associated with both acute and chronic pericoronitis [18–23].

The surgeon should recognize that the presence of asymptomatic disease may necessitate extraction of retained third molars at an age when morbidity is likely to be less and recovery faster. There has always been a debate whether to remove or leave asymptomatic mesioangular impacted lower third molars. Controversy continues to cloud the issue of lower third molar retention, although enough information is available for the surgeon to make informed decisions in recommending retention or extraction for his patients [24-27].

CONCLUSIONS

The conclusions that emerge from this study are based on the analysis of 950 patients and 10 types of affections in lower third molar. The statistical analysis assessed the fact that an asymptomatic third molar does not necessarily reflect an absence of disease.

Unerupted, disease-free third molar teeth may be retained indefinitely. Third molars are considered to be "impacted" when they don't have enough room to emerge or grow normally. Therapeutic decisions remain the responsibility of individual practitioners. The treatment indicated in the inclusion of the inferior third molar is the radical or conservative surgery in relation to the shape, position and depth of the tooth in the bone, the size of the distal space of the second molar, the patient's age, the condition of the bone, the complications that inclusion has caused.

Our study shows that the incidence and complications associated with lower third molar are higher in women than in men,

For all the findings of the present study, we are the followers of the idea that the third lower molar, through itself and through what it can train during its formation and development, deserves and justifies giving attention to complex and extended studies over time. We also support the need for a preventive attitude set as many as possible early on.

REFERENCES

- 1. Azaz B, Lustmann J. Anatomical configurations in dry mandibles. Br. J. Oral Surg. 1973; 11(1):1-9
- 2. Celebic A, Valentic-Peruzovic M, Kraljevic K, Brkic H. A study of the occlusal plane orientation by intra-oral method (retromolar pad). J. Oral Rehabil. 1995; 22(3):233-6
- 3. Fakhry A. The mandibular retromolar area as a donor site in maxillofacial bone grafting: surgical notes. Int. J. Periodontics Restorative Dent. 2011; 31:275-83
- 4. López FB, Suazo G I ,Cantín LM, Sandoval MC. Biomethrics study of the retromolar pad. Int. J. Odontostomat. 2008; 2(1):22-5
- 5. Samsudin AR, Mason DA. Symptoms from impacted wisdom teeth. Br J Oral Maxillofac Surg. 1994; 32:380–3
- 6. Shugars DA, Jacks MT, White RP, et al. Occlusal caries experience in patients with asymptomatic third molars. J Oral Maxillofac Surg. 2004; 62(8):973-979
- Garaas R, Moss KL, Fisher E, et al. Prevalence of visible third molars with caries experience or periodontal pathology in middle-aged and older Americans. J Oral Maxillofac Surg. 2011; 69(2):463-470

- 8. Hazza'a AM, Bataineh AB, Odat AA. Angulation of mandibular third molars as a predictive factor for pericoronitis. J Contemp Dent Pract. 2009; 10:51–8
- 9. Blakey GH, White RP Jr, Offenbacher S, et al. Clinical/biological outcomes of treatment for pericoronitis. J Oral Maxillofac Surg. 1996; 54:1150–60
- 10. Halverson BA, Anderson WH 3rd. The mandibular third molar position as a predictive criteria for risk for pericoronitis: a retrospective study. Mil Med. 1992; 157:142–5
- 11. Leone SA, Edenfield MJ, Cohen ME. Correlation of acute pericoronitis and the position of the mandibular third molar. Oral Surg Oral Med Oral Pathol. 1986; 62:245–50
- 12. Gungormus M. Pathologic status and changes in mandibular third molar position during orthodontic treatment. J Contemp Dent Pract. 2002; 3:11–22
- 13. Laine M, Venta I, Hyrkas T, et al. Chronic inflammation around painless partially erupted third molars. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2003; 95:277–82
- 14. Dodson TB. How many patients have third molars and how many have one or more asymptomatic, disease-free third molars? J Oral Maxillofac Surg. 2012; 70(9 suppl 1):S4-S7
- 15. Blakey GH, Marciani RD, Haug RH, et al. Periodontal pathology associated with asymptomatic third molars. J Oral Maxillofac Surg. 2002; 60(11):1227-1233
- 16. Gelesko S, Blakey GH, Partrick M, et al. Comparison of periodontal disease in young adults with and without pericoronitis involving mandibular third molars. J Oral Maxillofac Surg. 2009; 67:134–9
- 17. Blakey GH, Jacks MT, Offenbacher S, et al. Progression of periodontal disease in the second/third molar region in subjects with asymptomatic third molars. J Oral Maxillofac Surg. 2006; 64(2):189-193
- 18. Leung WK, Theilade E, Comfort MB, et al. Microbiology of the pericoronal pouch in mandibular third molar pericoronitis. Oral Microbiol Immunol. 1993; 8: 306–12
- 19. Mombelli A, Buser D, Lang NP, et al. Suspected periodontopathogens in erupting third molar sites of periodontally healthy individuals. J Clin Periodontol. 1990; 17:48–54
- 20. Hurlen B, Olsen I. A scanning electron microscopic study on the microflora of chronic periocoronitis of lower third molars. Oral Surg Oral Med Oral Pathol. 1984; 58:522–32
- 21. Sixou JL, Migaud C, Jolilvet-Gougeon A, et al. Evaluation of the mandibular third molar pericoronitis flora and its susceptibility to different antibiotics prescribed in France. J Clin Microbiol. 2003; 41: 5794–7.
- 22. Sixou JL, Magaud C, Jolivet-Gougeon A, et al. Microbiology of mandibular third molar pericoronitis: incidence of beta-lactamase-producing bacteria. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2003; 95:655–9
- 23. Rajasuo A, Sihvonen OJ, Peltola M, et al. Periodontal pathogens in erupting third molars of periodontally healthy subjects. Int J Oral Maxillofac Surg. 2007; 36: 818–21
- 24. Stanley HR, Alattar M, Collett WK, et al. Pathological sequelae of "neglected" impacted third molars. J Oral Pathol. 1988; 17:113–7
- 25. Yildirim G, Ataoglu H, Mihmanli A, et al. Pathologic changes in soft tissues associated with asymptomatic impacted third molars. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008; 106:14–8
- 26. Chaves AJ, Nascimento LR, Costa ME, et al. Effects of surgical removal of mandibular third molar on the periodontium of the second molar. Int J Dent Hyg. 2008; 6:123–8
- 27. Krausz AA, Machtei EE, Peled M. Effects of lower third molar extraction on attachment level and alveolar bone height of the adjacent second molar. Int J Oral Maxillofac Surg. 2005; 34:756–60

Tooth wear - a current problem



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Abstract

Tooth wear is the term used to describe the progressive loss of a tooth's surface due to actions other than those which cause tooth decay or dental trauma. Tooth wear is deterioration as a result of use. Occurring in teeth, it is considered to be a physiological and adaptive phenomenon that has existed since the beginning of mankind. Pathological wear of teeth that do not correlate with biological age is asymmetric in most cases. Dental wear is loss of tooth structure resulting from abrasion, erosion, attrition and abfraction [1-3]. There are two basic mechanisms of hard dental tissues pathological wear: mechanical and chemical. Mechanical wear includes attrition, abrasion and abfraction. Chemical wear includes erosion.

Dental wear is an irreversible process. Identifying and treating the causes, restoring destroyed areas, and tracking the stability of therapeutic outcomes are absolutely necessary to preserve the health and function of the oral cavity.

Keywords: tooth wear, attrition, abrasion, erosion, abfraction

INTRODUCTION

Tooth wear is deterioration as a result of use. It has existed since the beginning of mankind in all cultures and civilizations. It occurred routinely and intensely in early populations but was considered to be a physiological process.

With aging, the primary tooth morphology changes as a result of a process of enamel and dentin wear. It occurs slowly and progressively (causing volume loss), causing the appearance of another form of morphology, called secondary. This phenomenon is normal (physiological) and occurs to the same extent at the level of all the teeth present on the arch [4,5].

Pathological wear of the teeth, which does not correlate with age, is asymmetric in most cases. This causes muscular and articular imbalance during chewing, swallowing or phonation [4,5]. Nowadays, pathological wear is more and more common among young people. The amount of tooth wear seen currently is considerably greater than in the past due to the fact that more people are now retaining their natural teeth into old age. The prevalence of any tooth wear (where dentine is exposed on at least one tooth surface) among the dentate (possessing natural teeth) population reported during the 2000–2002 National Surveys by Dental Health Foundation Ireland was 17.4% for 12 year old's; 29.7% for 15 year old's; 38.1% for 16–24 year old's; 76.2% for 35–44 year old's; 93.0% for 65+ year old's. For all age groups, males had a higher prevalence of tooth wear than females. Modern available studies examined the prevalence of hard dental tissues mechanical wear. This provides that 3% of individuals in the aged of 20 years have signs of tooth wear, while older individuals (17% in the age 70) are characterized as people with increasing index [6].

Ideas about dental wear are not as clear today because while it is less pronounced it sometimes appears in pathological patterns. Moreover, it is produced by many complex mechanisms acting in synchrony or sequentially, in synergy or additive, in patterns that often mask its true origins. This notion is sometimes confusing because wear can also assume a pathological character when it is associated with problems of alimentation, bruxism with frequent awakenings from sleep, noxious habits, medications, or certain types of behavior or repeated work-controlled activity.

Examined under a microscope no surface appears totally smooth. When two different surfaces meet it is their asperities that come into contact acting as abrasive particles. Wear starts with loss of the hard, translucent enamel that forms the outer covering of teeth, and might, in more serious cases, progress to the softer inner tooth structure, dentin. Dental wear is loss of tooth structure resulting from abrasion, erosion, attrition and abfraction [1-3].

Aim and objectives

The aim of this study is to discuss the cause of pathological tooth wear and its consequences, in an effort to ameliorate the means of preventing and diagnosing dental wear and improving our understanding of its diverse manifestations.

TYPES OF TOOTH WEAR

There are two basic mechanisms of hard dental tissues pathological wear: mechanical and chemical. Mechanical wear includes attrition, abrasion and abfraction. Chemical wear includes erosion.

Attrition is the type of wear of two solid moving bodies whose surfaces are in direct contact. It is the mechanical wear caused by functional or para-functional dento-dental contact without food interposition or the action of other tooth extrinsic factors. Microscopically, parallel striations are observed, macroscopically glossy faces appear with well-rounded edges. Within one year about 0,03mm of the enamel thickness is lost. In the oral

cavity these progressive phenomena cause tooth-to-tooth friction occlusally and interproximally that can be physiological or pathological [7]. Mostly it occurs on the antagonist teeth in the incisal edges of the anterior teeth and the occlusal surfaces of posterior teeth, where there are defects in the shape of smooth shiny facets bounded by a sharp edge. It will tend to be more pronounced in people who eat a particularly fibrous diet [8]. When dentin is exposed it appears at the same level as remaining enamel without any margin between them (Figure 1).



Figure 1. When wear is widespread and dentin is exposed there is no demarcation between dentin and enamel

The degree of attrition will depend on the use of each person's teeth. It will increase in people who habitually clench or grind their teeth (bruxism), (Figure 2) [9-11].



Figure 2. The attrition wear facets that correspond with each other and remain in contact during minor excursive movements of the mandible indicate to the examiner that a diagnosis of daytime bruxism is appropriate [10]

Abrasion is the loss of hard dental tissues contingent by physical damage due to mechanical action of substances or objects from the external environment [5]. Abrasive defects are localized on the incisal edges of the anterior teeth and the occlusal surfaces of the posterior teeth as well as in the cervical area of the teeth (Figure 3).



Figure 3. Abrasive defects localized on the incisal edges of the lower anterior teeth

Localization and appearance of abrasive defects are conditioned by the type of causing factors, which are:

- abrasive effect of food;
- traumatizing technique of oral hygiene (toothbrushing using traumatic technique with a predominance of horizontal movements using high pressure, using a toothbrush with hard bristles, inconsiderate use of floss or toothpicks, abrasive effect of toothpastes);

- some bad habits: biting of nails, tacks, clips, threads, as well as holding of different objects in the teeth (pencils, pens, pipes) that can be related to some professions (musicians playing wind instruments, dressmakers, glass blowers, etc.) [5, 12, 13]. The most typical localization of abrasive defects in this case is the upper central incisor, where the notch on the incisal edge can be seen;
- iatrogenic factors like nonarticulated fillings, crowns, dentures clips;
- peculiarities of the environment (quarries, mines, deserts), where the sand particles and other substances can get into the oral cavity.

According to the depth of abrasive defect we can distinguish: enamel abrasion; enamel and dentin abrasion; abrasion of whole dental crown with the risk of the dental pulp exposing [13]. Clinical manifestations are similar to attrition. The term abrasion can also include the fatigue wear (Figure 4). This is a process where one object exerts a force on the surface of second one with simultaneous linear movement. In the oral cavity, fatigue wear can appear on some sectors of enamel contact subjected to strong pressure not related to mastication [14,15].



Figure 4. Fatigue wear of enamel

Abfraction is also called "cervical stress lesions" [13]. The term abfraction was first introduced by McCoy in 1982 and explains the processes in which eccentric occlusal forces cause compression or tension in the enamel and dentin of the cervical area of the tooth and makes it susceptible to damage by abrasive and erosive factors [3, 13]. They are localized in the cervical third of the tooth in the cement-enamel junction and have typical shape of the letter V, with glossy surface and the sharp incisal/occlusal edge (Figure 5).



Figure 5. Abfraction (wedge-shaped defects in cervical part of teeth)

Erosion or *corrosive wear*, occurs when a chemical attack of acid or chelation breaks inter-molecular bonds of dental tissues or restorative materials, making it possible for other wear mechanisms, notably attrition during parafunctional activity during sleep or waking hours, occlusal abrasion, and cervical iatrogenic abrasion stemming from tooth brushing [16]. The principal extrinsic agents are derived from foodstuffs and chemical elements in the environment. They consist of sodas, citric fruits, fruit juices, wines, pre-mixed alcoholic beverages designed for the adolescent market, so-called energy drinks. Some medications, like ascorbic and salicylic acids and some mouthwashes can also be incriminated. The

principal intrinsic sources are regurgitations, gastro-esophageal re- flux, and spontaneous vomiting provoked by chronic alcoholism or anorexia/bulimia.

When corrosive wear is active it strongly aggravates brushing-caused cervical and occlusal abrasion, helping to create concave and rounded wear zones [17,18].

DISCUSSIONS

They are many factors favoring pathological dental wear, such as: the number of teeth present at the arcades level, quality of the dental structure, traumatic occlusion, parafunctions, diet, status of salivary secretion, gastrointestinal disorders, vicious habits and last but not least excessive brushing.

The mechanisms of hard dental tissues wear is very rarely act in isolation. Mostly combined lesions occur. Multifactorial character of wear includes three basic mechanisms such as friction, chemical influences and the load due to compression, flexion and tension. Various types of hard dental structures wear are the result of isolated or combined action of causing factors.

Erosion and abfraction combination is characterized by a loss of hard dental tissues during synergistic effect of erosive chemical substances at places of load concentration. Erosion and abfraction combination is described as a loss of hard dental tissues when erosive substances act on places with attrition wear [3]. These defects can be observed in patients with gastroesophageal reflux disease or frequent vomiting [5].

Combined erosive-abrasive lesions are the most common type of hard dental tissues noncarious lesions. They are formed by the synergistic action of erosive agents and abrasive factors. It is proven that the enamel disturbed by action of acids has greater susceptibility to abrasion and attrition compared to intact enamel [19]. This condition can occur during the teeth brushing, their enamel has been demineralized due to erosive attack. In this case the erosive-abrasive additional effect is observed. Eroded enamel loss after tooth brushing is 10 times greater than that of intact enamel [14]. Similarly, the abrasive-erosive additional effect impacts on coronary or prosthetic restoration materials [7].

CONCLUSIONS

A number of physical and chemical mechanisms, which interact with each other in most cases, are implicated in the development of dental wear.

Defects of hard dental tissues contingent by physical or chemical wear are frequently occurring condition. Reconstruction of advanced stages is very demanding and requires a comprehensive, interdisciplinary approach. If these defects are diagnosed at an incipient stage and their etiologic factors are determined and eliminated, their progression can be stopped only by preventive or minimal invasive measures. In the treatment and prevention of defects is important to provide a regular monitoring of existing lesions and the stabilization of other pathologies, such as periodontal diseases, xerostomia or dentin hypersensitivity.

Dental wear is an irreversible process. Identifying and treating the causes, restoring destroyed areas, occlusion, and tracking the stability of therapeutic outcomes are absolutely necessary to preserve the health and function of the oral cavity.

REFERENCES

- 1. Litonjua LA, Andreana S, Bush PJ, Cohen RE. Tooth wear: Attrition, erosion, and abrasion. Quintessence Int. 2003; 34:435-46
- Lussi A. Dental erosion. In: Lussi A, editor. Monographs in Oral Science. Vol 20. Basel: Karger. 2006; pp:1-8

- 3. Grippo JO, Simring M, Schreiner S. Attrition, abrasion, corrosion and abfraction revisited. A new perspective on tooth surface lesions. Journal of the American Dental Association. 2004; 135(8):1109-1118
- 4. Smith BG, Knight JK. An index for measuring the wear of teeth. British Dental Journal. 1984; 156(12):435-438
- 5. Lussi A, Ganss C. Erosive tooth wear from diagnosis to therapy. Basel: Karger; 2014.
- 6. Van't Spijker A, Rodriguez JM, Kreulen CM, Bronkhorst EM, Bartlett DW, Creugers NH. Prevalence of tooth wear in adults. International Journal of Prosthodontics. 2009; 22(1):35-42
- 7. Zum Gahr KH. Classification of wear processes, in Zum Gahr KH (Ed.), Microstructure and wear of materials (Amsterdam: Elsevier). 1987; 80-131.
- 8. Lussi A, Jaeggi T, Schaffner M. Diet and dental erosion. Nutrition. 2002; 780-781
- 9. Mair LH. Wear in dentistry. Current terminology. J Dent. 1992; 20(3):140-4
- 10. Seligman DA, Pullinger AG. The degree to wich dental attrition in modern society is a function of age and of canine contact. J Orofac Pain. 1995; 9(3):266–75
- 11. Brocard D, Laluque JF, Knellesen C. La gestion du bruxisme. Paris: Quintessence International. 2008.
- 12. Pickles MJ. Tooth wear, in R.M. Duckworth (Ed.), The teeth and their environment. Physical, chemical and biochemical influences. Basel: Karger. 2006; 86-88.
- 13. Bartlett DW, Shah P. A critical review of non-carious cervical (wear) lesions and the role of abfraction, erosion, and abrasion. Journal of Dental Research. 2006; 85(4):306-312.
- 14. Mair LH, Stolarski TA, Vowles RW, Lloyd CH. Wear: mechanisms, manifestations and measurement. Report of a workshop. Journal of Dentistry. 1996; 24(1-2):141-148.
- 15. D'Incau E, Saulue P. Undestanding dental wear. J Dentofacial Anom Orthod. 2012; 15:104
- 16. Ganss C. Definition of erosion and links to tooth wear. In: Lussi A, ed. Dental erosion. Monogr Oral Sci. Bassel: Karger. 2006; 20:9–16.
- 17. Ganss C, Lussi A. Diagnosis of erosive tooth wear. In: Lussi A, ed. Dental erosion. Monogr Oral Sci. Bassel: Karger. 2006; 20:32–43.
- 18. Bacon W, Canal P, Walter B. Reconnaître les érosions coronaires: atlas des principales formes cliniques. Rev Orthop Dento Faciale 2007; 41:333-47.
- 19. Yip HK, Smales RJ, Kaidonis JA. Tooth erosion prevention and treatment. New Delhi: Jaypee Brothers, 2-nd printing, 2009.

The cumulative effect of antioxidant vitamins in the precancerous stages of the oral cavity and the decrease of relapses



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Abstract

The cumulative effect of vitamin E administered in polytherapy with certain carotenes or with vitamin C enhances prevention by acting on the carcinogenesis of the salivary glands and on the head and neck carcinoma. For the oral cavity cancer, a tumor of the upper digestive tract, the association of vitamin E with some carotenes contributes to the synergistic effect of counteracting these processes. Antioxidants, such as vitamin C, vitamin E and retinoids play an essential role in metabolism. Besides their antioxidant and protective effect on the cells, they also interfere in modulating immunity, inducing apoptosis and regulating cellular proliferation and differentiation.

There are several risk factors in triggering oral cavity cancer: smoking, excessive alcohol consumption, prolonged exposure to the sun, irritations in the oral cavity, unhealthy nutrition or nutrition that is defficient in some vitamins, poor oral hygiene. Abusive and prolonged smoking for a period of 15-20 years, producing chronic mucosal irritation with tobacco products, represents the main factor in causing oral cavity cancer (98%). The limitation of risk factors in combination with vitamin therapy contributes significantly to the remission of the precancerous conditions of the oral cavity.

The use of antioxidants in precancerous and cancerous conditions should be considered according to the individual factors that require both natural and parenteral nutrition to be analyzed as antioxidants have proven useful as supportive treatment, reducing inflammation by suppressing COX-2 and NF- κ B pathways.

Keywords: precancerous, carcinogenesis, antioxidant vitamins, vitamin E, oral cavity.

INTRODUCTION

Lal et al., 1999, considered that the effect of antioxidant vitamins such as tocopherols, carotenoids and ascorbic acid on the mechanisms of carcinogenesis is more beneficial if these chemopreventive substances are administered in polytherapy as it is known that carotenoids have an enhanced prevention effect in lung cancer, the ascorbic acid acts on the salivary gland cancer and tocopherols act on the head and neck cancers [1].

According to Gurkan et al., 2014, the precancerous lesions of the oral mucosa are considered as malignant potentiators that are included in pathologies with early diagnosis [2]. A very high malignant transformation is seen in oral leukoplakia, oral submucous fibrosis and oral erythroplakia. The lichen planus of the oral mucosa is one of the conditions with malignant potential that can be divided into six different subtypes: papular, reticular, plaque-like, atrophic, erosive and bullous. The atrophic and erosive subtypes present a higher risk of malignant transformation compared to the other subtypes. The etiology of these pathologies remains unknown in almost all cases despite the various etiological studies.

Etiological factors may vary due to their origin. The more frequently reported ones are alcohol consumption, tobacco consumption and the consumption of chewable tobacco that contains areca nut extract under UV light. Early diagnosis is very important for the prevention of oral cancers in early stages because in late stages they can progress into severe dysplasia and even carcinoma in situ and / or squamous cell carcinoma. In most pathologies, the results of the treatment are not satisfactory, despite different therapies. After surgical intervention, different alternative maneuvers can be used locally and systemically, such as corticosteroids, calcineurin inhibitors and retinoids.

According to Axell et al., 1994 leukoplakia can affect clinically any part of the oral and oropharyngeal cavity and can be divided into two subtypes, including the homogeneous and non-homogeneous types [3]. Homogeneous lesions are characterized by a uniform, thin colour with superficial lesions in the keratin layer [3, 4]. Non-homogeneous lesions are defined as white and erythematous lesions, also called erythroleukoplakias, which may be irregular, smooth or nodular. Verrucous leukoplakia is another type of non-homogeneous erythroleukoplakia.

The role of vitamin E in the prevention of oral cancer consists in inhibiting the tobaccospecific nitrosamine reaction that undergoes a specific activation and detoxification process. According to Asad Iqubal et al., 2014 vitamin E, a food supplement, can prevent oral cancer in the very early stage of premalignant lesions [5]. Its main role is to increase immunity, control free radicals on cellular mediated disorders, maintain membrane integrity, inhibit cancer cell growth, cytotoxicity. According to the specialized literature, vitamin E has an antioxidant role in the treatment of the oral mucosal lesions that include mainly erythroplakia, oral leukoplakia, oral lichen planus, oral submucous fibrosis and oral cancer. Its antioxidant effect helps prevent and slow the development of head and neck cancers, improve the effects of chemotherapy in cancer pathologies, and reduce side effects in chemotherapy and radiotherapy.

Following multiple research on the role of vitamin E as a chemopreventive factor in cancer pathologies, by its antioxidant effect, inhibits oral carcinogenesis, reduces the risk of developing oral cancer and contributes to the remission of premalignant lesions such as oral erythroplakia [5]. These oxidative processes in the body have a major role in the pathogenesis of cancer, which could be induced by inappropriate nutritional habits and unhealthy lifestyle practices. This process can cause changes in the DNA, which is a basic mechanism in the induction of cancer [5].

The increased antioxidant effect, reported by Silverman et al., 1991, both by food intake and by supplements, is crucial for the body when fighting against the free radicals [6]. To reduce the risk of oral and pharyngeal cancer, especially oral squamous cell carcinoma, the

diet should be optimized primarily to reduce calorie intake, monounsaturated fats, red meat or meat products. Vitamin E (alpha-tocopherol), vitamin A, β -carotene, lycopene, vitamin C, zinc and selenium are important dietary micronutrients with antioxidant effect. There is a considerable body of evidence suggesting the role of nutrients, especially of such antioxidants as vitamin E, vitamin A, β -carotene, vitamin C, lipoic acid, zinc, selenium and spirulina to prevent this disease.

Antioxidants are chemopreventive compounds that can deactivate free radicals and prevent their formation. These antioxidant nutrients inhibit the growth of cancer cells and destroy them by apoptosis (programmed cell death), by stimulating cytotoxic cytokines, by acting on gene expression, by inhibiting the blood supply for the tumor or by cell differentiation. It is also believed that antioxidants have the effect of reducing the side effects of chemotherapy when administered concomitantly.

The evaluation of serum glycoproteins run by Chitra and Shyamala Devi, 2008 in oral squamous cell carcinoma treated with radiation associated with vitamin E highlighted that the efficacy of vitamin E on glycoconjugates is of major importance in reducing disease progression [7]. The study conducted by the above mentioned authors included 26 patients with oral squamous cell carcinoma divided into two groups. The first group received a radiotherapy dose of 6000 cGy in five fractions per week for a six-week course and the second group received radiotherapy associated with vitamin E at a dose of 400 I.U./day for the entire period of radiotherapy. Glycoconjugate levels were significantly lower in patients treated with radiation and vitamin E than in patients receiving only the radiotherapy dose. This determination may be useful in assessing disease progression and in identifying resistant patients, the importance of vitamin E on reducing the glycoconjugate levels of the oral squamous cell carcinoma.

The combination of vitamin E, with antioxidant effect, with vitamin A and other carotenoid substances has the same beneficial effect on precancerous stages as well as in the prevention of relapses.

The study run by Stich et al., 1991 on maintaining the protective effect of beta-carotene or vitamin A on the remission of precancerous lesions located in the oral cavity in people who consume chewable tobacco shows that vitamin A administrated at a dose of 60 mg/week over a 6-month period resulted in a complete remission of leukoplakia in 57% of the subjects and in a decrease of the micronucleated cells by 96% [8]. Beta-carotene at a dose of 2.2 mmol/week induced remission of leukoplakia by 14.8% and a decrease of the micronucleated cells by 98%. Six months after vitamin A and beta-carotene were completely suppressed, leukoplakias relapsed by 50%, the frequency of micronuclei in the oral mucosa increased and the nucleus structure regained its initial form before the administration of the chemopreventive compounds.

In 1989, the study run by Stich et al. highlighted the fact that the administration of vitamin A and beta-carotene, 180 mg/week, plus vitamin A (100,000 I.U./week) or the administration of vitamin A alone (200,000 I.U. /week) in subjects who consume chewable tobacco reduced the frequency of micronucleated cells in the oral mucosa, led to the remission of oral leukoplakia and inhibited the development of new leukoplakias [9]. The advantages of this study lie in the fact that it uses a testing system that includes a thorough knowledge of the level of exposure to nitrosamines in tobacco and to reactive oxygen species that produce polyphenols, ease of quantifying the micronuclei in exfoliated oral mucosa and of assessing oral leukoplakia by means of noninvasive procedures. These studies provide "solid" information on the incidence of preneoplastic lesions and carcinomas. A dose of beta-carotene up to a level not considered overdose could maintain the reduced frequency of micronucleated cells and lead to the the remission of oral leukoplakias over extended periods of time.

Aim and objectives

The aim and objectives of this study was to evaluate the effect of antioxidant vitamins in defending the body against free radicals.

MATERIAL AND METHODS

The material required for the study consisted of a group of 20 male and female patients, smokers, aged 35-50 years, divided into two groups, the control group and the experimental group.

The clinical method, which includes the anamnesis and the objective clinical examination, was performed in the dental practice for the judicious clinical assessment of the physiological status of patients' oral cavity, respectively for the assessement of the pathological disorders in the oral cavity. Clinically, erythroplakia is the only lesion considered genuinely precancerous in the oral mucosa. The percentage of malignancy is estimated in 1/3 of cases. Erythroplakia (Figure 1) is considered to be the clinical expression of severe dysplasia and of carcinoma "in situ" as well as a form of onset in oral malignant tumors. From a histopathological point of view, the lesion is defined by the unique plaque typology as minor lesions with ulceration, rolled inverted edges, base extended in the surrounding tissues, firm consistency and imprecise borders, bright red with "lacquered" exudative surface.



Figure 1. Premalignant oral erythroplakia

The epidemiological method investigated incidence, prevalence, morbidity, mortality and lethality. The research method consisted in applying a series of epidemiological studies.

RESULTS AND DISCUSSIONS

According to the specialised literature, vitamin E, as a chemoprevention marker, can inhibit the carcinogenesis of the oral cavity, respectively reduce the risk of developing cancerous pathologies. Vitamin E can cause the reversal of the premalignant lesion, such as oral leukoplakia.

The oxidative processes in the body play a role in cancer pathogenesis which may be caused by poor nutrition. This process may result in DNA changes, a basic mechanism in the induction of cancer. The increased antioxidant effect is essential in defending the body against free radicals. Antioxidant combinations with vitamin A, vitamin E and vitamin C proved to be the most effective ones, with a maximum clinical resolution of 90%, and a regression of dysplasia of 97.5%.

Statistical analyses show that the remission of the oral erythroplakia was clear in patients who underwent a cumulative therapy with antioxidants, vitamin E, vitamin A and vitamin C. The remission of the oral erythroplakia in patients who received 400 I.U./day of vitamin E, 10 mg of beta-carotene and 500 mg of vitamin C for 6 weeks is higher compared to the group of patients who received vitamin E as monotherapy at a dose of 200 I.U./day.

The cumulative positive effect of food supplements on complete response (CR) and partial response (PR) in the experimental group was 17.9%, showing a difference of 11% compared to the control group where the complete response (CR) and partial response (PR) was 6.9%, but statistically non-significant (Figure 2).



Figure 2. Comparative clinical prognosis of oral precancerous lesions for the two groups of patients (CR = complete response, PR = partial response, NC = no change, PD = progressive disease)

Antioxidant supplementation does not interfere with chemotherapy. On the contrary, it has a positive influence on the side effects and on the tumour response, the positive effect in the case of antioxidant supplementation being even 3 times higher.

CONCLUSIONS

Oral cancer is generally preceded by precancerous lesions including erythroplakia, leukoplakia, lichen planus, oral submucous fibrosis, oral epithelial dysplasia. Tobacco and alcohol consumption represent the major risk factors for oral cancer.

Vitamin E is a food supplement with a major impact in preventing precancerous lesions thanks to its antioxidant effect. Fresh vegetables, vegetable oils, cereals, oil fruits (nuts, almonds, peanuts) and seed oil represent natural sources of vitamin E rich in fat-soluble vitamins.

Antioxidants such as vitamin C, vitamin E, retinoids play an essential role in metabolism. Besides their antioxidant effect, they protect cells, modulate the immunity, induce apoptosis and regulate cell proliferation and cellular differentiation.

The cumulative positive effect of dietary supplements (CR + PR) in the study group compared to the control group showed a difference of 11%, but statistically non-significant (p = 0.3916, chi-square test with Yates correction).

Results show that antioxidant therapy improve the prognosis of oral precancerous lesions in patients receiving vitamin supplements.

The results of this study are based on the action of antioxidants on the free radicals of the reactive oxygen species (ROS), inhibiting the production of reactive oxygen derived from NADPH-cytochrome P450 and improving precancerous pathologies.

REFERENCES

- 1. Lal H., Pandey R, Aggarwal SK., 1999. Antioxidant vitamins and chemoprevention. Indian J Clin Biochem. Jan;14 (1):1-11.
- 2. Gurkan Yardimci, Zekayi Kutlubay, Burhan Engin, and Yalcin Tuzun. 2014. Precancerous lesions of oral mucosa. World J Clin Cases. Dec 16; 2(12): 866–872.
- 3. Axell T, Pindborg JJ, Smith CJ, van der Waal I. Oral white lesions with special reference to precancerous and tobacco-related lesions: conclusions of an international symposium held in Uppsala, Sweden, May 18-21 1994. J Oral Pathol Med 1996;25:49-54.
- 4. Östör AG. Natural history of cervical intraepithelial neoplasia: a critical review. 1993.Int J Gynecol Pathol. 12:186-92.
- 5. Md. Asad Iqubal, Mobeen Khan, Prabhakar Kumar, Anjani Kumar, and Kratika Ajai. 2014. Role of Vitamin E in Prevention of Oral Cancer:-A Review. J Clin Diagn Res. Oct; 8(10): ZE05–ZE07
- 6. Chitra S, Shyamala Devi CS. 2008. Effect of vitamin E on protein bound carbhohydrate complexes in radiation treated oral squamous cell carcinoma patients. Indian J Clin Biochem. Jan;23(1):92-4.
- Silverman S Jr, Gorsky M, Lozada-Nur F, Giannotti K. A prospective study of findings and management in 214 patients with oral lichen planus. 1991. Oral Surg Oral Med Oral Pathol. 72:665-70
- 8. Stich HF, Mathew B, Sankaranarayanan R, Nair MK., 1991. Remission of precancerous lesions in the oral cavity of tobacco chewers and maintenance of the protective effect of beta-carotene or vitamin A. Am J Clin Nutr. Jan;53 (1 Suppl): 298S-304S.
- 9. Stich HF, Brunnemann KD, Mathew B, Sankaranaryanan R, Nair MK. 1989. Chemopreventive trials with vitamin A and beta-carotene: some unresolved issues. Prev Med. Sep;18 (5):732-9.

Implant-prosthetic restauration in Kennedy class I and II edentulos



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Abstract

Dental implants have recently become a treatment solution that is frequently used. With the development of biomaterials and implantation techniques, it has grown significantly. The study was conducted over a period of 16 months, 125 patients, 480 implants were applied. Of these, 400 were applied to the Kennedy 1st and 2nd edentulous. The prosthetic works were fixed by cementation or by screwing. Patients were applied 6 months after cementation, questioning related to adaptation, the comfort of the prosthetic work, the price-quality ratio. We can say that over 96.5% of the patients considered the prosthetic work to be beneficial, they appreciated the improvement of the masticatory efficiency. The patients who had previously mobile prosthetic works were 100% satisfied with this kind of works 87.6% of patients considered that the investment was not too high in relation to benefits. In the case of Kennedy first and second edentulous, the implant solution o-prosthesis should be the first option for the patient, mentioning his major bouts.

Keywords: prosthetic restorations, implant, Kennedy class edentulous.

INTRODUCTION

Dental implants are inert alloplastic materials, integrated into the jaw and/or mandible to be used in teeth loss situations that are surgically inserted into a residual bone crest in order to become a prosthetic infrastructure. Helps to restore damaged / lost orofacial structures due to trauma, neoplasia and congenital defects. Generally, an implant system consists of the implant itself and the prosthetic bunt. The restorative prosthetic structure is typically fixed to the bunt by one of the following methods: cementation, use of an occlusal bolt or pins attachment that allow the assembly of a mobile prosthesis [1]. The implant is the part implanted in the bone, and the bust is the part that supports and / or fixes the prosthetic structure.

The principle of osteointegration and the knowledge of the particular aspects of loading and gnathological balancing of the implants allowed us to achieve memorable success rates (90-92% for the jaw and 98% for the mandible) thus placing implantology on the most reliable techniques in dentistry and explaining its current development [2]. Every year, hundreds of thousands of implants are inserted and then "loaded" with prosthetic superstructures. Many people get rid of the nightmare of mobile prostheses or restore the integrity of their arches in conditions of increased comfort due to implantology prosthetics.

Fixing a bridge on implants to the infrastructure (at the implant pillars) can be done by cementing or screwing.

Fixing by cementation

Cementing of the bridges on the implants, as a fastening method, is performed mostly in the form of parallel pillars, when the aggregation elements have clear boundaries of the cervical region termination and especially in the pure implantations. In mixed type aggregations, there is greater risk of overflowing than in implantation because of the mobility differences of the pillars.

Fixing a bridge on implants can be done with zinc oxide phosphate cements (FOZ), resin-based cements as well as zinc polycarboxylate (PCZ) or glass ionomer (CIS) polyelectrolyte cements, which actually perform a bonding [3].

If cementing a bridge on implants, we must keep in mind that cements (mostly classical) do not adhere to the metal surface of an implant as it adheres to the surface of enamel or dentine of natural teeth (due to different chemical structure).

Fixing by screwdriving

Fixed switchable fixed screwdriving bridges provide additional safety in addition to cementing and the fact that they always allow access to the implant. This aggregation method also allows reoptimization or repairs, as well as some further expansions.

Their disadvantages are related to a more complicated technology of realization as well as to the occurrence in time of some fatigue accidents that can occur at the level of some components.

MATERIAL AND METHOD

The study was conducted over a period of 16 months (January 2017 - April 2018), in two dental surgeries in Oradea, where implant insertion and implant prosthetic restorations are performed. We appreciate that the prices in the two dental office at the median level. Of the 186 patients (84 males and 102 women) aged 25-77 years to whom the implant was inserted, 125 patients (51 males and 74 women) were enrolled with Kennedy Class I and II and total of 320 dental implants were inserted.



Female 64.5%

Figure 2. Number of implants and sex distribution

As can be seen from Figures 1 and 2, although the number of men is 40.08% smaller, the number of implants inserted in the lateral area is higher for males of 64.5%. The masticatory qualities for males have also received the number of edentates class I and II Kennedy was bigger for them.

The prosthetic works were fixed by cementing or by screwdriving. The patients were applied 6 months after finishing the work, questioning about comfort, efficiency, hygiene, price-quality ratio.

The responses were centralized into Table 1 and Figure 3, based on data analysis and related graphs.

Evaluation	А	nswers	Total
Items			
	Male	Female	
Comfort	47 (92%)	69 (93.24 %)	116 (92.8 %)
Efficiency	50 (98 %)	62 (83.78 %)	112 (89.6 %)
Cleaning problems	45 (88.23%)	65 (87.83%)	110 (88 %0
Price ratio	47 (92.15 %)	65 (87.83%)	113 90.04%)

Table 1 Accessment of	prosthatic work 6	months after in	cortion
Table 1. Assessment of	prostnetic work o	months after f	isertion



RESULTS

From the table and the figures it is observed that high percentages, over 90% of both men and women consider comfortable implants in the masticator process. There are no significant differences between genders.

From the point of view of masticatory effectiveness, it is noticeable that men especially appreciate the masticatory efficiency, in a higher percentage than women. 98% versus 83%. This is explained by the fact that men generally prefer harsh foods to a higher percentage than women.

A fairly significant percentage of both men and women (about 15%) have problems with the hygiene of prosthetic works on the implant. When questioned declare that the food retains under the deck and has trouble removing it, there is a problem with the use mouthwash, etc. Over 25% of patients experienced plaque, gingival inflammation, and bleeding in the prosthetic area.

The price-quality ratio was considered favorable by the vast majority of patients (over 90% of men and over 85% of women), which indicates that implants have become affordable.

DISCUSSIONS

A feature of the cemented bridge on the implant is that between the infrastructure and the superstructure there is a space of approximately 40µm, intended for cement and which can be extended to the edge of the restoration, because implants do not pose the problem of secondary caries. Because of this space, the prosthetic superstructure is passive, that is, it dampens and evenly distributes the occlusal stress to the bone tissue. This is a considerable advantage for a cemented bridge on implants because an inappropriate distribution of forces is the primary cause of bone resorption, fracture, and implant mobility [4]. Regardless of the cement used, as in the traditional prosthesis, complications such as overflows may occur over time. These are unpleasant, because not always downhill concerns all pillars, sometimes ablation of the deck.

Screw-in aggregation involves the existence of screws for fixing the superstructure to the prosthetic infrastructure. These screws are threaded into some special holes on the occlusal face of the implant pillars. Because they are visible on the occlusal face of the superstructure, in the case of special aesthetic requirements, they can cover (plaque) different physiomic materials, usually with composite resins [5]. Cover (plating) should be done in such a way that the occlusion is not affected. The area to be plated is known in the Anglo-Saxon literature as the "occlusal hatch".

It has been demonstrated that the existence of an occlusive torsional force at the occlusal level can cause displacement of the fixation screw, which implicitly causes bone resorption, mobilization of the implant and/or fracture [6]. Because the functional stress at the occlusal surfaces of the superstructures is greatest, the fractures of the ceramic masses or of the composite dialectic resins in the occlusal traps are quite common. In these fractures, the correction is difficult, requiring additional laboratory or clinical detail steps.

CONCLUSIONS

1. Implanto-prosthetic is a treatment solution commonly used lately, with the number of implants being increased every year. Also, the patient's acceptance of this treatment option is increasing due to both the process mediation and the increase in the number by a specialist who implants the implant and lowering the cost of the implant.

2 From the point of view of the masticatory effiency, the comfort and the degree of acceptance, this type of prosthetic work is an effciency, the feedback of the patients being

positive. 85-90%. In the patients carrying mobile and mobile prostheses in the past, the degree of satisfaction was 100%.

3. The problem is the hygiene of prosthetic works on the implant, in our opinion the patients are not adequately trained in this respect, the proof that after training many have taken off satisfied with the assurance of oral hygiene.

4. The prices of these types of works became accessible to most patients, the evidence and the large number of implants inserted in the two dental clinics in 16 months.

5. Considering the findings we can say that the implant-prosthetic solution in the lateral area is one to be considered as the first option in such cases.

REFERENCES

- 1. Ravnholt G, Jensen J. Corrosion investigation of two materials for implant: Supraconstructions coupled to a titanium implant. Scand J Dent Res 1991; 99:181-6.
- 2. Cortada M et al. Galvanic Corrosion behaviour of titanium implants coupled to dental alloys. J Mater Sci Mater Med 2000; 11:287-93.
- 3. Dumitrașcu N. Biomateriale și biocompatibilitate, Editura Universității "Alexandru Ioan Cuza", Iași, 2007
- 4. MaryAnnLieber. Characteristics of Metals Used in Implants. Journal of Endourology Volume 11, Number 6, December 1997 t, Inc. IRENA GOTMAN, Ph.
- Carl E Misch. Contemporary Implant Dentistry, Science Of Dental Materials, eleventh edition 6. Craig And Powers: Restorative Dental Materials, 8th August 2006 Biomaterials in Implants - Dr Shilpi Gilra 91

Statisticaly study of dental anomalies in primary dentition



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Abstract

The occurrence of dento-maxillary abnormalities has led to controversial discussions in specifying the primary and secondary factors involved in the etiopathogenesis of these disorders. Most of the hereditary information in the development of the skull is used prenatally. Some organs involve crucial mechanisms in the development of the dental-maxillary apparatus, implicitly of the teeth. The purpose of this study was to track, assess the frequency and type of dental abnormalities encountered in children aged 0-3 years and preschool (3-6 years). The study was conducted on 867 children aged 2-6 years, of whom 179 have dental abnormalities (20.64%). The results relate to the most common occurrences are isolated 172 (94.85%), but they are also cases of associated anomalies 7 (5.15%).

Keywords: dento-maxillary abnormalities, primary dentition, etiopathogenesis

INTRODUCTION

Numerical dental abnormalities include: hypodonty (involves one or more missing teeth), oligodontia (involves six or more missing teeth), anodontia (complete teeth missing) and hyperdonia (one or more additional teeth, also called osteoporosis) [1]. Changes in tooth dimensions include microdontion (lower teeth than normal) and macrodontia (higher teeth than normal). (3) Both of these conditions can either be generalized to all teeth or isolated to one or more teeth. Variations in the shape of teeth include double teeth (fusion and gemina), cusp, thick evaginatus, and dense invaginatus (dense in dente) [2]. Early diagnosis of dental abnormalities in primary dentition determines and establishes term treatment planning long [3].

Although there have been some studies on dental abnormalities in permanent dentition, the frequency of dental abnormalities in primary dentition has not been sufficiently discussed in the literature, and controversial discussions about the various dental anomalies discussed in the literature have determined to evaluate the frequency, distribution, gender differences and the characteristics of dental anomalies in primary teenage children in Bihor county.

Aim and objectives

The purpose of this study was to determine their prevalence, distribution, and to investigate the emergence of these children in primary dentistry in children, aged between 0-3 and preschoolers (3-6).

MATERIALS AND METHODS

The studied sample comprises 867 children aged between two and six years with complete eruption of primary teeth from both sexes, both in urban and rural areas, in Bihor county.

All children with dental anomalies were enrolled in this study. Descriptive statistics for the variables studied were performed. A control group has been studied according to gender, age, place of origin, presence of single anomalies and associated dental arcades. Clinical data obtained were collected during controls in various school settings, medical offices and the Municipal Clinical Hospital Dr. Gavril Curteanu by the dentist.

All children and parents or guardians signed an informed consent and agreed that the collected data and materials would be used only for scientific and research purposes.

Dental abnormalities may show the following changes: 1 number, 2 form, 3 volume, 4 structure, 5 eruptions and were recorded according to the criteria described b by Kreiborg et al.

RESULTS

Of the 867 study children aged 2-6 years, the statistical analysis of the data reveals that the total number of children with dental anomalies is 179 (20.64%) (Figure 1).



Figure 1. Distribution of cases with dental abnormalities

Of the total number of children with dental abnormalities 179, the majority percentage was made up of 106 children (59.21%) and the girls were 73 (40.78%). Analyzing statistics on the country of origin, children from urban areas are 61 (34.07%), compared to rural ones 118 (65.93%) (Figure 2).



Figure 2. Distribution of the lot by sex and environment

Out of the 179 cases studied, 129 children show 94.85% of unique dental abnormalities, and 7 children have associated dentist abnormalities of 5.14% (Figure 3).



Figure 3. Batch distribution depending on type of anomaly
Table 1. Distribution of dental abnormalities by groups

	Nr	%
Unique dental abnormalities	129	94,85
Number abnormalities	2	1.55
Form abnormalities	1	0,79
Volume abnormalities	32	24,80
Structure abnormalities	73	56,58
Eruption abnormalities	21	16,28
Associated dental abnormalities	7	5,14
2 associated abnormalities	6	85,71
Eruption abnorm.+ form abnorm.	1	14,28
Volum abnorm.+ structure abnorm.	1	14,28
Structure abnorm. + eruption abnorm.	2	28,58
Volume abnorm. + eruption abnorm.	2	28,58
3 associated abnormalities	1	14,28
Volum abnorm.+ form+eruption		14,28
Total dental abnormalities	136	100%

Table 1 presents the distribution of individual anomalies among children, depending on the classification of dental abnormalities. In one unique number of anomalies, 1 child presented bilateral hypotony, 1 child presented a tooth (interdent). In form abnormalities, 1 child has a double tooth. In the abnormalities we have 2 children with localized microdontitis, 4 children with macrodontitis and 26 children with generalized microdermosis. In structure anomalies we have 10 children with imperfect amelogenesis, 42 children with secondary dental dysplasias, 3 children with imperfect dentinogenesis, 15 children with odontogenesis, 3 children with Beltrami melanodon. In eruption abnormalities we meet 4 children with rotation, 14 children with native teeth 3 children with diastemes. In abnormal dental anomalies -2 abnormalities - eruption anomaly + 1 child abnormality, volume abnormality + structure anomaly 1 child, structural anomalies + eruption abnormalities 2 children, volume abnormality + eruption abnormality 2 children.In associated dental anomalies -3 anomalies-Volume abnormality + form anomaly + eruption abnormality 1 child.

DISCUSSIONS

The prevalence of dental abnormalities in primary dentition has been reported in numerous studies previously conducted. Esenlik et al.12 have found that the prevalence of primary and permanent supernumerary teeth was 0.4% and 2.3% [4]. Uslu et al. reported a prevalence of supranumerar teeth of 0.3%, a 0.7% microdontity prevalence and a 21.6% prevalence of permanent tooth agenesis. Altug-Attack and Erdem14 reported that 3043 orthodontic patients had 166 (5.46%) dental anomalies of development [5,6].

CONCLUSIONS

Following our study we came to the following conclusions:

1. Although there are no major forms, the percentage of dental abnormalities is quite high in this age group (20.64)

2. The vast majority of anomalies are isolated, of which the highest frequency is the number and structure anomalies.

3. There are no significant differences between the patients' home environment, we can only mention a slight increase in rural boys.

4. The percentage of abnormalities as well as their distribution fall within the limits of other Romanian and foreign researchers.

REFERENCES

- 1. Jernvall J, Thesleff I. Reiterative signaling and patterning during mammalian tooth morphogenesis. Mech Dev. 2000; 92: 19-29. [PubMed]
- 2. Glavan F, Moses M, Bratu C. Orthodontics and dental-facial orthopedics. Eubeea Edited, Timisoara, 2008
- 3. Thesleff I, Nieminen P. Tooth induction. Helsinki; Finland: 2006. Encyclopedia of life sciences; p. 132.
- 4. Stecker SS, Beiraghi S, Hodges JS, Peterson VS, Myers SL. Prevalence of dental anomalies in a Southeast Asian population in the Minneapolis / Saint Paul metropolitan area. Northwest Dent. 2007; 86: 25-28. [PubMed]
- 5. Brook AH. Dental anomalies of number, form and size: their prevalence in British schoolchildren. J Int Assoc Dent Child. 1974; 5: 37-53. [PubMed]
- 6. Whittington BR, Durward CS. Survey of anomalies in primary teeth and their correlation with permanent dentition. N Dent J. 1996; 92: 4-8. [PubMed]

PRGF use for closure of the sinus membrane perforations during sinus lift with lateral approach



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Abstract

The sinus lift procedure with lateral approach is the method of choice for sinus pneumatization and lack of bone high for implant placement. Before sinus lift with lateral approach, CBCT is recomended for the evaluation of sinus anatomy: thickness of lateral sinus wall, localization of alveolar antral artery and the risk of intersecting durring the fenestration, diameter of alveolar antral artery, the maxillary sinus floor width and angulation, irregularity of sinus floor, relation of Schneiderian membrane with the roots of the adjacent teeth, sinus septum. In spite of the precautions, there is a risk of Schneider membrane perforation. There are several methods to close the sinus membrane perforations that occur durring sinus membrane detachment from the sinus walls: use of collagen membranes, nonresorbable barrier membranes, suture, lamellar bone, metal crib, use of fibrin glue or fibrin membranes.

Keywords: sinus membrane perforation, fibrin membranes, PRGF.

INTRODUCTION

Sinus membrane elevation during sinus lift with lateral approach is a delicate surgical procedure, during which a series of complications may occur as it follows: bleeding from sinus bone walls or from Schneider membrane, perforations of sinus membrane etc. Schneiderian membrane perforation is the most common complication, which occurs when the sinus membrane is detached from the sinus bony walls. The reasons why the perforations occur durring sinus membrane detachment from the sinus bony walls are: Schneider membrane structure with very few elastic fibers, preexisting perforations, surgical procedure (performing of the access window, membrane detachment), sinus pathology, sinus septa, thin membrane [1-3].

In case the sinus membrane perforation occurs, the membrane detachment has to continue, aiming sinus membrane detachment from the bone walls to decrease the perforation's size; moreover, the sealing of the perforation must be achieved using collagen membrane (fixed with pins on the lateral wall in case of large medial-lateral tearing). By elevating the membrane, the size of the perforation decreases by membrane folding over on itself [1,2]. Membrane perforations can also be closed by using Plasma Rich In Growth Factors [4], fibrin adhesive [1,5,6], by suturing with 6-0 resorbable sutures [5-7] or by resorbable or non-resorbable barrier membranes, resorbable foil, metal crib, lamellar bone [1].

Aim and objectives

The aim of this paper is to describe the procedure and the results of closing small perforations of sinus membrane with PRGF.

MATERIALS AND METHODS

Before surgery 80 ml of blood have been withdrawn from the cephalic vein in sterile tubes with sodium citrate 3,8%; the sterile tubes were further centrifugated for 8 minutes at 560 G separating the plasma from leukocytes and erythrocytes. By pipetting, the plasma was divided in two fractions: fraction 2, which is Plasma Rich in Growth Factors (PRGF), mixed with the bone graft and fraction 1, which is used to obtain the fibrin clot and then the fibrine membrane. The two fractions were then activated by adding CaCL2 10% according to Anitua's protocol (8,9,10).

The patient presented with a deep decay at 1.6, with no sensitivity at mechanical and thermal stimuli; moreover, the root canal probing showed no pain. The X-ray examination reveals a radiolucency at the apexes of 1.6, oval shape with 2/3 mm dimension, a welldefined contour, separated from the sinus floor by a thin bone layer of approximately 0,1 mm. The apical granuloma at 1.6 diagnose was set based on clinical and radiological examination. An incomplete root canal filling can be observed at the level of 1.7 (mesio-vestibular root), gingival and bone retraction (Figure 1); a two degree mobility was also noticed. A surgical tooth extraction for 1.6 and 1.7 was performed; two months after the healing of the post extraction site, (Figure 2) the sinus lift with lateral approach was performed. During sinus membrane detachment from the bony walls, Schneiderian membrane was accidentally teared; a perforation for about 2-3 mm diameter resulted (Figure 3). The sinus membrane detachment was continued in order to reduce the perforation size; PRGF fraction 1 was placed over the teared membrane (Figure 4) which sealed the perforation; the sealing became obvious with the movement of the sinus membrane during respiration. Further, the sinus was carefully filled with spongy bovine (Bioteck®) bone (Figure 5), in order not to dislodge the fibrin membrane from the perforation site. Finally, the fibrine membrane, fraction 1, covered the entire subantral graft (Figure 6); then the suture was performed with Polypropylene 4-0 (Prolene - Ethicon ®) (Figure 7). After six months, a panoramic X-ray was taken; graft integration into the sinus was noticed (Figure 8). Consequently, three implants were placed (TBR ®, diameter 4 mm with 13 mm length in the position of 1.4 and 5 mm diameter with 10 mm length in the position of 1.6 and 1.7) in the right posterior maxillary. Six months after the implants' placement, a good osseointegration can be observed (Figure 9). A ceramic fused to metal bridge was cemented over the implants abutments (Figure 10).



Figure 1. Panoramic X-ray reveals apical granuloma at the 1.6 buccal roots, gingival and bone retraction at the level of 1.7 with a reduced subantral bone high (3-4 mm)



Figure 3. Schneider membrane perforation, 2-3 mm diameter, which occurred at sinus membrane detachment from the bony walls



Figure 2. Two months healing after surgical extraction of 1.6 and 1.7 with the use of PRGF (fraction 2 and fraction 1)



Figure 4. Sinus membrane perforation sealing with use of PRGF membrane, fraction 1



Figure 5. Sinus filling with bovine bone mixed with PRGF, fration 2



Figure 6. Fibrine membrane placement over the entire bone graft just before suture performing



Figure 7. Wound closure with Polypropylene 4-0 (Prolene – Ethicon ®)



Figure 8. Graft integration into the sinus after 6 months



Figure 9. Implants integration 6 months after their insertion



Figure 10. Clinical aspect of cemented ceramic fused to metal bridge

RESULTS AND DISCUSSIONS

Sinus membrane perforations occur in 10-30% of the cases during the Schneiderian membrane detachment from the bony walls because of the previously mentioned causes; if a higher percentage occurs, a revision of surgical approach must be taken into account. In order to prevent the complications, preoperative evaluation must not be limited just to the evaluation of bone height and width, but also to maxillary sinus anatomy. On this perspective, a thorough examination of the following must be done: sinus lateral wall width, localization of posterior superior alveolar artery and the risk of its intersection during the fenestration, diameter of alveolar antral artery, the maxillary sinus floor width and angulation, irregularity of sinus floor, relation of Schneiderian membrane with the roots of the adjacent teeth, sinus septum, and the quality of subantral bone [11].

It is highly recommended to perform a CBCT for detection and evaluation of Underwood's septa (numbers, locations, orientations, and height); sinus septa are detected more frequently in edentulous patients (57,4%) then dentates ones (39,7%) [12]. When sinus septa are detected, the sinus membrane thickening is noticed at this level; the membrane thickness increases from 0,85 to 1.8 mm [13]. However, the risk of membrane tearing at the level of sinus septa is high, despite the thickening of the sinus membrane.

Another anatomic element that increases the chances of sinus membrane perforations is the width of the sinus lateral wall; the width varies: 1.21 ± 1.07 mm at the second molar,

 1.98 ± 1.87 mm at the first molar, 2.02 ± 1.53 mm at the second premolar and 2.16 ± 1.25 mm at the first premolar. For this reason, when these intraoperative complications are predicted, the use of piezo-surgery is highly recommended [14]. The outline of lateral-access window is scored on the bone by using piezosurgery without sinus membrane tearing because it is well known that the inserts cut only the bone, leaving the soft tissues undamaged [15,16].

When the CBCT examination is performed, the thickness of sinus membrane must be evaluated because it is variable $(1.32 \pm 0.87 \text{ mm})$; the lowest perforation risk is at 1-1,5 mm, perforation risk increasing if the membrane is thicker then 2 mm or thinner then 1 mm [17].

If the tearing of the sinus membrane occurs, the following rules must be taken into account: the limitation of the perforation as well as the decreasing of the perforation size by membrane detachment from bony walls, starting distally; in this manner, the tension around the perforated membrane decreases, followed by the folding of the membrane over on itself and resulting the closure of the perforation.

Usually, the use of collagen membranes is recommended to close the perforation by following some rules: membrane stabilization (in large membrane tearing with lateral-medial direction membrane stabilization, using pins fixed on sinus walls is recommended) and overlap the perforation margins with 5 mm.

Suturing the sinus membrane is delicate: good surgical skills and also a favorable membrane thickness for performing the suture are required.

When small tears occur after sinus membrane detachment and folding, fibrine membrane placement over the perforation is a simple method to achieve the sealing (Figure 3).

Care is necessary when the sinus graft materials are introduced into the sinus in order to avoid PRGF membrane dislodge.

CONCLUSIONS

Perforation of sinus membrane during its detachment from the bony walls is inevitable, even when the surgical skills are good. If the perforations occur, the complication must be professionally managed so that a highly predictable and successful longterm outcome will be ensured. PRGF use in small Schneider membrane tears (2-3 mm) seals the sinus membrane without affecting graft revascularization and integration into the sinus.

REFERENCES

- 1. Jensen OT. The Sinus Bone Graft, Quintessence Publishing, 2006, pp 103-113 Misch CE. Contemporary Implant Dentistry, Third Edition. Mosby Elsevier. 2009; 86-87, pp 588, pp 956-960
- 2. Testori T, Weinstein R, Wallace S. La chirurgia del seno mascellare. ACME. 2005; p-336
- 3. Anitua E. A Biological Approach to Implantology. Team Work Media Espana. 2009; 273-274
- 4. Khoury F, Antoun H, Missika P. Bone Augmentation in Oral Implantology. Quintessence. 2007; p. 189;
- 5. Khoury F, Hanser Th, Khoury Ch, Neugebauer J, Terpelle T, Tunkel J, Zoller JE, Greffe osseuse en implantologie. Quintessence. 2011; 301
- 6. Gănuță N, Bucur A, Gănuță A. Tratat de implantologie orală Ed. Național p.-352
- 7. Anitua EA, Orive G, Andia I. Use of PRGF-Endoret to accelerate bone and soft tissue regeneration in postextraction sites. Dental Dial. Vol1/2006, 3-14
- 8. Anitua E. Extraction Socket Treatment A Biological Approach. Team Work Media Espana. 2015; 115-126
- 9. Anitua E, Andia I, Carda C. BTI: New process for drilling, placing implants and obtaining autologous bone. Dental Dialogue. Vol.1/2003; 3-10;

- 10. Rahpeyma A, Khajehahmadi S. Open Sinus Lift Surgery and the Importance of Preoperative Cone-Beam Computed Tomography Scan: A Review. J Int Oral Health. 2015; 7(9): 127–133
- Qian L, Tian XM, Zeng L, Gong Y, Wei B. Analysis of the Morphology of Maxillary Sinus Septa on Reconstructed Cone-Beam Computed Tomography Images. J Oral Maxillofac Surg. 2016; 74(4):729-37. doi: 10.1016/j.joms.2015.11.019. Epub 2015 Nov 24
- 12. Rancitelli D, Borgonovo AE, Cicciù M, Re D, Rizza F, Frigo AC, Maiorana C. Maxillary Sinus Septa and Anatomic Correlation With the Schneiderian Membrane. Journal of Craniofacial Surgery. June 2015 - Volume 26 - Issue 4 - p 1394–1398
- Danesh-Sani SA, Movahed A, ElChaar ES, Chong Chan K, Amintavakoli N. Radiographic Evaluation of Maxillary Sinus Lateral Wall and Posterior Superior Alveolar Artery Anatomy: A Cone-Beam Computed Tomographic Study. Clin Implant Dent Relat Res. 2017 Feb;19(1):151-160. doi: 10.1111/cid.12426. Epub 2016 May 30
- 14. Vercellotti T. Essentials in Piezosurgery Clinical Advantages in Dentistry, Quintessence. 2009; 65-75
- 15. Wallace SS, Mazor Z, Froum SJ, Cho SC, Tarnow DP. Schneiderian membrane perforation rate during sinus elevation using piezosurgery: clinical results of 100 consecutive cases. Int J Periodontics Restorative Dent. 2007 Oct;27(5):413-9
- Lin YH, Yang YC, Wen SC, Wang HL. The influence of sinus membrane thickness upon membrane perforation during lateral window sinus augmentation. Clin Oral Implants Res. 2016 May;27(5):612-7. doi: 10.1111/clr.12646. Epub 2015 Jun 16

Interdisciplinary management of dentofacial imbalances in young adult patients



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Abstract

Aim and objectives. A first objective of this study was to determine the percentage of the non-growing patients and, respectively, the ratio between the cases requiring an orthodontic-orthognathic surgical interdisciplinary approach and the cases where dento-alveolar camouflages may be accepted. We also aimed to present clinical cases where we opted for an interdisciplinary approach. *Material and methods.* The sample consisted of 534 patients aged between 5-45 years with different types of malocclusions. The initial sample was divided into three age subgroups, as follows: children and adolescents (5-16 years), young adults (17-25 years) and adults (26-45 years). Although the therapeutic methods differ according to the age of the patient, the therapeutic objectives are similar, including: obtaining a balance in the intermaxillary skeletal relationship, obtaining a dental alignment, obtaining an ideal overpiet and overbite, obtaining correct and stable canine and molar relationships, achieving a balance of soft tissues with improved facial profile and aesthetic. To emphasize the importance of the orthodontic-orthognathic surgical interdisciplinary therapeutic approach, we selected some clinical cases of young adults considered relevant. *Results.* Patients in the growing period accounted for 55,62%. Out of 33,38% non-growing patients, 38,2% were young adults and the rest of 6,18% were over the age of 26 years. *Conclusions.* A correct orthodontic-orthognathic surgical interdisciplinary approach ensures the therapeutic success of orthodontic adults patients.

Keywords: growing patients, young adults, orthodontic-orthognatic interdisciplinary approach.

INTRODUCTION

It is well-known that the therapeutic approach for non-growing patients is different from that for patients in the growth period.

Cases of orthognathic surgery represent some of the greatest challenges in contemporary orthodontics. The therapeutic results are spectacular and consist of an obvious improvement in dentofacial aesthetics, providing the possibility of establishing stable and functional occlusion relationships.

Orthognathic surgery offers the possibility of obtaining dentofacial harmony, good facial aesthetics and positive implications on the self-esteem and on the quality of life of the orthodontic patients with dentofacial imbalances.

Treatment possibilities for young adult and adult patients include orthodontic camouflage treatment in mild to moderate cases and orthognathic surgery in moderate to severe cases. Orthognathic surgery is a more effective treatment option when dealing with skeletal imbalances. However, this treatment modality presents higher risks and costs [1]. On the other hand, the orthodontist may be confronted with patients who are not particularly concerned about facial aesthetics, but whose facial appearance may get worse as a result of orthodontic camouflage. The lack of upper lip support, an obtuse nasolabial angle, a long anterior face height may become more apparent as a result of the orthodontic camouflage treatment [2].

Combined orthodontic and orthognathic surgical treatment is nowadays feasible to manage dentofacial deformity problems. The orthognathic planning and raising patients' awareness on the prediction of the outcome of the orthognathic treatment are important in receiving patients' informed consent. Patients must be informed about the predicted results prior to treatment in order to optimize case management and increase patients understanding and acceptance of the recommended treatment. Cephalometric radiography is a routine part of the diagnosis and the treatment planning process which also allows the clinician to evaluate changes following the orthognathic surgery. Traditionally cephalometry has been employed manually, but in recent decades the computerized cephalometric systems have been introduced to simplify and reduce the orthodontist's working time [3].

As a rule in orthodontics, the diagnosis and treatment plan are based on clinical examinations associated with cephalometric assessments, study casts and photostatic examinations. More than half a century ago, A. M. Schwarz (1958) used "facial profile" for the clinical assessment of the face. Schwarz's "Gnathic profile field (GPF)" is a simple but efficient clinical appraisal of a patient's maxillofacial profile pattern by observing patient's in profile view, for a first idea of their anteroposterior skeletal imbalances [4,5].

Aim and objectives

A first objective of this study was to determine the percentage of the non-growing patients from a sample of orthodontic patients.

Another objective was to evaluate the ratio between the cases of young adults requiring an orthodontic-orthognathic surgical interdisciplinary approach and the cases of young adults for whom dentoalveolar camouflages may be accepted.

We also aimed to present a clinical case where we opted for an interdisciplinary approach.

MATERIALS AND METHODS

The sample consisted of 534 orthodontic patients aged 5 - 45 years with different types of malocclusions. The study was conducted in accordance to the World Medical Association (WMA) Declaration of Helsinki – Ethical Principles for Medical Research Involving Human

Subjects, approved by the Ethics Committee of the University of Oradea, Romania. All patients included in the study had their consent. For the underaged patients, the consent of the parents was received.

The initial sample was divided into three age subgroups as follows: children and adolescents (5-16 years), young adults (17-25 years) and adults (26-45 years).

Several skeletal cephalometric parameters such as FMA angle, SNA angle, SNB angle, ANB angle, HFP/HFA ratio were taken into consideration in assessing the ratio between the young adult patients requiring an orthodontic-orthognathic surgical interdisciplinary approach and the young adult patients where dentoalveolar camouflages may be accepted. OnyxCeph (open software licence (OSL), version 62) a computerized defalcation software, was used for the cephalometric analysis. Patients with mild skeletal discrepancies, within maximum of \pm 1° to the normal range for the ANB angle and \pm 2° for the FMA angle were considered as patients who could be treated with orthodontic camouflage. Patients with moderate skeletal imbalances, with deviations of \pm 2 to \pm 3 degrees for the ANB angle and \pm 3 to \pm 5 degrees for the FMA angle were considered as borderline cases, for whom an orthodontic-orthognathic surgical interdisciplinary approach had a significantly better therapeutic outcome. Patients with severe skeletal deformities, with variation above \pm 4° for the ANB angle and \pm 6° for the FMA angle were considered surgical orthognathic cases.

Although the therapeutic methods differ according to patients' age, the therapeutic objectives are similar, including: obtaining a balance in the intermaxillary skeletal relationship, obtaining a dental alignment, obtaining an ideal overjet and overbite, obtaining correct and stable canine and molar relationships, achieving a balance of soft tissues with improved facial profile and aesthetics. To emphasize the importance of the orthodontic-orthognathic surgical interdisciplinary therapeutical approach, we selected a clinical case of a young adult considered as being relevant.

All the data from the study was analyzed using IBM SPSS Statistics 20. Quantitative variables were written as averages with standard deviations, while categorical variables were written as counts or percentages.

RESULTS

From the total of 534 orthodontic patients, 297 patients (55.62%) were in the growing period (aged between 5-16 years). Out of the 237 non-growing patients (44.38%), 204 patients (38.2%) were young adults (aged between 17-25 years) and the rest of 33 patients (6.18%) were over the age of 26 (Graphic 1).



Graphic 1. Distribution of patients by age

In Table 1 and Graph 2 it is illustrated the average value of SNA, SNB angles. As such, SNA has an average value of 81.73 ± 3.806 degrees with a range from 73 to 89, while SNB has an average value of 78.88 ± 4.039 degrees with a range from 71 to 88.



Table 1. Average value of SNA, SNB angles

Graphic 2. Average value of SNA, SNB angles

In Table 2 and Graph 3 it is illustrated the distribution of the patients according to the grade of skeletal imbalances in the sagittal plan (evaluated using the value of the ANB degree). As such, it can be seen that almost half of the patients do not present skeletal imbalances (45.8%), but there is an important share of patients (34%) who have moderate skeletal imbalances according to the ANB degree.

Table 2. Distribution of the patients according to the grade of skeletal imbalance in the sagittal plan (evaluated using the value of the ANB degree)

Grade of skeletal imbalance	Nr.	Percentage
Normal	93	45.8%
Mild	28	13.8%
Moderate	69	34%
Severe	13	6.4%



Graphic 3. Distribution of the patients according to the grade of skeletal imbalance in the sagittal plan (evaluated using the value of the ANB degree)

In Table 3 and Graph 4 it is illustrated the distribution of the patients according to the grade of skeletal imbalance in the vertical plan (evaluated using the value of the FMA degree). There is an important share of patients who have severe skeletal imbalances (24.1%) almost equal to the share of patients who have mild imbalances (26.6%). Most of the patients in the study have skeletal imbalances according to the FMA degree (62.6%).

Grade of anomaly	Nr.	Percentage
Normal	76	37.4%
Mild	54	26.6%
Moderate	24	11.8%
Severe	49	24.1%

Table 3. Distribution of the patients according to the grade of skeletal imbalance in the vertical plan (evaluated using the value of the FMA degree)





Case presentation

A 20-year-old male patient presented himself with chief complaints of absence of an upper front tooth, spacing, upper midline deviation and a large mandible. The extraoral examination showed the patient had a concave profile, increased lower anterior face height, mild hypoplasic maxilla, negative lip step, hyperdivergent growth pattern and chin deviation to the left side by 2 mm (Figure 1). Intraorally, the absence of the upper left lateral incisor with almost closed space was observed, Class III molar and canine relationships, upper midline deviation to the left side by 2.5 mm, moderate crowding of lower anterior teeth, reverse overjet of 1 mm (Figure 1).

As for the examination of the dento-maxillary functions, swallowing was atypical with excessive tongue pressure on the upper and lower anterior teeth, alteration of the physionomy, poor incision.



Figure 1. Initial photographic examination: facial aspect and intraoral aspect

Lateral cephalograph and orthopantomograph confirmed the clinical findings (Figure 3). The cephalometric analysis revealed a high Frankfurt-mandibular plane angle, decreased IMPA angle, low SNA angle, SNB angle, increased IF angle, decreased proportion between the lower posterior facial height and the lower anterior facial height, 5 mm retroarhial profile, 4 mm skeletal class III and 3 mm alveolar class III, 5 mm open-bite (Figure 3, Table 4).



Figure 2. Initial lateral cephalography and orthopantomography

Morphological orthodontic diagnosis:

- Skeletal and dental class III relationships (SNA = 79°, SNB = 83°), skeletal open bite (high degree of hyperdivergence FMA=32°), upper dentoalveolar protrusion and lower dentoalveolar retrusion (IF = 113°, IMPA = 84°);
- Mild facial asymmetry;
- Upper left lateral incisor agenesis;
- Lower anterior crowding.

Treatment plan

The clinical examination and the cephalometric assessments showed that the Class III deformity was a combination of retrognathic maxilla and prognathic mandible In addition, the mandible was deviated to 2 mm to left side. The negative ANB value (- 4°) confirmed that the patient's skeletal imbalance could only be improved by an orthodontic-orthognatic surgical combined treatment plan. Also, the increased value of the FMA angle (32°) suggested

that its correction requires an orthognathic surgical approach. The patient was adherent and compliant with the proposed treatment plan, giving his informed consent.

Treatment progress

All teeth were bonded with 0.022" preadjusted brackets, with the usual archwires sequence to the dental alignment and the space for the absent lateral incisor was opened. Once the crowding was alleviated, presurgical records were taken (clinical measurement, photographs, study casts and cephalometric analysis) (Figure 3).



Figure 3. Pre-surgical photographic examination: intra-oral aspect

After 18 months of pre-surgical orthodontic treatment, the patient underwent orthognathic surgery. Prior to the orthognathic surgery, occlusal splints were made using an orthognathic articulator. In collaboration with the surgeon, it was decided that surgery would take place under general anaesthesia and nasal intubation. The orthognathic surgery consisted of three pieces Le Fort I posterior impactation osteotomy, bilateral sagittal split osteotomy (BSSO), followed by counter-clockwise rotation of the mandible and set-back of the mandible using occlusal splints. The occlusal splint was removed six weeks after the orthognathic surgery. The lower anterior facial height was reduced, and the sagittal intermaxillary relationship was improved significantly (Figure 4, Table 4). Reversed lip relationship and chin position were also greatly improved. Following the orthognathic surgery, all cephalometric parameters improved, reaching normal values (Table 4).



Figure 4. Post-surgical photographic examination: facial aspect and intraoral aspect; upper left lateral incisor agenesis camouflaged with an acrylic crown and a bonded metallic bracket

Parameters	Normal value	Pre- treatment	Before orthodontic	After	Differences
	Turuc	th cut literat	surgery	surgery	
FMA	25±3°	32°	32°	27°	-5°
IMPA	88 ± 3°	84°	89°	88°	4°
SNA	82 ± 2°	79°	79°	83°	4°
SNB	$80 \pm 2^{\circ}$	83°	83°	80°	-3°
ANB	± 2°	- 4°	- 4°	3°	7°
IF	107°±5°	113°	114°	112°	-1°
HFP/HFA	0.69	0.59	0.58	0.65	0.6

Table 4. Pre- and post-treatment cephalometric measurements

The post-surgical orthodontic treatment phase for occlusal refinement lasted 4 months [Figure 5].



Figure 5. After debonding photographic examination: intraoral aspect with the healing abutment attached; intraoral aspect with the permanent artificial crown in place

The orthognathic surgery resulted in the correction of the patient's facial morphology, with a harmonious facial profile [Figure 6].



Figure 6. Comparative examination: facial aspect – profile view

DISCUSSIONS

In this study, the authors analyzed the sample of young adult orthodontic patients from the perspective of intermaxillary skeletal imbalances in sagittal and vertical plans. We consider that adult patients with mild skeletal discrepancies (slight variations ± 1 degree for ANB angle and ± 2 degrees for FMA angle) can orthodontically be successfully treated, resorting to mild dental-alveolar camouflage if necessarily. In our opinion, patients with moderate skeletal imbalances (ANB angle variations of ± 2 to ± 3 degrees to normal range limits and FMA variations of ± 3 to ± 5 degrees to normal range limits) represent border line cases, where treatment by orthodontic camouflage can be considered a compromise. For facial aesthetics, the ability of soft tissues to compensate the skeletal imbalances is very important. The treatment for these patients shall also take into account other factors such as: the severity of the dental malocclusion, the lack of space on the alveolar arches, the quality of the periodontal support, disorders associated to the temporomandibular joint etc. In contrast, \pm adult orthodontic patients with severe skeletal deformities (variations above ± 4 degrees ANB angle and above ± 6 degrees FMA angle) certainly require orthognathic surgery interventions associated for a proper treatment outcome.

According to Larson (2014), orthodontic preparation is critical to the success of the orthognathic surgery. This implies recognition and correction of existing dental

compensations to achieve full correction of skeletal discrepancies. It is important to define the presurgical orthodontic goals at the beginning of the treatment as they may not always include complete arch levelling or space closure, or ideal interdigitation. Proper planning, monitoring, and communication between the surgeon and the orthodontist are critical to an optimal orthodontic preparation [6]. Patients undergoing orthodontic-orthognathic surgical treatment should be well-informed about the orthodontic preparation procedures, which most of the times involve the decompensation of malocclusion, followed by the temporary worsening of the dentofacial appearance.

The different sagittal, vertical or transversal skeletal dysmorphoses can be treated by orthodontic, orthopaedic, surgical approach, or by a combined approach. Most often, treatment limits are dictated by patients' age, the severity of the skeletal imbalances, as well as by patients' perception of dentofacial aesthetics, respectively patients' motivation. For this reason, an orthodontic treatment combined with orthogonal surgery may be indicated [7].

In a study conducted by Daniels et al. (2017) on a sample of 60 patients (20 of which underwent surgical correction and 40 of which did not), the authors obtained a significantly larger reduction in ANB angle, 3.4° reduction in the orthognathic surgical group versus 1.5° reduction in the non-surgical group [8].

In our opinion, most of the patients with mild skeletal discrepancies (within maximum of $\pm 2^{\circ}$ to the normal range for ANB, FMA angles, mild asymmetries) can be treated successfully with orthodontic camouflage. In contrast, for patients with more severe skeletal imbalances (with deviations between $\pm 2-5$ degrees to the limits of normality or visible facial asymmetries), often considered as borderline cases, the therapeutic outcome is significantly better through an orthodontic- orthognathic surgical interdisciplinary approach. Patients with more severe deformities should be considered orthognathic surgical cases.

Many studies have shown that psychosocial factors play a major role in determining the patient's selection of a treatment option. This emphasizes the need for careful attention to global psychologic factors, with special attention to patients' concerns to body image, level of self-esteem, current thoughts related to themselves [9,10,11,12]. Morphometric criteria have been offered describing appropriate candidates for orthodontic camouflage. On the other hand, patients who do not fit these criteria should not automatically be considered candidates for surgery. Psychosocial research suggests a percentage of these individuals place less importance on facial change and are content to improve dental aesthetics and function to the degree possible [9].

The literature contains many researches meant to compare dental, skeletal, and aesthetic outcomes between orthodontic camouflage and surgical-orthodontic treatment. The authors found that orthodontic-orthognathic surgical treatment was more effective with regard to ANB, SNB, and FMA angles (changes in vertical and sagittal intermaxillary relationship) and to the soft tissue profile [13,14,15]. In a study conducted by Xiong et al. [16] the authors investigated 46 patients with Class III malocclusion, out of which 25 adults females who had been treated with orthodontic camouflage and 21 patients who had bimaxillary surgical correction. All patients were recalled 3 years post- treatment to evaluate stability and satisfaction with treatment outcomes. The authors concluded that in the camouflage patients, slight mean changes in skeletal problems occurred over the long-term, although the changes were generally less obvious than in the surgery patients. The camouflage patients reported fewer functional or temporomandibular joint problems than surgery patients did. Both groups reported similar levels of overall satisfaction with treatment. These results suggest that both camouflage and surgical treatment in moderate skeletal Class III adults can achieve satisfactory outcomes and provide long-term stability. If patients refuse orthognathic surgery due to potential surgical complications or financial difficulties, camouflage treatment may be an effective alternative treatment [17]. Busby et al. [17] who studied for a period of 5 years or more the stability of bimaxillary surgery found that bimaxillary surgery in Class III patients is more stable than in Class II patients. Kraft et al. [18] investigated 12 patients, four of them developed skeletal instability (follow-up at 3 years 8 months). De Villa et al. [19] studied 20 surgical patients and reported that the mean long-term horizontal relapse was 2.3 mm (28.0%) at B point and 3.0 mm (34.1%) at Pogonion. According to Joss [20], long-term relapse was between 14.9% and 28.0% at point B and between 11.5% and 25.4% at Pogonion.

CONCLUSIONS

The choice of therapeutic methods for adult patients shall primarily take into account the values of skeletal cephalometric parameters, but also the values of dental parameters and facial soft tissues. The authors of this article believe that it is of utmost importance to properly inform patients about the advantages, disadvantages, benefits and risks of each treatment plan. A proper orthodontic-orthognathic surgical interdisciplinary approach ensures the therapeutic success of orthodontic young adult patients.

REFERENCES

- 1. Yavuz I, Halicioğlu K, Ceylan I. Face mask therapy effects in two skeletal maturation groups of female subjects with skeletal Class III malocclusions. The Angle Orthodontist. 2009;79(5):842-848.
- 2. Tucker MR. Orthognathic surgery versus orthodontic camouflage in the treatment of mandibular deficiency. J Oral Maxillofac Surg. 1995;53(5):572-578.
- 3. Kolokitha OE, Topouzelis N. Cephalometric methods of prediction in orthognathic surgery. J Maxillofac Oral Surg. 2011;10(3):236-245.
- 4. Schwarz AM. Röntgenstatik. München: Urban & Schwarzenberg; 1958.
- 5. Rakosi T, Jonas I. Kieferorthopädie Diagnostik. Stuttgart: Georg Thieme Verlag; 1989.
- 6. Larson BE. Orthodontic preparation for orthognathic surgery. Oral Maxillofac Surg Clin North Am. 2014;26(4):441-58.
- 7. Bousaba S, Siciliano S, Delatte M, Faes J, Reychler H. Indications for orthognathic surgery, the limitations of orthodontics and of surgery. Rev Belge Med Dent. 2002;57(1):9-23.
- 8. Daniels S, Brady P, Daniels A, Howes S, Shin K, Elangovan S, Allareddy V. Comparison of surgical and non-surgical orthodontic treatment approaches on occlusal and cephalometric outcomes in patients with Class II Division I malocclusions. Prog Orthod. 2017;18(1):16.
- 9. Thomas OM. Orthodontic camouflage versus orthognathic surgery in the treatment of mandibular deficiency. J Oral Maxillofac Surg. 1995;53(5):579-87.
- 10. Vaida L, Pirte A, Corega C, Slăvescu D, Muțiu G. Correlations between the changes in patients dental-facial morphology at the end of the orthodontic treatment and the psychological variables. Rom Journal of Morphology and Embryology. 2009;50(4):625-629.
- 11. Tung AW, Kiyak HA. Psychological influences on the timing of orthodontic treatment. Am J Orthod Dentofacial Orthop. 1998;113(1):29-39.
- 12. Vaida L, Todor BI, Bertossi D, Corega C. Correlations between Stress, Anxiety and Coping Mechanisms in Orthodontic Patients. Iranian Journal of Public Health. 2015; 44(1): 147-149.
- 13. Raposo R, Peleteiro B, Paço M, Pinho T. Orthodontic camouflage versus orthodonticorthognathic surgical treatment in class II malocclusion: a systematic review and meta-analysis. Int J Oral Maxillofac Surg. 2018;47(4):445-455.
- 14. Kinzinger G, Frye L, Diedrich P. Class II treatment in adults: comparing camouflage orthodontics, dentofacial orthopedics and orthognathic surgery-a cephalometric study to evaluate various therapeutic effects. J Orofac Orthop. 2009;70(1):63-91.
- 15. Lohrmann B, Schwestka-Polly R, Nägerl H, Dankmar Ihlow D, Dietmar Kubein-Meesenburg D. The influence of orthodontics and mandibular sagittal split osteotomy on dental and skeletal variables a comparative cephalometric study. Eur J Orthod. 2006;28:553–60.
- 16. Xiong X, Yu Y, Chen F. Orthodontic camouflage versus orthognathic surgery: A comparative analysis of long-term stability and satisfaction in moderate skeletal Class III. Open Journal of Stomatology. 2013;3(1): 89-93.

- 17. Busby BR, Bailey LJ, Proffit WR, Phillips C, White Jr RP. Long-term stability of surgical class III treatment: A study of 5-year postsurgical results. International Journal of Adult Orthodontics and Orthognathic Surgery. 2002;17(3):159-170.
- 18. Kraft T, Boulétreau P, Raberin M, Étienne C, Breton P, Freidel, M. Severe Class III malocclusion: Long-term stability. Retrospective analysis of 12 cases. Revue de Stomatologie et de Chirurgie Maxillo-Faciale. 2004;105(3):153-159.
- De Villa G, Huang C, Chen P, Chen Y. Bilateral sagittal split osteotomy for correction of mandibular prognathism: Long-term results. Journal of Oral and Maxillofacial Surgery. 2005; 63:1584-1592.
- 20. Joss C, Thüer U. Stability of hard tissue profile after mandibular setback in sagittal split osteotomies: A longitudinal and long-term follow-up study. European Journal of Orthodontics. 2008;30(4):352-358.

Composite adition enameloplasty for diastema closure – case report



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Abstract

The case presented is of a patient with a complex diagnosis of maxillo-lateral lateral edentation without prosthetic work and mandibular left lateral edentation with an incorrect fixed prosthetic work, due to cavity etiology, unbalanced occlusion through loss of dental lateral areas, chronic marginal parodontopathy (superior localized in the frontal area and inferior localized in the lateral areas), consecutive to occlusal trauma, chronic bilateral joint pain due to occlusal traumatic etiology (arthritis). In this case the diastema was secondary to the maxillary lateral edentations (along with the other spaces in the frontal area). The case treatment required interdisciplinary, the orthodontic therapeutic objectives aiming at the occlusal rebalance, with the closure of the existing spaces in the upper frontal area and then the contention of the obtained result. Also, the complete closure of the diastema was carried out before going to the proper prosthesis phase. We used Vertise TM Flow (Kerr®, Germany).

Keywords: diastema, orthodontic treatment, dental restorative treatment, composite material.

INTRODUCTION

The diastema is defined by classical literature as the space between the two central incisors (superior or inferior) and which may have varied dimensions. It occurs more frequently in the upper jaw which generates higher esthetical disturbances than in the lower jaw. It is an anomaly of position, but also of eruption, also being named in literature as:

- true diastema/ vera/ primary (Kalvelis quoted by Ionescu [1]),

- interincisive diastema (Boboc [2]),

- pathological diastema (Pont, Dechaume quoted by Ionescu [1]).

After Boboc [2], the true or diastema vera occurs in the case of a upper lip phrenum low developed and inserted, or in the case of fibrous septum that exists between the two central upper incisors located on the median line and which prolongs into the depth of bone the abundant fibrous mucosa. On the other way, Cocârlă, Grivu [3, 4] consider that the diastema vera has a purely genetic origin, without the intervention of other factors.

The secondary or false diastema occurs due to the existence of other anomalies such as [1-4]: the mesiodens, the unilateral or bilateral lateral incisor anodontia, the mesial pressing of the apexes of the two central incisors (with concurrent distal crown tipping) by the horizontal position impacted canines and which have later resumed the intraosseous migration. In the literature, there are exposed some secondary diastema cases occurring after the central incisor wearing beyond the equator (relative diastema); in the case of a poorly reduced intermaxillary median fracture; or consecutively to an unresolved/ poor resolved posterior edentulous spaces.

Regarding the therapy of this anomaly, the quoted authors [1-4] agree that should be considered as main objectives:

- the removing of the cause of the anomaly,
- the orthodontic closure of the existing space (by bodily teeth moving), followed by the contention of the obtained result. In such situation the diastema is a recurrent anomaly.

CASE REPORT

I. Anamnesis and clinical examination data

A complex situation, which included the existence of diastema and in which enameloplastic therapy was practiced, was M.D., female, 42 years old. The reasons for the presentation were masticatory and esthetic disorders. She was coming from her own initiative to the dental clinic, at prosthetic department.

The facial examination revealed a decreased facial lower level with depressed genius areas and bilateral articular noises of the temporomandibular joints.

Intraoral examination revealed the absence of premolars and bilateral maxillary molars, 3-4 mm diastema, spaces in the upper frontal area, left deviation of the lower interincisive line by 1 mm, overjet of 4 mm at level of 1.1 and 2.1 and of 3 mm at level of 1.2 and 2.2, inversion of the right sagittal curve through the egression of 4.5 and 4.6, front overbite of 1 mm (Figure 1).

II. Paraclinical investigations

The appearance of the edentulous edges (Figure 1) confirmed the anamnestic data about a complicated old carious etiology that generated it, with the decrease of the vertical facial dimension. That showed the lack of any prosthetic intention until the patient presentation at our clinic.



Figure 1. Patient M.D., 42 years old, female. Emphasizing lateral areas that generated secondary diastema (a-d study models) (personal case)

<u>III. Diagnosis</u>

The diagnosis was as follows:

- maxillar latero-lateral edentation without prosthetic work and mandibular left lateral edentation with fixed incorrect prosthetic work; carious etiology,
- unbalanced occlusion by loss of dental lateral areas,
- chronic marginal periodontitis, localized: superior in the frontal area, and lower in the lateral areas, following occlusal trauma
- bilateral chronic joint pain of occlusal traumatic etiology (arthritis).

In this situation the diastema is secondary due to edentulous upper spaces (along with the other spaces in the frontal area).

IV. Treatment

For a complex treatment solution, the case of this adult patient has received an orthodontic treatment, thus the orthodontic therapy becoming a pre-prosthetic treatment [5]. The orthodontic therapeutic objectives aimed at the occlusal rebalancing, with the closure of the existing spaces in the upper frontal area, followed by the contention of the obtained result. Thus, by the orthodontic intervention, with the space closure, the upper front group dental axes were also corrected, remaining at last a diastema between the two teeth of max. 0.5 mm. So the resulting position of the teeth was favorable to the prosthetic restoration.

The patient expressed the desire to completely diastema closure before going to the proper prosthesis phase. The enameloplastic method was performed before the prosthetic treatment phase and using the "in the office" dental composites. Their application was layered (Figure 2). One of the determining factors for selecting direct work was the speed of execution and minimal enamel sacrifice.



Figure 2. Patient M.D., 42 years old, female - intraoral aspect at the end of orthodontic treatment and after diastema closure (enameloplasty with composite materials) (personal case)

In this case, the sequence of work times was as follows:

- isolation of the working field;

- the diastema delimiting proximal enamel surfaces were prepared with a very large granular disk mounted on the counter piece (extracoarse, OptiDisc®, Kerr, Germany) - usually used for finishing and occlusal composite restorations adaptation stage, but which has led to the increased retention of the enamel area of interest. The option for such an instrument occurred due to the small remaining distance between the two maxillary central incisors, the intervention area being limited. The insertion of ordinary grinding tools or crown modelling tools (eg, a small oral spatula with 0.5 mm thickness of active heads) was prevented;

- we chose a self-adhesive light curing flow composite (Vertise TM Flow, Kerr, Germany) in the closest color to that of the tooth (A2);

- the enamel portion representing the preparation was no longer acid etched;

- we have introduced cellulose interdental strips (matrices), interdental fixed to prevent the adhesion of the material to the neighboring tooth and to facilitate the modeling of the reconstitution;

- next, with the help of the composite syringe applicator tip, we deposited successively thin layers, "lost" trimmed at the gingival level (for the protection of the marginal periodontium) and each followed by polymerization in a visible spectrum for 20 seconds. The restoration was extended to the palatal slope for closing the interdental niche;

- finishing we made it a classical manner, like any composite restoration, with finishing discs, fillers, polishes and polishing pastes.

In order to maintain the outcome of the treatment, we proceeded to solidarize the upper frontal group through a composite ligature tie fixed at frontal group cingulum level (Figure 3) - also an adhesive technique.



Figure 3. Patient M.D., 42 years old, female - intraoral aspect and final prosthetic restoration of superior lateral areas with frontal group palatal solidarization (personal case)

DISCUSSIONS

In this case of diastema enameloplasty, Kerr's Vertise TM Flow composite material has provided a practical solution, self-resilience, fluid consistency and thixotropic capacity [6-8], being of real use in crown remodeling within reduced maneuverability spaces. In addition to the qualities listed above, a contributing factor was also the presentation of the composite (applicator tip syringe). In our opinion, we considered that the choice of the enameloplastic restoration material proved to be pertinent also from the resistance point of view to mechanical stresses (the proximal areas are not subjected to high masticatory pressures) [9, 10], the composite being developed by the company for sealing in ditches and fossils and subsequently improved to respond to more extensive occlusal requests.

REFERENCES

- 1. Ionescu, Ecaterina, Anomaliile dentare, Ed. Cartea Universitară, București, 2005,
- 2. Boboc, G, Anomaliile dento-maxilare, Ed. Med., Bucureşti, 1971,
- 3. Cocârlă, Elvira, Ortodonție, Tip. UMF "Iuliu Hațieganu", Cluj-Napoca, 1995,
- 4. Grivu, O, Sinescu, C, Abdalla, N, Florescu, Monica, Dragomirescu, D, Lenhardt, F, Ortodonție și ortopedie dento-facială, Ed. Mirton, Timișoara, 2001
- 5. Munteanu, A., Bratu, E., Vernic, C., Evaluation of the soft tissue esthetic changes after orthodontic treatment, Medicine in Evolution, 2012, 18(1), 180-183
- 6. Van Meerbeek, B, De Munck, J, Yoshida, Y, Inoue, S, Vargas, M, Vijay, P, Van Landuyt, K, Lambrechts, P, Vanherle, G, Buonocore memorial lecture. Adhesion to enamel and dentin: curreent status and future challenges, Oper Dent, 2003, 28, 215-235
- 7. Păstrav, O, Pop, Angela, Păstrav, Mihaela, Aprecierea comportamentului clinic al materialelor compozite în restaurarea coronară la dinții frontali, Clujul Medical, 2009, LXXXII, 3, 420-424,
- 8. https://www.kerrdental.com/kerr-restoratives/vertise-flow-self-adhering-flowable-composite
- 9. Söderholm, K-J, Critical evaluation of adhesive test methods used in dentistry, J Adhes Sc and Tech, 2009, 23, 973-990,
- 10. Mattick, CR, Hobson, RS, A comparative micro-topographic study of the buccal enamel of different tooth types, J Orthod, 2000, 27, 143-148

Incidence of dental decay in six-year molar



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Abstract

The six-year molar is a tooth that is very vulnerable to cavities. The eruption of permanent teeth in the lateral area is largely dictated by the position and presence of this tooth. If the six-year molar is compromised, occlusal disorders may occur.

The purpose of the study was to assess the odontal status of the 6-year-old molar in a group of school children in Oradea.

Material and method: a group of 364 children aged 6-8 years has been studied. They were examined, the dental status of the primary molar, the affected areas and the extent of the lesion have been recorded, the incidence rates for cavities, and the DMFT and DMFS intensity indices have been calculated.

Conclusions: Of the total of 364 children, 40.93% had the six-year molars affected by cavities. Greater frequency has been observed in girls than in boys, and also more in the lower dental arcade as compared to the upper one. The average cavities prevail, extending more on the surface than in depth. Knowing the importance of the six-year molar, it is important to treat the cavity from the earliest age, with regular check-ups every 6 months.

Keywords: six-year molar, decay, cavity.

INTRODUCTION

The first permanent molar erupts around the age of 6-7 years, and this is why it is also called the "six-year molar". Heredity and other factors can influence the approximate age at which we expect these teeth to erupt [1].

The permanent first molar is a tooth very vulnerable to dental decay. It has an important role in both the dental arches, and the eruption of permanent teeth is largely influenced by the condition of six-year molar. If compromised, this tooth leads to occlusal disorders in terms of vertical dimension [2,3].

Dental carries are the most common disease, and the permanent first molars are highly prone to decays due to their anatomical structure and early eruption in the mouth. This is the reason why children should consult their physician for dental treatment or extraction of this tooth. This is often a traumatic event for children, so teeth decay prevention is very important [4-6].

Several studies have reported a high prevalence of dental decay in children from schools in Saudi Arabia and other developing countries [6,7].

The frequency of involvement of dental surfaces by carious lesions varies with age, and the peak of intensity occurs at certain stages of human life [8].

A study carried out in Japan showed that most of the occlusal caries occurred 1-2 years after related teeth eruption [9]. Also, a study in northeast China shows a high prevalence of caries in the six-year old molar [10].

Following a study carried out in Amsterdam, 7.5% of the children subject to dental check-up had "hidden caries" [11].

In Pakistan, 30.6% of a study subjects have caries on their permanent first molar, and all four molars were affected in 1.8% of subjects [12].

Aim and objectives

The purpose of the study was to identify as early as possible the carious lesions of permanent molars and to prevent them from occurring.

MATERIALS AND METHODS

In selecting the survey target group, we decided to include children enrolled in the preparatory class and first grade, taking into consideration the following criteria:

- children are aged corresponding to mixed dentition;
- at this age, children develop attitudes, habits and behaviors related to the preservation of oral health, oral hygiene and the integrity of the lower and upper jaws and teeth;

Since they are forming a collectivity, the oral health education program is easier to implement and monitor.

Three schools were selected, according to the following criteria:

- schools should be located in different areas of the city;
- children families have different levels of education and training, living standards, and various social backgrounds.

Thus, the resulting target group, based on the inclusion criteria listed above, included 364 children.

The working technique consisted of:

- a. Oral examination in children enrolled in the study;
- b. Drawing up an observation sheet for each child where the condition of the molars, the affected areas and the extent of the carious process were written down;
- c. Running a prophylactic and oral health education program;

d. The children were subject to dental check-up, underwent oral hygiene procedures and had their 6 year molars treated.

RESULTS

Of the total of 364 children subject to dental check-ups, 149 had their permanent first molars affected, that is 40.93% of the total target group being affected by one or more molar lesions.

A number of 215 children were uninjured in terms of tooth decay i.e. 59% of total, of whom only 30 children had their teeth already sealed i.e. 13.9%. Out of the 149 children with affected molars: 55 children had one affected molar, i.e.15.18%; 64 children had two molars affected, i.e. 17.58%; 21 children had three molars affected, i.e. 5.77%; nine children had all four molars affected i.e. 2.47% of the total.

1,454 teeth were subject to dental check-ups, of which 282 molars were affected by dental decay.

Calculating the Dental Decay Severity Index, whose formula is equal to total teeth no./ teeth examined no. x100 i.e. = 282x100/1456 = 19.36%

Dental caries intensity index = no. teeth CAO / no. examined subjects x100

Analysis by gender revealed a slight increase in girls, of the 167 females examined, 73 had dental decay i.e.43.71%, general index (GI)= 19.91%, and in the 197 examined boys, 76 had dental decay i.e. 38.57%, general index = 18 9%.

Analyzing the frequency of tooth decay occurrence by dental arches, lower molars are more affected i.e. 14.49% in comparison with the upper ones i.e. 4.8%, lower molars being affected on multiple surfaces.

The extent of cavities on the number of surfaces is as follows: the upper molars are affected on a surface GI= 0.48% at the level of 16, 0.50% at the level of the tooth 26, while the lower molars exhibit extensive lesions on several surfaces i.e. 1.6% at the level of the tooth 36 and 1.89% at the level of tooth 46, the latter undergoing with several injuries.

From the point of view of cavity occurrence, these cavities occur symmetrically, the most affected being the lower molars i.e. 14.49%, compared to the upper molars i.e. 4.8%. The most frequently affected tooth was the first lower left molar 35% (100 teeth), followed by 33% first lower right molar (92 teeth). The left and right upper molars were affected to a lesser extent, i.e. 17.7% (50 teeth) and 12.05% (34 teeth), respectively.

The carious processes are most frequently located on the occlusal face, followed by the vestibular alveoli of the molars. Regarding the depth of cavities, the moderate stage caries prevail 18%, followed by extensive stage caries 2,61%, and initial stage caries in a smaller percentage1,99%.

Of this total, 215 children presented had uninjured teeth, and 30 presented to a dental practice where they learned the correct tooth brushing technique and underwent sealing of tooth fissures and cracks.

Unerupted six-year molars were considered uninjured and no cases of molars extracted at the age of seven among children surveyed were met.

DISCUSSIONS

Analyzing the results of the study carried out on a target group of children aged 6-7, we obtained results that allowed us to assess that dental hygiene at this age group is precarious and the incidence of dental decay is increased.

In our study we examined children aged 6-7 who had their permanent first molars already erupted. We studied this tooth because it is more prone to dental decay due to fissures and cracks [13,14]. This tooth plays an important role in both arches, and the eruption of permanent teeth is largely influenced by the condition of the six-year molar. If

compromised, this tooth leads to occlusal disorders in terms of vertical dimension. It also has an important role in mastication, and its premature extraction can lead to malalignment of the interincisive line with negative impact on physiognomic parameters and mastication. The most affected teeth were inferior molars, and in terms of gender distribution, girls were more affected than boys a finding which is consistent with other studies [14-17]. The oral prophylaxis program for school age children, mothers and educators will lead to raising awareness of the importance of oral hygiene, food factor, regular dental check-up, and finally to the conclusion that the most important role in oral health education is played by prevention in dentistry. Excessive consumption of sweets and carbonated drinks has a primary negative effect on teeth, by increasing caries index values and rapid progression to severe early childhood caries syndrome.

CONCLUSIONS

While being fully aware of the importance of the six-year molar as well as the caries severity index of molars, it is necessary to treat the caries from the earliest age as well as to run regular dental check-ups i.e. every 6 months. Sealing alveoli and fissures is an important prophylaxis method that should be performed to all children at this age in order to reduce the incidence of dental decay and complications thereof.

REFERENCES

- 1. JADA, Vol. 137 http://jada.ada.org January 2006
- 2. World Health Organization. World Health No. 1. 1994. [Google Scholar]
- 3. Oral health. ICMR Bulletin. 1994;24, 4 [Google Scholar]
- 4. Marthaler TM. Caries status in Europe and prediction of future trends. Caries Research. 1990;24:381–386. [PubMed] [Google Scholar]
- 5. Schlagenhauf U, Rosendahl R. Clinical and microbiological caries-risk parameters at different stages of dental development. Journal of Pedodontics. 1990;14(3):141–143. [PubMed] [Google Scholar]
- 6. Stewart BL, Al-Juhani TS, Al-Akeel AS, et al. Caries experience in Grade 1 and 6 children attending elementary school at King Abdulaziz Military City, Tabuk Saudi Arabia. Saudi Dental Journal. 2002;12:140–148. [Google Scholar]
- 7. Wyne AH, Al-Ghorabi BM, Al-Asiri YA, Khan NB. Caries prevalence in Saudi primary schoolchildren of Riyadh and their teachers' oral health knowledge, attitude and practices. Saudi Medical Journal. 2002;23(1):77–81. [PubMed] [Google Scholar]
- 8. Prashanth VK, Nagesh L, Ankola AV, Hegde P, NayakS. Comparision of Glass-Inomer (FUJI III) and resin based fissure ealant (3M ESPE) one year clinical trial.JPak Dent Assoc 2010;19:24-29
- 9. Hata H, Igari K, Kanou N, Kamiyama K. Evaluation of preventive dental care for first permanent molars in children. Shoni Shikagaku Zasshi. 1990;28(4):928–936. [PubMed] [Google Scholar
- 10. Cheng RB 1 , Tao W , Zhang Y , Cheng M , Li Y , Analysis of the first permanent molar caries epidemiological investigation in area of northeast China], (PMID:18357890) [01 Feb 2008, 26(1):73-76]
- 11. Weerheijm KL , Gruythuysen RJ , van Amerongen WE , Prevalence of hidden caries. (PMID:1491078), ASDC Journal of Dentistry for Children [01 Nov 1992, 59(6):408-412]
- 12. Mahjabeen Khan, Prevalence of Dental Caries in the first permanent molars in children between 8-12 years, Journal Alabama Dental Association 22(13):119-123
- 13. Demirci M, Tuncer S, Yuceokur AA. Prevalence of Caries on Individual Tooth Surfaces and its Distribution byAge and Gender in University Clinic Patients. Eur J Dent. 2010; 4: 270–279.
- Prashanth VK, Nagesh L, Ankola AV, Hegde P, Nayak S. Comparison of Glass-Ionomer (FUJI III) and resin based fissure sealant (3M ESPE) one year clinical trial. J Pak Dent Assoc 2010;19:24-29

- 15. Fazeli SA, Fazeli SA. First molar caries in primary school children of a Northern city of Iran. Pakistan Oral Dent. J. 2005;25
- Lukacsand JR, Largaespada LL. Explaining sex differences in dental caries prevalence: saliva, hormones, and "life history" etiologies. American Journal of Human Bio, 2006;18, 540–555,
 Antunes JL, Junqueira SR, Frazão P, Bispo CM, Pegoretti T, Narvai PC. City-level gender
- 17. Antunes JL, Junqueira SR, Frazão P, Bispo CM, Pegoretti T, Narvai PC. City-level gender differentials in the prevalence of dental caries and restorative dental treatment. Health Place. 2003;9:231-23

Dental age estimation using the Demirjian method in a sample of patients from the Crișana region



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Abstract

Aim and objectives. The Demirjian method has been used in recent years for the assessment of the dental age. There are only a few studies in Romania that make use of this method. The objective of the study was to evaluate the dental age of a sample of children and adolescents in the Crişana region based on the Demirjian method, as well as to compare the dental age with the chronological age. *Material and methods.* The authors evaluated the dental age using the Demirjian method, which is based on panoramic radiographs. The initial sample consisted of 400 radiographs of patients aged between 5 and 13 years, from the Crişana region. After applying the exclusion criteria, 52 radiographs were removed and 348 radiographs were kept in the study. The chronological age considered was the age that the patients had when the radiographs were taken. *Results.* In many situations, patients showed rhythm discrepancies between the dental age and the chronological age than male patients. In most cases, discrepancies occurred in the form of a precocity in the estimation of the dental age. *Conclusions.* The Demirjian method is useful in establishing the dental age. The values proposed by Demirjian are not, however, always validated in the populations of other countries. The authors believe that national studies and larger batches are needed to adapat the values to the Romanian population.

Keywords: Demirjian, dental age, chronological age.

INTRODUCTION

In pediatric dental medicine and in orthodontics, establishing the correlation between the dental age and the chronological age in order to diagnose discrepancies between the dental and the chronological age is of utmost importance for formulating the appropriate treatment plan. Chronological age estimation is also needed in areas such as anthropology, archeology, legal medicine and forensic sciences [1].

Each individual's development can be affected by genetic, racial, nutritional, climatic, hormonal and environmental factors. The development of secondary sexual features, mental age, skeletal development and dental mineralization are some useful tools in determining chronological age. Some authors believe that the safest method for establishing the chronological age is based on the skeletal age [2]. Others consider that a much easier tool is to estimate the chronological age based on the dental age [3]. Human dentition represents an excellent assessment instrument due to the high degree of independence from the influences exercised by the environmental factors and other systemic diseases [4].

For the exact determination of the dental age, several methods have been proposed over time, such as: Nolla, Willem, Moores, Haaviko, Schour, Demirjian [5,6,7]. Of these, the Demirjian method is the one most used for determining dental age [8]. The Demirjian method analyzes the maturing stages of permanent teeth on the lower left dental arch. It implies the existence of 8 stages of maturation, marked with letters from A to H. Each stage is given a score, depending on the tooth assessed and the gender of the patient. The scores obtained for each of the 7 left mandibular teeth will be added, the end result representing the Dental Maturity Score (DMS). The Dental Maturity Score will be converted to the dental age based on the tables proposed by Demirjian et al. Differences between chronological and dental age indicate early or late dental age, with discrepancies between the two [8,9,10].

The method, however, is not always validated in the populations of other countries, often requiring adaptation in the population in which it is intended to be applied [11,12,13].

In Romania, there are studies that investigate the dental age, but these are not multicentric, dental age being individually assessed in different areas [10,14,15,16].

Aim and objectives

The main objective of this study was to assess the dental age based on the Demirjian method in a group of children and adolescents in the Crişana region. The second objective was to establish correlations between the dental age and the chronological age and to diagnose discrepancies between the two.

MATERIALS AND METHODS

The retrospective study was conducted in agreement with the World Medical Association Declaration of Helsinki-Ethical Principles for Medical Research Involving Human Subjects and approved by the Ethics Committee of the University of Oradea, Romania. Panoramic radiographs of patients between 5 and 13 years of age requiring specialized pedodontic or orthodontic treatment were analyzed. For this study, the authors assessed only radiographs of patients from Bihor County or neighboring counties: Satu Mare and Sălaj, who were considered representative of the Crișana region.

The initial sample consisted of 400 randomly selected radiographs of male and female patients. The following exclusion criteria were applied: inferior quality of the panoramic radiographs (old, damaged, undated radiographs), congenital absence of one or more teeth on the lower left dental arch (a correct assessment of the Dental Maturity Score would not have been possible), one or more extracted teeth on the lower left dental arch (most commonly the first permanent molar due to the complications of caries in this tooth), radiographs of syndromic patients, radiographs of patients with congenital abnormalities (such as patients with clefts). After applying the exclusion criteria, 52 radiographs were removed and 348 remained in the study. The patients were divided according to the chronological age, in 4 categories: 5 years – 6 years and 11 months, 7 years – 8 years and 11 months, 9 years – 10 years and 11 months, 11 years – 13 years and 11 months. The patients of each category were also divided into two gender sub-groups: boys and girls.

For the assessment of the dental age, the Demirjian method was used. This method is based on the determination of dental age using panoramic radiographs (Figure 1). The different stages of development of the left lower dental arch teeth are assessed. The method involves the existence of 8 different stages of development, each tooth receiving a letter from A to H, which corresponds to the maturing stage. These stages will then be converted into scores based on the tooth investigated and gender. At the end the scores of the seven permanent teeth on the lower left dental arch (the third permanent molar is not taken into account) will be collected and added, the result being the Dental Maturity Score (DMS). The Dental Maturity Score will then be converted to dental age based on gender [9]. The date of birth of the patients and the date the radiographs were made were used for assessing the chronological age.



Figure 1. Example of a panoramic radiograph used for the dental age assessment

The data was analyzed with the GraphPad Prism8 software. Quantitative variabled were written as averages with or without standard deviations, while categorical variables were written as counts or percentages. A paired sample t-test was used to determine the mean difference between the mean chronological age and the mean dental age. Microsoft Excel for Mac 2011 programme was used for the making of tables and graphics.

RESULTS

Table 1 illustrates the number and percentages of patients investigated according to their gender and Graphic 1 highlights the percentages of boys and girls included in the study. As such, the sample consisted of radiographs of 145 boys (42%) and 203 girls (58%).

Gender	No.	Percentage
Boys	145	42%
Girls	203	58%

Table 1. Number and percentages of boys and girls included in the study



Graphic 1. Percentages of boys and girls included in the study

In Table 2 and Graphic 2 the distribution of the patients according to age and gender is illustrated. The first age group (5y-6y11m) represents 8% of the total sample, the second age group (7y – 8y11m) represents 35% of the total sample, the third age group (9y – 10y11m) represents 24% of the total sample and the fourth age group (11y – 13y11m) represents 33% of the total sample.

Age groups	No. of boys	No. of girls	Total no.	Percentage
5y - 6y11m	12	15	27	8%
7y - 8y11m	58	65	123	35%
9y - 10y11m	33	52	85	24%
11y - 13y11m	42	71	113	33%

Table 2. Distribution of the patients according to age and gender



Graphic 2. Distribution of the patients according to age and gender

Table 3 and Graphic 3 depicts the mean chronological age for each age groups investigated. The first group has a mean chronological age of 5,97 years. The second age group has a mean chronological age of 7,92 years. The third age group has a mean chronological age of 12,27.

Age groups	MCA (in years)	SD	SEM
5y - 6y11m	5,97	0,59	0,11
7y - 8y11m	7,92	0,55	0,05
9y - 10y11m	9,75	0,59	0,06
11y - 13y11m	12,27	0,79	1,74

Table 3. Mean chronological age for each age group

MCA: Mean chronological age; SD: Standard deviation; SEM: Standard error of mean



Graphic 3. Mean chronological age for each age group

Table 4 and Graphic 4 depicts the mean dental age for each age group. The first group has a mean dental age of 7,65. The second group has a mean dental age of 9,01. The third group has a mean dental age of 10,95. The fourth group has a mean dental age of 13,31.

Table 4. Mean dental age for each age group

Age groups	MDA(in years)	SD	SEM
5y - 6y11m	7,65	0,69	0,13
7y - 8y11m	9,01	1,26	0,11
9y - 10y11m	10,95	1,46	0,15
11y - 13y11m	13,31	1,74	0,16

MDA: Mean dental age; SD: Standard deviation; SEM: Standard error of mean



Graphic 4. Mean dental age for each age group

Table 5 and Table 6 illustrate the mean chronological age and the mean dental age with their standard deviations separateley in boys and girls. The mean difference between the chronological age and dental age is shown. The paired sample t-test was used to analyze the mean difference. For boys the mean difference is considered extremely statistically significant for the first, second and third age group (p<0.0001) and very statistically significant for the fourth age group (p<0.0032). For girls the mean difference is considered extremely statistically significant for all age groups (p<0.0001).

BOYS						
	MCA±SD MDA±SD MCA-MDA					
Age groups	(in years)	(in years)	(in years)	t value*	p value**	
5y - 6y11m	$6,06 \pm 0,68$	7,70 ± 0,65	-1,64	13,29		
7y - 8y11m	7,92 ± 0,56	9,16 ± 1,45	-1,24	6,97		
9y - 10y11m	9,66 ± 0,62	10,72 ± 1,25	-1,05	5 <i>,</i> 57	< 0.0001	
11v - 13v11m	12.26 ± 0.78	13.07 + 1.89	-0.81	3.13	0.0032	

Table 5. Mean chronological age, mean dental age and mean difference between them for each age group in boys

MCA: Mean chronological age; MDA: Mean dental age; MCA-MDA: Mean difference between mean chronological age and mean dental age; * paired sample t-test; **paired sample t-test

Table 6. Mean chronological age, mean dental age and mean difference between them for each age group in girls

	GIRLS					
	MCA±SD (in	MDA±SD (in	MCA-MDA			
Age groups	years)	years)	(in years)	t value*	p value**	
5y - 6y11m	$5,91 \pm 0,52$	$7,62 \pm 0,73$	-1,7	11,58		
7y - 8y11m	7,93 ± 0,55	8,88 ± 1,06	-0,95	6,88		
9y - 10y11m	9,81 ± 0,58	11,1 ± 1,57	-1,28	6,47		
11y - 13y11m	12,27 ± 0,79	13,45 ± 1,65	-1,17	6,9	< 0.0001	

MCA: Mean chronological age; MDA: Mean dental age; MCA-MDA: Mean difference between mean chronological age and mean dental age; * paired sample t-test; **paired sample t-test

Table 7 shows the distribution of normal, premature and delayed dental age for each age group. The chronological age was correlated to the dental age. If the chronological age and dental age had similar values that could be included in a 0 to 6 months range, the dental age was considered normal. The premature dental age and the delayed dental age diagnosis was decided for all situations in which the difference between the chronological age and the dental age was more than 6 months.

Age groups	Normal DA	Premature DA	Delayed DA
5y - 6y11m	0	27 (100%)	0
7y - 8y11m	50 (41%)	68 (55%)	5 (4%)
9y - 10y11m	22 (26%)	56 (66%)	7 (8%)
11y - 13y11m	22 (19%)	72 (64%)	19 (17%)

Table 7. Distribution of normal, premature and delayed dental age for each age group

DA: Dental Age

DISCUSSIONS

The total number of radiographs analyzed in this retrospective study was 348, of which 145 were radiographs of boys, and 203 were radiographs of girls, meaning that the sample consisted of 42% boys and 58% girls. The distribution of patients by gender was therefore acceptable in therms of ratio. The distribution of patients according to age was variable. The first batch, consisted of only 27 (8%) patients aged between 5 years and 6 years 11 months. This can be explained by the fact that specialized orthodontic treatment in children under the age of 7 years, which require a panoramic radiograph, is only recommended for the interception of localized malocclusions. Many of the apparent malocclusions noticed in children under the age of 7 are transitory [17]. The other age groups consisted of larger and simillar number of patients.

By comparing the chronological age with the dental age in boys, we found that in all four age groups there were rythm discrepancied between the chronological age and the dental age. In all age groups, the dental age had an advance over the chronological age. The most obvious advance was seen in the first age category, and the lowest in the last age category. The same is true for the girls. All age groups showed an overestimation in dental age versus chronological age. Compared to the data proposed by Demirjian, there is an advance in the dental age in all age groups investigated, both in boys and girls. The results of our study are similar for some age groups with other studies that were conducted in our country. Thus, Jurca et al. noted an advance of dental age in boys aged 6-9 years and girls aged 6-11 years [14]. However, in our study, the advancement of dental age was higher. Ogodescu et al. records an increase in dental age in all age categories investigated, with significant differences in patients between 5.5-6.4 years, 11.5-12.4 years, 12.5-13.4 years, 13, 5-14.4 years [16].

Discrepancies between the chronological age and the dental age were reported in several European populations. Nur et al. in a study that wanted to test the validity of the Demirjian and Nolla method on a group of children in northeastern Turkey, found an advance of the dental age in all the age groups investigated, both in boys and girls [18]. Tomas et al. concludes, following a study on a group of Spanish and Portuguese children, that the Demirjian method tends to everestimate the patient's age [1]. There are, however, studies that conclude that the Demirjian method does not need adaptation and is validated in the investigated populations. Sobieska et al. and Birchler et al., consider that the Demirjian method is validated in Polish, Finnish and Swiss children [19,20,21].

The Demirjian method was applied in other populations, outside Europe, where it was validated or not. Ali et al., Maber et al., Chen et al. and Baghdadi ZD recommend adaptations of the Demirjian method for Egyptian, Bangladeshi, Western Chinese and Saudi populations [8,13,22,23]. However, the method showed a high degree of accuracy in the Iranian and Southern Indian populations [5,24,25].

Panoramic radiographs and, implicitly, the Demirjian method can also be used to compare skeletal age with dental age and chronological age. Litsas et al. and Vaida et al. have made such comparisons in their studies. [26,27].

Our research highlights that many of the patients included in this study show discrepancies between the chronological age and the dental age. All patients in the first age group showed an overestimation of the dental age. Approximately half of the patients in the second age group (55%) and two-thirds of the patients in the last two age groups (66% and 64%, respectively) showed an overestimation of the dental age. Girls showed more obvious discrepancies between the dental age and the chronological age than boys.

CONCLUSIONS

Altough the Demirjian method is considered a useful tool for the assessment of dental age, our study indicates that it overestimates the dental age of the patients from the Crişana region. The sample, however, was only of 348 patients. A larger sample is necesarry and recommended for the exact determination of the validity of the Demirjian method. The authos also consider that a multicentric approach would be beneficial.

REFERENCES

- 1. Tomás LF, Mónico LSM, Tomás I, Varela-Patiño P, Martin-Biedma B. The accuracy of estimating chronological age from Demirjian and Nolla methods in a Portuguese and Spanish sample. BMC Oral Health. 2014; 14:160.
- 2. Kurita LM, Menezes AV, Casanova MS, Haiter-Neto F. Dental maturity as an indicator of chronological age: radiographic assessment of dental age in a brazilian population. J Appl Oral Sci. 2007; 15(2):99-104.
- 3. Rai V, Saha S, Yadav G, Tripathi AM, Grover K. Dental and skeletal maturity-a biological indicator of chronologic age. J of Clinical and diagnostic research. 2014; 8(9):60-64.
- 4. Wolf TG, Briseno-Marroquin B, Callaway A, Patyna M, Müller VT, Willershausen I, Ehlers V, Willershausen B. Dental age assessment in 6 to 14 years old German children: comparison of Cameriere and Demirjian methods. BMC Oral Health. 2016; 16:120.
- 5. Mohammed RB, Sanghvi P, Perumalla KK, Srinivasaraju D, Srinivas J, Kalyan US, Rasool SKMDI. Accuracy of four dental age estimation methods in southern Indian children. J of clinical and diagnostic research. 2015; 9(1):1-8.
- 6. Martinez Gutierrez VM, Ortega Pertuz AI. Comparacion de los metodos de Nolla, Demirjian y Moorrees en la estimacion de la edad dental con fines forenses. Revista Odontologica Mexicana. 2017; 21(3):155-164.
- 7. Panchbhai AS. Dental radiographic indicators, a key to age estimation. Dentomaxillofacial Radiology. 2011; 40:199-212.
- 8. Chen JW, Guo J, Zhou J, Liu RK, Chen TT, Zou SJ. Assessment of dental maturity of western Chinese children using Demirjian's method. Forensic Science International. 2010; 197:119.e1-119.e4.
- 9. Demirjian A, Goldstein H, Tanner JM. A new system of dental age assessment. Human Biology. 1973; 45(2):211-227.
- 10. Vaida LL, Todor BI, Moca AE, Scrobota I, Negruțiu BM, Muntean A. Correlations between dental age and chronological age in children and adolescents. HVM Bioflux. 2019; 11(2):43-47.
- 11. Hagg U, Matsson L. Dental maturity as an indicator of chronological age: the accuracy and precision of three methods. Eur J Orthod. 1985; 7(1):25-34.
- 12. Willems G, Van Olmen A, Spiessnes B, Carels C. Dental age estimation in Belgian children: Demirjian's technique revisited. J Forensic Sci. 2001; 46(4):893-895.
- 13. Maber M, Liversidge HM, Hector MP. Accuracy of age estimation of radiographic methods using developing teeth. Forensic Sci Int. 2006; 159(1):68-73.
- 14. Jurca A, Lazar L, Pacurar M, Bica C, Chibelean M, Bud E. Dental age assessment using Demirjian's method- a radiographic study. Eur Sci J. 2014; 10(36):51-60.
- 15. Savin C, Bălan A, Gavrilă LM, Sîrghe A, Batajoo R, Dragomir B. Dental age estimation in a sample of children popultion from Iasi county. Rom J of Oral Rehab. 2018; 10(2):119-128.
- 16. Ogodescu AE, Bratu E, Tudor A, Ogodescu A. Estimation of child's biological age based on tooth development. Rom J Leg Med. 2011; 19(2):115-124.
- 17. Fleming PS. Timing orthodontic treatment: early or late?. Australian Dental Journal. 2017; 62(S1):11-19.
- 18. Nur B, Kusgoz A, Bayram M, Celikoglu M, Nur M, Kayipmaz S, Yildirim S. Validity of Demirjian and Nolla methods for dental age estimation for Northeastern Turkish children aged 5-16 years old. Med Oral Patol Oral Cir Bucal. 2012; 17(5):e871-877.
- 19. Sobieska E, Fester A, Nieborak M, Zadurska M. Assessment of the dental age of children in the Polish population with comparison of the Demirjian and the Willems methods. Med Sci Monit. 2018; 24:8315-8321.
- 20. Birchler FA, Kiliaridis S, Combescure C, Julku J, Pirrtiniemi PM, Vazquez L. Dental age assessment on panoramic radiographs: comparison between two generations of young Finnish subjects. Journal of International Medical Research. 2019; 47(1):311-324.
- 21. Birchler FA, Kiliaridis S, Combescure C, Vazquez L. Dental age assessment on panoramic radiographs in a Swiss population: a validation study of two prediction models. Dentomaxillofacial Radiology. 2016; 45(1):20150137.
- 22. Ali AM, Ahmed WH, Khattab NM. Applicability of Demirjian's method for dental age estimation in a group of Egyptian children. BDJ Open. 2019; 5:2.
- 23. Baghdadi ZD. Testing international dental maturation scoring system and population-specific Demirjian versions on Saudi sub-population. J Clin Exp Dent. 2014; 6(2):e138-144.
- 24. Abesi F, Haghanifar S, Sajadi P, Valizadeh A, Khafri S. Assessment of dental maturity of children aged 7-15 years using Demirjian method in a selected Iranian population. J Dent Shiraz Univ Med Sci. 2013; 14(4):165-169.
- 25. Javadinejad S, Sekhavati H, Ghafari R. A comparison of the accuracy of four age estimation methods based on panoramic radiography of developing teeth. J Dent Res Dent Clin Dent Prospect. 2015; 9(2):72-78.

- 26. Litsas G, Lucchese A. Dental and chronological ages as determinant of peak growth period and its relationship with dental calcification stages. The Open Dentistry Journal. 2016; 10:99-108.
- 27. Vaida LL, Moca AE, Todor L, Tent A, Todor BI, Negrutiu BM, Moraru AI. Correlations between morphology of cervical vertebrae and dental eruption. Rom J Morphol Embryol. 2019; 60(1):in press.

Dental severe abrasion, between the mixed mandibular instability and orofacial muscular malfunction



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Abstract

Dental abrasion has, according to specialty literature, a lot of etiological factors. Patients with abrasion are examined functionally - biomechanical, logopedic, psychological and orthodontic [1-7]. This paper aims to study the link between severe dental abrasion and mixed mandibular instability on the one hand and orofacial muscular malfunction on the other hand.

Keywords: dental abrasion, mandibular instability, orofacial muscular malfunction.

INTRODUCTION

Dental abrasion has, according to specialty literature, a lot of etiological factors. There are many link between severe dental abrasion and mixed mandibular instability on the one hand and orofacial muscular malfunction on the other hand.

Work hypothesis:

- 1. Alteration of the receptors of postural system determines a cranial-cervical instability and, implicitly, cranial-mandibular.
- 2. The primary cranial-cervical unbalance induces a facial asymmetry with the alteration of the functions of the stomatognathic system
- 3. A cranial-mandibular/orofacial myofascial disfunction induces an unbalance of the mandibular dynamic (a laterognathia).

Objectives:

- 1. Correcting and reeducation of the receptors of the postural system determines a recovery of the report between the cranium, mandibular and the first cervical vertebrae.
- 2. The improving of the anterior guidance and of the canine one facilitates the physiological mandibular movements.
- 3. Reeducation of the orofacial muscles and of the masticating muscles reduces significantly the laterognation

Choosing an interdisciplinary therapeutic strategy as a measure of prevention of the relapses and a method to keep the functions of the stomatognathic system unchanged on a long period of time.

MATERIALS AND METHODS

The patient P.T., with the age of 31, masculine sex, with the profession of informatics programmer, known with antecedents of accentuated abrasion and facial asymmetry, treated at the clinic for 12 years, is presented in 2018 at the dental medicine practice for the remaking of the occlusal obturation in the side teeth (premolars and molars) and for the remaking of the mouthguard of nocturne bruxism (Figures 1,2,3). We mention that the patient has changed constantly these mouthguards, once every 2 years, these being perforated in the occlusal level.



Figure 1. Front view and half-section left and right occlusion



Figure 2. Upper and lower arch

When he came for the examination it was found an aggravation of the dental abrasion in the last year, reaching to an abrasion of 2nd degree after Broca. As a consequence, the authors consider that it is necessary a global and multidisciplinary reevaluation of the case.



Figure 3. Front view

Practically, the patient is examined from the functional point of view – biomechanics, speech therapy, psychologic and orthodontics point of view [1,2].

The multidisciplinary team includes an orthodontics specialist doctor, a speech therapy-psychologist and physiotherapist. This applies functional tests scientifically validated on the international level: Palmerini, Giannelli (VAD Test) [3], Bricot [4], Rocabado [5], functional orofacial evaluation [6], evaluation of the psycho-emotional status [7], static and dynamic examination of the occlusion.

RESULTS AND DISCUSSIONS

The global postural evaluation underlines an inclination of the cranium to the right (Figure 3). In this position, the mandibular opening tend to follow the median physiological line of the body, all the supra- and infrahyoid structures guiding the mandible on this trajectory, this aspect being placed in a postural syndrome of descendent type.

According to the tests proposed by Rocabado, the inclination of the bipupilar and occlusal plan in the same direction indicates a primary cranial-cervical problem (C1, C2).

Even from the static examination of the occlusion is considered a disaccord between the inferior and superior inter-incisive lines, the inferior one being deviated to the right with 3-4 mm.

On the mandibular dynamic tests, in the maximum physiological opening, there are no TMA (Temporal-Mandibular Articulation) interferences, but it presents right laterognation of approximately 20 mm.

The movements of laterality bad coordinated involve excessively the orofacial muscles, the mandible having the unbalance in accomplishing the laterality (right hypermobility, >10 mm, left hypermobility, >10 mm). In the tendency to uniformize movements, the forcing of the left laterality produces symptoms on the TMA level on the same side [8].

We mention that the patient presents a generalized hyperlaxity in the entire body.

On the manual tests of TMA mobility the patient doesn't present discrepancies of ROM (Range of Motion), being asymptomatic.

The static, dynamic and end-feel tests don't show the symptomatology on the TMA level (tests of provoking the TMA and the orofacial muscles).

The patient doesn't present myalgia on the tests of palpation the smooth craniomandibular and cranial-cervical tissues.

It is found a right ocular dominance. In the moment of examination the patient presents a slow ocular convergence, bilaterally. Following the applying of the VAD test is raised the suspicion of astigmatism [9,10], the patient being guided to the ophthalmologist for

specialty consultation and clarification of the diagnosis. This thing is happening, on the future control the patient coming with the ophthalmology examination which shows the existence of an astigmatism and of alteration of the ocular convergence, and the necessity of the correcting of these.

In the position of maximum intercuspation is found that there is a coincidence between the two inter-incisive lines, with the space of non-occlusion on the right side accentuated.

On the dynamic examination of the occlusion, is found the passive interference in propulsion, with premature contact on 2.2. Also it is also found the absence of the left canine guidance, due to the surfaces of abrasion accentuated from this level, the tooth 2.3 not having the incisal margin, but a real occlusal surface.

According to Rocabado, the transversal plan of the vertebrae C2 coincides with the occlusal plan (fact demonstrated on large batches of subjects and verified, along the time, by numerous imagistic methods). Considering the anatomic and functional influence the evaluation of the stomatognathic system has to be preceded by a careful examination of the upper cervical shaft [11] in the global postural context [12,13], of the psychological and environment factors (ergonomics) [14].

The establishing of a balance on the level of the upper cervical shaft is essential in the rehabilitation of all the functions of the stomatognathic system. In case of the vertebral rotations C1 and/or C2 [15], are necessary authorized interventions from the specialized physiotherapists – these rehabilitations being possible only by manual therapy, performed with great precision, considering the increased sensitivity of the segment in discussion and to avoid the eventual unpleasant results.

The ocular convergence is most of the time neglected, even in the examinations of specialty but precisely this can offer indices regarding the involvement in the compensation purpose of the orofacial and cervical muscles, considering that, from the embryologic point of view, the segments mentioned have a common origin.

In the international database the authors that analyze the connections between the body posture/walking/gestures and stomatognathic system are divided in two categories:

• A part confirms, by validated methods and statistical studies, filtered by metaanalysis that these connections are not only existing physiologically but, moreover, a modification to one of these levels will influence, even at a great distance, the function of another segment [16].

• The other part denies these connection, but, for now, the reduced number of subjects studied and some ambiguities related to the methodology lead the scientific community to adopt a reserved position towards these studies.

On the other side the evaluation of the psycho-emotional status indicated an increased level of perceived stress. The modern life requests, in the professional plan, and in the social-personal one, continuous adapting to the new situations or to situations for the management of which we are not always prepared enough. The human body needs to produce reactions of adapting, and their accomplishing is controlled by hormonal and neuro-hormonal processes; the frequency of the breathing increases, also the heart beats, the value of the arterial tension, the level of the glucose, and not the last, the muscular tension. If, in the past, this condition of hyper-activation is diminished once the releasing factor disappears, the modern life maintains us in a condition of permanent "activation" with less occasions of relaxation, which has as result the development of a muscular parafunction – bruxism (centered and/or eccentric), which leads to the gradual degradation of the teeth, of the oral mucous, an increased tension followed by the hypertrophy of the muscles involved in mastication (masseters, temporal, pterigoid), chronic headaches, degrading of TMA. The most destructive form is the nocturne bruxism [17].

For the correct and complete management of a case of bruxism is necessary the presence, in the multidisciplinary team, of a psychologist (that approaches the cognitivebehavioral problems that generate and maintain the symptomatology and teaches the patient to manage them in an adaptive way) and a speech therapist (who comes with a set of exercises targeted on the muscles involved in bruxism, for the relaxation and "functionality" of its utilization).

CONCLUSIONS

1. The stomatognathic system has to be approached as a complex of functions that, although most of the times are studied distinctively, they work in a continuous syntony, from the first days of life, some of them even from the intra-uterine life (the sucking movements); any perturbation/modification of a function from this level produces modifications of the other functions, initially of compensation type, transformed then in real pathologies that are self-propagating.

2. No matter the competences of the examining specialist, when there is a modification observed of one or more functions, on the level of the stomatognathic system, and in the postural or psycho-emotional, the correct attitude towards the patient is of involvement of a multidisciplinary team for the management of the case.

3. The presentations of case report type are not considered, generally, extremely relevant from the scientific point of view, even if they can bring to light some situations which followed then in the extended casuistry can change approaches or even influence concepts already existent, either enriching them or invalidating them by cases thorough documented. The methods of EBM type (evidencebased medicine) are considered today extremely credible. The case studies are more and more appreciated by the scientific community, precisely because they are concentrated on the personalization of the diagnosis and the therapeutic approach, placing in the secondary plan the statistics.

4. The multidisciplinary approach reduces the risk of the eventual omissions in the complexity of the signs and symptoms with which the patient is presenting on the consultation. The clinical manifestations apparently without a connection with the initial accusations can be interpreted correctly only by overlapping of more disciplines and concepts.

5. The accentuated and accelerated dental abrasion can have explanations in overstressing the orofacial muscles because of some deficiencies of the receptors of the postural system, some anomalies of position of the head, of some parafunctions and many times because of the conditions of exaggerated emotional tension insufficiently or incorrectly managed.

6. The prevention of the pathologies induced by the above mentioned dysfunctions would be more efficient if the specialists from the areas that study the functions of the stomatognathic system, the posture and psycho-emotional status would collaborate not only on a certain casuistic, but also on the exchange of relevant information and which would facilitate precisely the identification of the cases in which the multidisciplinary collaboration becomes a necessity.

REFERENCES

1. Isabela Maddalena Dias, Ingrid Duque Maia, LíviaMarinsRamalho de Mello, Isabel Cristina Gonçalves Leite,FabíolaPessôa Pereira Leite, Evaluation of correlation among sleep bruxism and depression levels, chronic pain and nonspecific physical symptoms according to axis II of the Research Diagnostic Criteria/Temporomandibular disorders, RSBO,2014 Oct-Dec; 11(4):352-9

- 2. Brendbekken R, Harris A, Ursin H, et al. Multidisciplinary intervention in patients with musculoskeletal pain: a randomized clinical trial. Int J Behav Med 2016;23(1):1-11.
- 3. Palmerini V, Giannelli L. Disfunciónesvisuales, estomatognáticas y posturales: interferencias y métodosdiagnósticos. Paper presented at: the XVIIth Sociedad Española De KinesiologiaMédicaOdontológica (Sekmo) Congress, October, 26-27-28, 2017, Bilbao, Spain.
- 4. Bricot B. La RiprogrammazionePosturaleGlobale, Marseille, Statipro, 1998:120
- La Touche R, París-Alemany A, von Piekartz H, Mannheimer JS, Fernández-Carnero J, Rocabado M. The influence of cranio-cervical posture on maximal mouth opening and pressure pain threshold in patients with myofascial temporomandibular pain disorders. Clin J Pain 2011; 27: 48-55.
- 6. Felicio CM, Melchior MO, Silva MAMR. Effects of orofacial myofunctional therapy on temporomandibular disorders. Cranio 2010; 28:249-259.
- 7. MieszkoWieckiewicz, Anna Paradowska-Stolarz, WlodzimierzWieckiewicz, Psychosocial Aspects of Bruxism: The Most Paramount Factor Influencing Teeth Grinding, Hindawi Publishing Corporation, BioMed Research International, Volume 2014, Article ID 469187, http://dx.doi.org/10.1155/2014/469187
- 8. Bragatto MM, Bevilaqua-Grossi D, Regalo SC, Sousa JD, Chaves TC. Associations among temporomandibular disorders, chronic neck pain and neck pain disability in computer office workers: a pilot study. Journal of Oral Rehabilitation 2016;43(5):321-332.
- 9. Erkan Turan K, Taylan Şekeroğlu H, Koç I, et al. Ocular causes of abnormal head position: strabismus clinic data. Turkish Journal of Ophthalmology 2017;47(4):211-215.
- 10. de Pádua M, Sauer JF, João SMA. Quantitative postural analysis of children with congenital visual impairment. Journal of Manipulative and Physiological Therapeutics 2018;41(1):62-70.
- 11. Ariëns G, Bongers P, Douwes M, et al. Are neck flexion, neck rotation, and sitting at work risk factors for neck pain? Results of a prospective cohort study. Occup Environ Med 2001;58(3):200-7.
- 12. Treleaven J. Sensorimotor disturbances in neck disorders affecting postural stability, head and eye movement control. Manual Therapy 2008;13:2-11.
- 13. Daly L, Giffard P, Thomas L, Treleaven J. Validity of clinical measures of smooth pursuit eye movement control in patients with idiopathic neck pain. Musculoskeletal Science & Practice 2017;33:18-23.
- 14. Brink Y, Louw Q, Grimmer K, Jordaan E. The relationship between sitting posture and seatedrelated upper quadrant musculoskeletal pain in computing South African adolescents: A prospective study. Manual Therapy 2015; 20(6):820-826.
- 15. Ling FP, Chevillotte T, Leglise A, Thompson W, Bouthors C, Le Huec JC. Which parameters are relevant in sagittal balance analysis of the cervical spine? A literature review. European Spine Journal 2018;27(1):8-15.
- 16. Lomas-Vega R, Garrido-Jaut MV, Rus A, Del-Pino-Casado R. Effectiveness of global postural reeducation for treatment of spinal disorders: a meta-analysis. American Journal of Physical Medicine & Rehabilitation 2017;96(2):124-130
- 17. Lobbezoo F, Ahlberg J, Raphael KG et al. International consensus on the assessment of bruxism: Report of a work in progress. J Oral Rehabil 2018;45:837-844.

Vitamine k2 and the "calcium paradox" in dental prophylaxy



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Abstract

In the absence of vitamins D3 and K2, calcium is not used efficiently by the body and this can lead to ample transformations within it such as kidney stones, cardiovascular afflictions or changes in the dental or bone structure as a whole. Without questioning the quality of the materials used in medical and dental practice or the competences of the medical practitioner, deficits in these vitamins lead to a decay in tooth and dental structure resistance. Furthermore, chronic deficits in these vitamins will affect the harmonious development of both dental structure and other bones. Most of the recent studies highlighted the necessity of using these two vitamins combined, and recommend future dosage of K2 vitamin in the blood as a routine procedure especially in organizing the prophylaxis of the dental system.

Keywords: Vitamin D3, Vitamin K2, bone system.

INTRODUCTION

Regardless of the quality of the materials used in dental treatment (curative or preventive) and the competency of the medical practitioner, if the human body presents with certain deficits such as Iron, Calcium, Vitamin D or Vitamin K, the resistance of the dental structure can become very frail and this can lead to the development of secondary pathologies.

Recent studies show the importance in combining Vitamin D3 with Vitamin K2 in order to ensure a proper absorption of Calcium throughout the body. In the future, routine blood dosages of Vitamin K2 as well as correcting any other established deficits will be a plus when discussing a well-organized dental prophylaxis which will ensure an optimal level of dental health [1].

Currently, vitamin D is supplemented with Vitamin K2. Common dosages of these two vitamins improves the effect of each one and, at the same time, with the two working in synergy, we can ensure that there will be no arterial calcification as a result of the dosage. As such, vitamin K2 has the important role of guiding the absorption of vitamin D and of removing the negative effects of vitamin D overdose [1,2].

Aim and objectives

The objective of this analysis is represented by the importance that needs to be given to utilizing and administering vitamins D3 and K2 in order to facilitate a proper absorption of Calcium at the level of the bone and dental systems.

MATERIALS AND METHODS

It appears that vitamin K currently occupies the place that vitamin D did a few decades ago in regards to the appreciation it gathers as a vital element with a lot more benefits than initially conveyed. According to dr. Cees Vermeer, one of the top researchers in the world in regards to vitamin K, almost everyone has a deficit of this vitamin as well as vitamin D.

The levels of vitamin K in plasma can be measured accurately but the results are not entirely useful as they are usually based on your last few meals. Most people absorb sufficient vitamin K from meals in order to maintain proper blood coagulation but not enough so that they are protected against a vast array of medical issues such as: arterial calcification, cardiovascular diseases, varicose veins, osteoporosis, cancers of the prostate, lungs, liver or blood and certain brain diseases such as dementia [3,4].

Vitamin K is part of the fat-soluble vitamin group, which present with a unique distinguishing function from other vitamins through their crucial role in blood coagulation. Two groups of vitamin K are known as being able to seriously influence the optimal functioning of the human body: **K1 – phylloquinone** – major role in blood coagulation and **K2 – menaquinone** – a newer form which is important in building and maintaining bone and teeth integrity.

Vitamin K1 is known for its role in blood coagulation since 1929 when Henrik Dam and his fellow researchers were investigating the role of cholesterol in the diet by analyzing hemp seeds and managing to isolate a factor that prevented clotting. This factor was then named the "coagulation vitamin" and had the letter K attached, the discovery leading to a Nobel Prize win for professors Henrik Dam and Edward Doisy in 1943 (Figure 1) [5,6].

Vitamin K2 is the newer form of vitamin K and has a major importance in the building and maintenance of bone integrity and the prevention of arterial calcium deposits, according to studies undertaken in the past decade. As a supplement it exists under varied forms depending on the length of the lateral chain which can vary from 4 to 13, of which the more frequent are menaquinone-4, synthetic MK-4 and menaquinone-7, natural MK-7 (Figure 1) [5,6]



Figure 1. Chemical Structure of Vitamin K

The mechanism through which Vitamin K helps assimilate Calcium in the human body is given by the capacity of this vitamin (especially K2) to activate osteocalcin in bones as well as the MSP protein in the arteries and the coagulation factors in the liver. An insufficient quantity of vitamin K leads to what is called the "CALCIUM PARADOX", with too little Calcium weakening the bones and too much Calcium leading to arterial deposits. A compromised metabolization of Calcium leads to the simultaneous destruction of bone tissue and an accumulation of Calcium on vessel walls. While bones do need Calcium, excessive calcifications on arteries or in soft tissues (including the skin) can appear. Vitamin K2 is an essential co-factor involved in the correct use of Calcium because it activates proteins responsible with cleaning minerals that circulate within the arteries and binding them to the bone matrix [7,8].

Important sources of vitamin K:

K1 - vegetal origin, present in greens (spinach, broccoli, cabbage) as well as soy oil; goes straight to the liver and helps maintain the blood coagulation system in good shape, with it being extremely important for children (Figure 2).



Figure 2. K1 - vegetal origin

K2- synthetized at intestinal level but excreted within feces, found as an external source in cheeses, chicken, beef, pork, Natto fermented soy (Figure 3, Table 1).



Figure 3. K2 - external source

Table 1. Content of vitamin K2 in 100 grams of produce

Goose liver	369 mcg MK-4	Gouda	76 mcg MK-8,MK-9
Chicken liver	14 mcg MK-4	Brie	56 mcg MK- 8,MK-9
Egg yolk	15-30 mcg MK-4	Cheddar	10 mcg MK -8,MK-9
Whole milk	1mcg MK-4	Miso	30 mcg MK-7
Salmon	0,5 mcg MK-4	Natto	900-1200 mcg MK-7

Bacteria present in the intestine produce vitamin MK-7. Vitamin K2 of MK-7 form can be found in produce with bacterial fermentation, especially types of soy. The highest content of this type of vitamin is found in **natto**, which contains between 900 and 1200 micrograms of vitamin K2 per 100 grams, of which 90% is MK-7 and 8% is MK-8. We should remember that vitamin K2 in MK-7 form is only produced by Baccilus subtilis, because **miso**, which is another soy product, has a reduced content of only 30 micrograms of Vitamin K2 while **tempeh** has none [9].

Clinical studies have proven that the regular intake of natto or using the other two diet supplements extracted from natto – nattokinase enzyme and Vitamin K2, form MK-7 – promotes the synthesis of coagulation factors, maintains calcium in the bones and teeth as well as improves the flexibility and shape of blood vessels, tendons, cartilages and other conjunctival tissues [9].

Some new properties have been recently discovered such as roles in controlling inflammatory processes, cell migration, division and specialization, etc. Studies were undertaken using MenaQ7 – with an individual dose of 45 micrograms of Vitamin K2 extracted from natto, with the results being remarkable [9]:

- Daily administering of 4x45 mcg or 8x45 mcg of vitamin K2 prevents osteoporosis;
- Administering 360, 720 and 1080 mcg of Vitamin K2 in three-day intervals helps with the regeneration of calcified arteries;
- Weekly consumption of 3-4 packs of 40-50 grams of natto in Japan is a tradition and thus helps keep levels of osteoporosis, atherosclerosis or cardiovascular diseases very low.

For over a century, the K vitamins have been recognized as necessary only in normal blood coagulation. Research in this area has gone through significant progress and has shown that vitamin K2 has effects in regards to the development of prostate cancer, decreasing this risk by 30% (study of European Prospective Investigation into Cancer and Nutrition – EPIC, published in March 2010 by the American Journal of Clinical Nutrition).

Other remarkable research has revealed the protective effects of Vitamin K2 in regards to osteoporosis [10].

- A series of Japanese studies have shown that vitamin K2 completely reverses losses in bone mass and, in some cases even increases bone mass in people with osteoporosis;
- Proof from 7 Japanese studies show that supplementing vitamin K2 in the human body reduces the risk of vertebral fractures by 60% and the risk of hip or other non-vertebral fractures by 80%;
- Dutch researchers have shown that vitamin K2 is three times more efficient than vitamin K1 in increasing osteocalcin, which controls bone construction.

Even if there are no human studies which test these facts on a direct level, the studies undertaken on animals show that Vitamin K2 can have benefic effects on **dental health** [11]. One of the main proteins involved in dental health is osteocalcin, which is the same protein that is critical for the bone metabolism and is activated by vitamin K2. Osteocalcin launches a mechanism which stimulates the growth in dentine, which is the calcified tissue under the

enamel of teeth. Vitamins A and D play an important role in this process, in synergy with Vitamin K2. It is also maintained that vitamin K is vital for remineralizing teeth and preventing cavities.

It is important to understand that vitamin K does not act alone. It needs "collaborators" such as vitamin D (a very important one at that). These two agents work together to increase the MGP protein (GLA matrix protein), which is responsible with protecting blood vessels and preventing calcification. These proteins are dependent on vitamin K in order to bind Calcium to the bones and prevent deposits of Calcium in arteries as well as helping blood coagulation [12].

The results of clinical studies in both humans and animals suggest that the simultaneous use of both vitamin K2 and vitamin D may substantially reduce the loss of bone mass and can further increase the levels of dental health.

RESULTS AND DISCUSSIONS

Vitamin K2 is an essential co-factor in utilizing Calcium through activating the proteins responsible with eliminating mineral deposits that may clog the arteries and binding them to the bone matrix. For over 50 years there has been recognized importance of vitamin K not only in clotting. Recent studies demonstrated the importance that it has in activating the MGP protein.

Most studies have proved that both adults and children have a K2 deficit, leading to the phrase "most healthy people have a deficit of vitamin K2". In order to maintain good bone health and healthy teeth we need to have a balanced nutritional triangle: vitamin D, vitamin K and Calcium. An increase in the quantity of Calcium is good for the bones but not as good for the arteries, which can become calcified, but vitamin K prevents this from happening through vitamin synergy, which needs more attention to it in order to properly optimize benefits [12].

One of the main proteins involved in dental health is osteocalcin, the same protein that is critical in order to maintain a healthy bone structure and is activated by vitamin K2. Osteocalcin launches a mechanism that stimulates the growth of new dentine, which is the calcified tissue under the enamel of teeth. It is suggested that vitamin K2 is vital for remineralizing teeth and preventing cavities.

CONCLUSIONS

Studies undertaken within the last decade indicate the fact that a good level of vitamin K2 contributes to a healthy metabolism of Calcium and is extremely important in correctly approaching dental prophylaxis in children. It is important to combine vitamin D3 with vitamin K2 in order to achieve a better absorption of Calcium at bone and dental structure levels.

In the future there is a growing necessity towards blood dosages of vitamin K2 especially in children, as well as correcting any imbalances in order to properly assimilate Calcium. Both types of clinical studies (on humans and animals) indicate that utilizing vitamin K2 and vitamin D simultaneously substantially reduces the loss of bone mass and contributes to ensuring an optimal level of oral health.

REFERENCES

1. van Summeren MJ, van Coeverden SC, Schurgers LJ, Braam LA, Noirt F, Uiterwaal CS, Kuis W, Vermeer C. Vitamin K status is associated with childhood bone mineral content. Br J Nutr.2008;1-7.

- 2. van Summeren M, Braam L, Noirt F, Kuis W, Vermeer C. Pronounced elevation of undercarboxylated osteocalcin in healthy children. Pediatr. Res. 2007;61(3):366-70.
- 3. https://www.nutraceuticalsworld.com/issues/2013-07/view_people-in-the-news/vitamin-k2-researcher-dr-cees-vermeer-honored-as-a-top-scientist/1426
- 4. https://www.ncbi.nlm.nih.gov/pubmed/24160554
- 5. Prynne CJ, Thane CW, Prentice A, Wadsworth ME. Intake and sources of phylloquinone (vitamin K1) in 4-year-old British children: comparison between 1950 and 1990s. Public Health Nutr. 2005;8(2):171-80.
- 6. http://ro.wikipedia.org/
- Schurgers LJ, Teunissen KJ, Hamulyak K, Knapen MH, Vik H, Vermeer C. Vitamin K containing dietary supplements: comparison of synthetic vitamin K1 and natto- derived menaquinone - 7. Blood. 2007 Apr 15;109(8):3279-83. Epub 2006 Dec 7
- 8. O'Connor E, Molgaard C, Michaelsen KF, Jakobsen J, Lamberg Allardt CJ, Cashman KD. Serum percentage undercarboxylated osteocalcin, a sensitive measure of vitamin K status, and its relationship to bone health indices in Danish girls. Br Nutr. 2007;97(4):661-6.
- 9. https://www.medichub.ro/reviste/farmacist-ro/mena-q7-vitamina-k2-naturala-peste-30-deani-de-cercetari-stiintifice-id-1216-cmsid-62
- 10. Cavaco S, Viegas CSB, Rafael MS, Ramos A, Magalhaes J, Blanco FJ, Vermeer C, Simes DC Glarich protein is insolved in the cross-talk calcification and inflammation in osteoarthritis – Cellular and Molecular Life Sciences (http://doi.org/10.1007/s00018-015-2033-9)
- 11. Beulens JW, Booth SL, van den Heuvel EG, Stoecklin E, Baka A, Vermeer C The role of menaquinones (vitamin K2) in human health.The British Journal of Nutrition (http://doi.org/10.1017/S0007114513001013)
- 12. Theuwissen E, Smit E, Vermeer C The role of vitamin K in soft-tissue calcification. Advances in Nutrition (Bethesda, Md.) (http://doi.org/10.3945/an.111.001628)



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