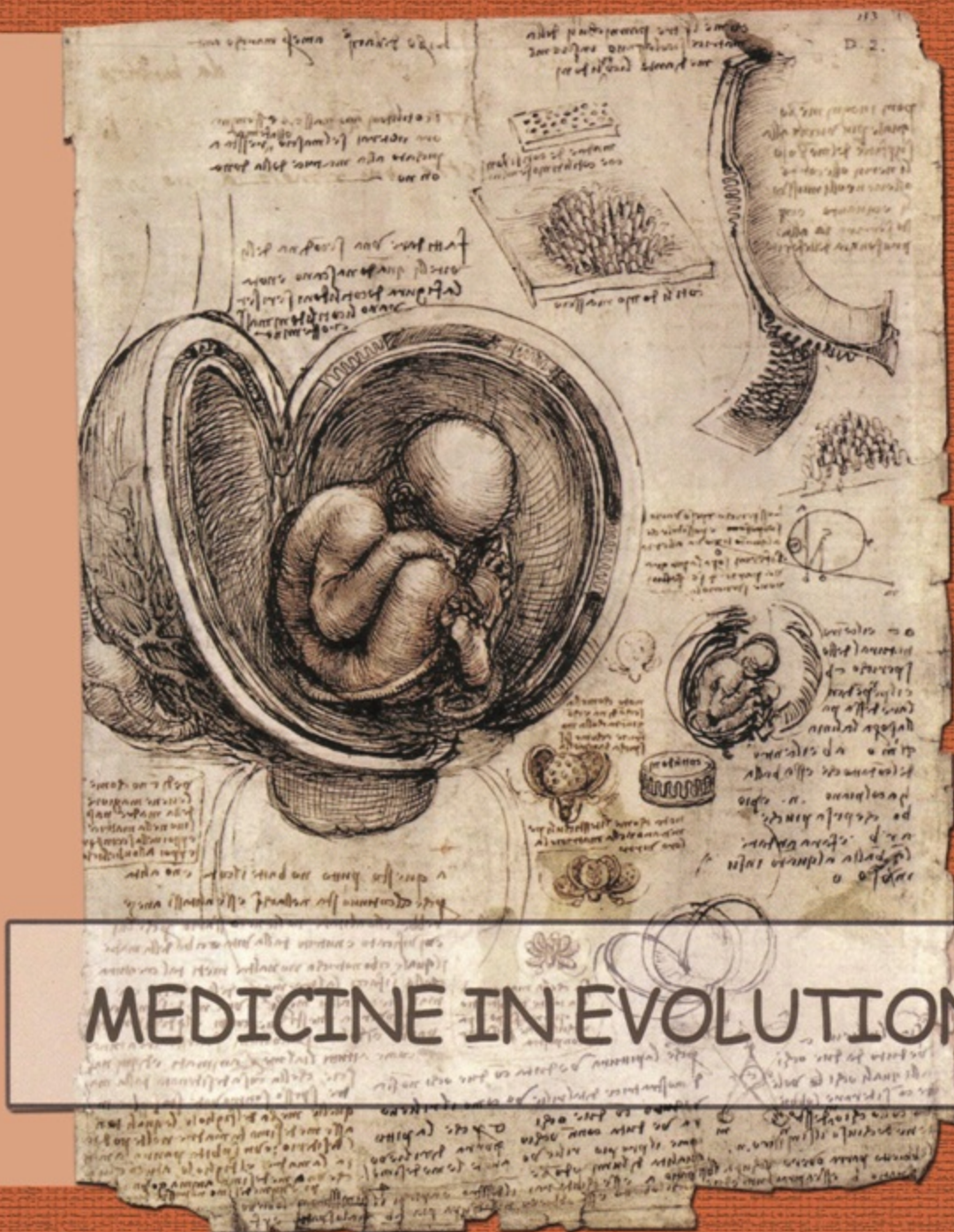


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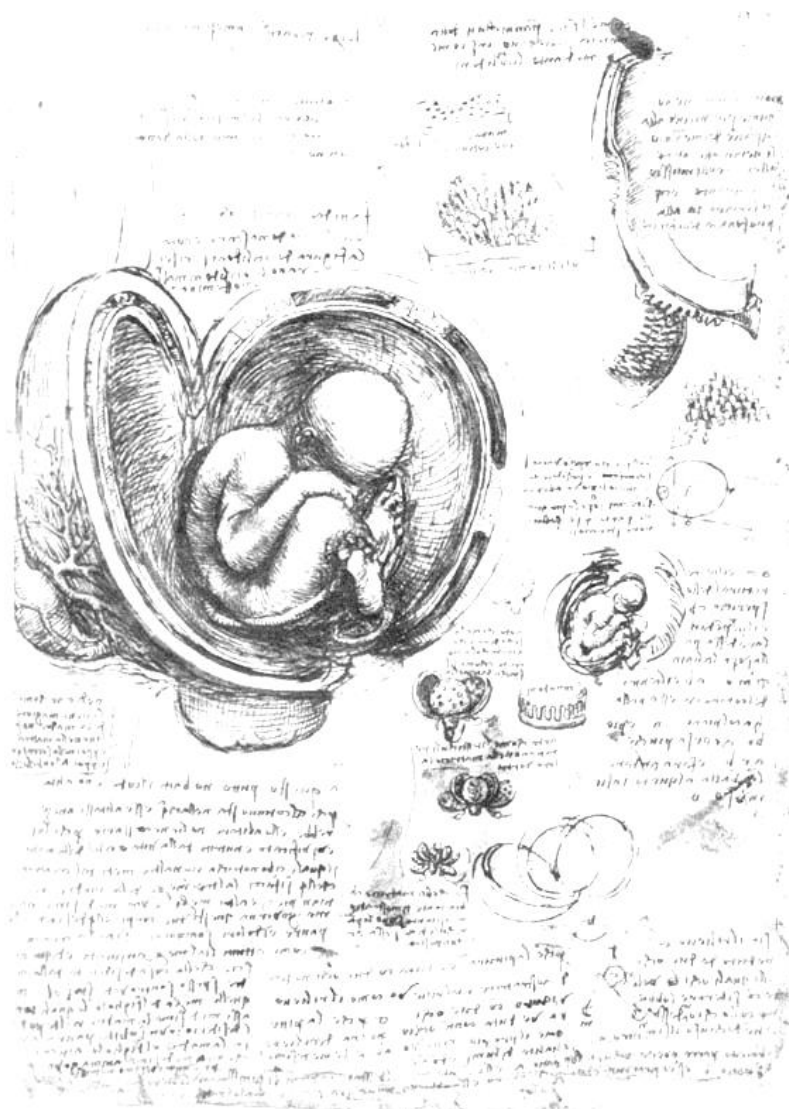


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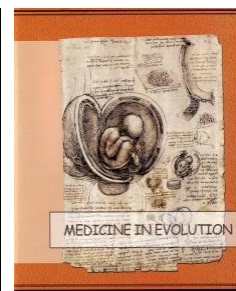
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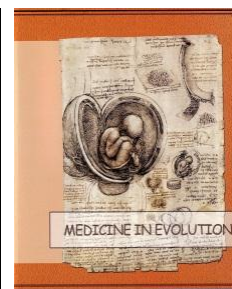


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# Thyroid nodules – related microcalcifications



**Gheorghisan A.A.<sup>1</sup>, Olaru M.<sup>1</sup>, Valea A.<sup>2</sup>, Ghemigian A.<sup>3</sup>, Carsote M.<sup>3</sup>**

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## Abstract

Microcalcifications of thyroid nodules represent the hallmark of papillary thyroid cancer. We introduce two adult male cases confirmed with neoplasia who were accidentally referred for an endocrine check-up. The first one had persistent cough, and the other restless legs syndrome of unknown cause. The thyroid panel of investigations pointed normal thyroid function, as well as calcitonin with negative thyroid antibodies in each case. The thyroid ultrasound showed a left lobe nodule of 1.68 by 0.97 cm associated small areas of necrosis (cystic-like) with microcalcifications in the case of 59-year old patient. Fine needle aspiration confirmed papillary thyroid carcinoma. The second case of 53-year old man had a right lobe nodule of 1.54 by 1.33 by 1.28 cm with hypoechoic, inhomogeneous structure, and irregular shape with multiple microcalcifications and macrocalcifications. A papillary thyroid cancer was confirmed after total thyroidectomy. The thyroid pathological report was not linked to either of initial symptoms. Microcalcifications in thyroid nodules associate a high suspicion index for papillary thyroid cancer. The underlying pathological report is usually represented by psammoma bodies.

**Keywords:** thyroid, nodule, calcification, ultrasound.



## INTRODUCTION

Thyroid nodules, a major topic of daily practice due to relatively high frequency in adult population, may associate different types of calcifications detected at anterior cervical ultrasound, which is the best tool for screening and follow-up. (1,2,3,4) These lesions are presented in both benign and malign nodules but they display distinctive features. (1,2,3,4) Typically, microcalcifications are the hallmark of papillary thyroid cancer, while macrocalcifications's associated malignancy risks are unclear. (1,2,3,4) One study of 1,431 thyroid nodules identified different calcified lesions in almost 40% of cases; 91% of all masses were confirmed as thyroid cancer and 40.2% of these subjects had calcifications, while only 22% of benign nodules had calcified areas. (5) Microcalcifications were the most frequent type in cancer-related nodules (43%), while annular-like calcifications were the least frequent (in 6% of cases). (5) Statistical significance of associated malignancy risk was detected for microcalcifications, not in annular-like or crescent-like lesions, neither in calcified spots. (5) We aim to introduce two adult male cases who were accidentally discovered at first diagnosis with thyroid nodule-associated microcalcifications as major ultrasound sign to point out a differentiated thyroid malignancy. Both patients agreed for anonymously use of their medical records. They were admitted in two tertiary Romanian centres of endocrinology.

## CASE REPORT

### *Case report 1*

This is a 59-year old, non-smoker male, admitted for persistent cough since last 3 years. The medical history is unrevealing; he has priory been evaluated for allergies and lung conditions with negative results. The clinical exam showed a mildly enlarged irregular goitre. Blood assays are displayed in Table 1. No serum hypercalcemia was identified. Thyroid ultrasound revealed a right thyroid lobe of 2.4 by 1.5 by 4.38 centimeters (cm), a left lobe of 2.07 by 1.9 by 4.9 cm with hypoechoic, inhomogeneous pattern, normal vascularisation and no local lymph nodes enlargement. A left lobe nodule of 1.68 by 0.97 cm associated small areas of necrosis (cystic-like) with microcalcifications and discrete vascularisation. (Figure 1) Fine needle aspiration of the nodule indicated a papillary thyroid cancer; currently the patient refuses thyroidectomy despite recommendations. The size and positon of the thyroid nodule and lobes does not relate it with the initial sign (cough); the patient was further referred for an upper digestive endoscopy.



Figure 1A.



Figure 1B.

Figure 1A. Thyroid ultrasound points a left lobe nodule with small cystic areas inside and microcalcifications (1A) and a hypoechoic, inhomogeneous right thyroid lobe (1B). This is a 59-year old male

## Case report 2

This is a 53-year old non-smoking male who was evaluated for restless legs syndrome. The anterior cervical ultrasound was done to evaluate the carotid arteries status. Accidentally, a poly-nodular goitre was found and he was referred to endocrinology. His medical family history is negative. The subject is known with chronic autoimmune thyroiditis. The thyroid function and antibodies, as well as serum calcitonin were normal. (Table 1).

Table 1. Thyroid parameters in patients with thyroid nodules and associated microcalcifications

PARAMETER	NORMAL VALUES	UNITS	CASE 1	CASE 2
TSH (THYROID STIMULATING HORMONE)	0.5-4.5	μUI/ML	1.66	1.2
FREE T4 (FREE LEVOTHYROXINE)	10.3-24.4	PMOL/L	15.3	12
TPO (ANTI-THYROPEROXIDASE ANTIBODIES)	0-35	U/L	24	19
CALCITONIN	1-11.8	NG/ML	8	2

Thyroid ultrasound revealed a right thyroid lobe of 4.5 by 1.8 by 2 cm, a left thyroid lobe of 4 by 1.3 by 1.3 cm. A right lobe nodule of 1.54 by 1.33 by 1.28 cm was identified (with hypoechoic, inhomogeneous structure, and irregular shape, with multiple microcalcifications and macrocalcifications having a posterior shade, and an intense vascularisation inside the nodule). (Figure 2) Right later-cervical lymph nodes (of the IV<sup>th</sup> compartment) were found with inhomogeneous consistence, of 0.77 by 0.49 cm, and other very small ones. (Figure 2) Both the nodule and the lymph node are suspected for a malignancy. Left cervical small lymph nodes are probably reactive. (Figure 2) The patient was further referred to surgery and total thyroidectomy was performed. A papillary thyroid cancer was confirmed without lymph node involvement. He started lifelong levothyroxine substitution based on periodic TSH (Thyroid Stimulating Hormone) assays. Up to this moment, no cause of the restless legs syndrome was identified.



Figure 2A. lateral cervical right inferior lymph node of 0.7 by 0.4 cm

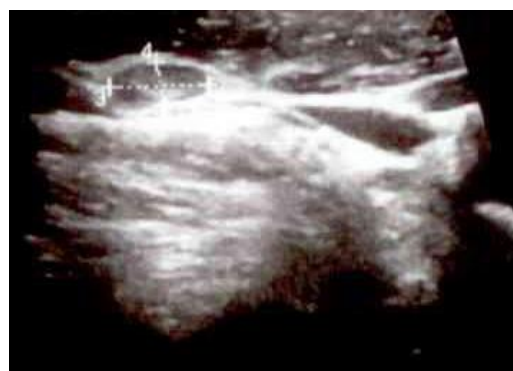


Figure 2B. lateral cervical right medium lymph node of 0.7 by 0.3 cm

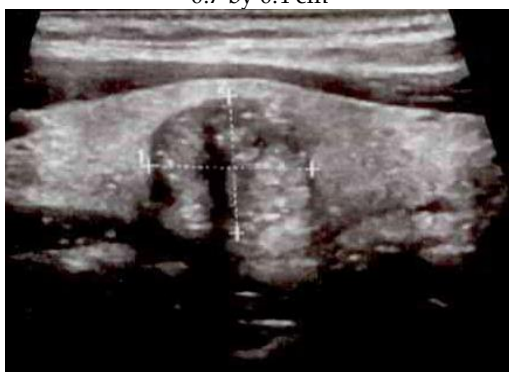


Figure 2C. right lobe nodule of 1.5 by 1.3 cm (longitudinal) - note the microcalcifications



Figure 2D. right lobe of 1.2 by 1.3 cm (transversal)



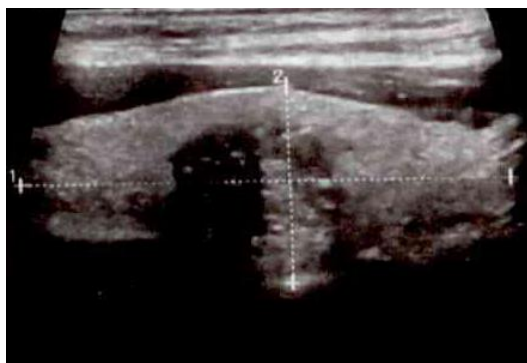


Figure 2E. right thyroid lobe of 4.53 by 1.3 cm

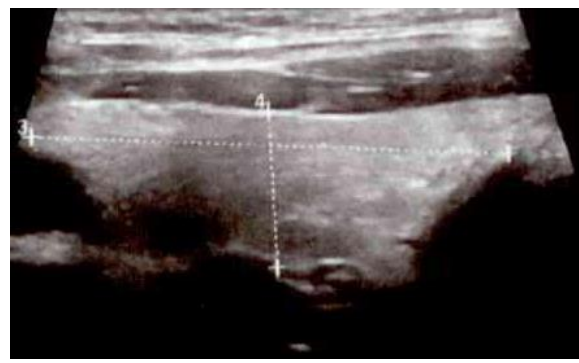


Figure 2F. left thyroid lobe of 4 by 1.3 cm

Figure 2. Thyroid ultrasound on a 53-year old male confirmed with papillary thyroid cancer and accidentally found with microcalcifications of the thyroid nodule during ultrasound evaluation

## DISCUSSIONS

The presence of calcifications in thyroid nodules may be caused by local biochemical changes since calcium input is caused by pH changes as seen in other tissues. (6,7) The particular type of microcalcifications in thyroid papillary cancer underlines psammoma bodies at pathological report which are not specific for thyroid lesions but, if presented here, they are tidily correlated with a malignancy risk, especially papillary thyroid cancer. (6,7) One study published in Medicine (Baltimore) investigated the ratio between psammoma bodies and papillary thyroid cancer in 1052 patients with or without chronic autoimmune thyroiditis. (8) All of the subjects had thyroid surgery and the calcified lesions were identified in 30.8% of them. (8) They were statistically significant associated with the presence of microcalcifications at thyroid ultrasound. (8) Moreover, they represent a predictor of a more severe behaviour regarding the papillary malignancy, especially in patients with positive thyroid autoimmunity. (8) Both our cases we introduced had negative thyroid antibodies.

## CONCLUSIONS

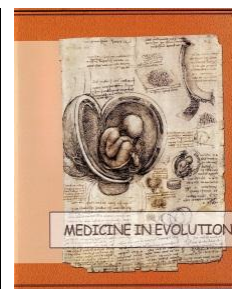
Thyroid nodules, a relatively frequent diagnosis in daily practice, may associate microcalcifications. This type of lesions associates a high suspicion index for papillary thyroid cancer. The underlying pathological report is usually represented by psammoma bodies. A more aggressive behaviour of the malignancy may also be expected, especially if positive thyroid autoimmunity is detected.

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# Factors influencing placebo reactivity



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## **Abstract**

This article provide a synthesis of current knowledge on Placebo factors and try to identify his role in therapeutic intervention

**Keywords:** Placebo, mechanism, expectation.

## INTRODUCTION

The Placebo effect has been a phenomenon of significant interest and debate in medicine.

Historically, in 1955, the Journal of the American Medical Association published a famous article, signed by Dr. Henry Beecher, titled "The Powerful Placebo." Dr. Beecher told him that if you administer drugs to people, many of them feel better, but if you administer salt water or another inert ingredient, about a third of them heals themselves, not just in their minds, but even physiologically, in a manner that can be clinically proven. [1] Beecher was the first scientist to quantify the placebo effect. He claimed that in 15 trials with different diseases, 35% of 1082 patients were satisfactorily relieved by a placebo alone.

## DEFINITION

Any therapy (or component of therapy) deliberately used for nonspecific psychological or psychophysiological effect and without specific activity for the condition being treated. [2]

In general, placebos are thought to be interventions which do not contain components that will improve the condition being treated. Inert interventions such as 'sugar pills' or saline injections are often designated "pure" placebos, whereas therapies that contain active components, but are considered ineffective for the condition being treated, are called "impure" placebos (for example, antibiotics in viral infections). [3]

So, in the narrowest sense, a placebo is a biomedically inert substance given by a healthcare practitioner to please a patient. [4,5]

The way in which patients perceive environmental factors contributes to the magnitude, duration and quality of the placebo response.

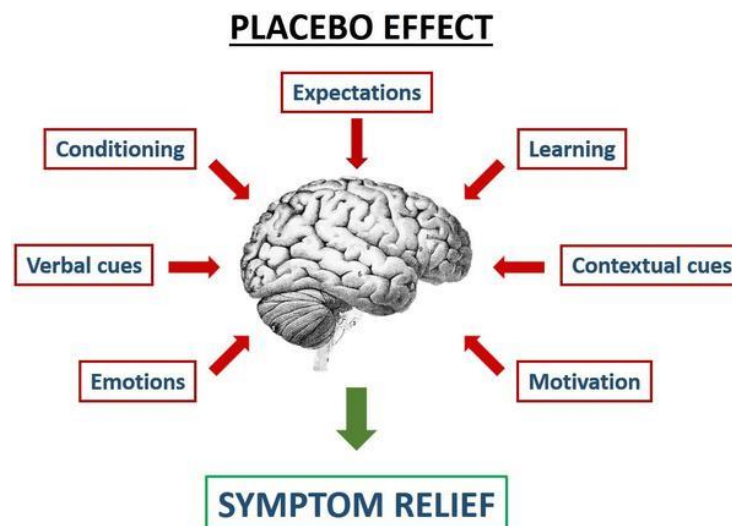


Figure 1. Placebo Effect

### Factors influencing placebo reactivity

The placebo effect is a multi-determined phenomenon. We emphasize only some of them:

- I. The actual or assumed power of treatment
- II. Factors related to the physician
- III. Social support



## **I. The actual or assumed power of treatment**

The actual or assumed power of the treatment is closely interdependent with the patient's expectations. It is well known that psychological phenomena like expectancy and classical conditioning can have physiological effects.

Although expectancy seems to be an important psychological mediator of placebo effects, it doesn't operate alone. Desire, which is the experiential dimension of wanting something to happen or wanting to avoid something happening, is also likely to be involved in placebo effect. [6]

Verne et al. (2003) and Vase et al. (2003) conducted two similar studies. Patients with irritable bowel syndrome (IBS) were exposed to rectal distention by means of a balloon barostat, a type of visceral stimulation that simulates their clinical pain, and tested under the conditions of untreated natural history (baseline), rectal placebo, and rectal lidocaine. Pain was rated immediately after each stimulus within each condition. The first study was conducted as a double-blind crossover clinical trial in which patients were given an informed consent form that stated they "*may receive an active pain reducing medication or an inert placebo agent*" (Verne et al. 2003). In this study, there was a significant pain-relieving effect of rectal lidocaine as compared with rectal placebo ( $p < 0.001$ ), and there was a significant pain-relieving effect of rectal placebo (pain in placebo < natural history). In a second similarly designed study, patients were told, "*The agent you have just been given is known to significantly reduce pain in some patients*" at the onset of each treatment condition (rectal placebo, rectal lidocaine). [7]

A much larger placebo analgesic effect (Cohen's  $d = 2.0$ ) was found in the second study, and it did not significantly differ from that of rectal lidocaine. These two studies show that adding an overt suggestion for pain relief can increase placebo analgesia to a magnitude that matches that of an active agent. [8]

In another study, Benedetti et al looked at the influence of expectation in 6 patients with severe Parkinson's disease who had been implanted with stimulating electrodes. When the electrodes were turned on, these patients underwent a dramatic improvement in their ability to move. When the electrodes were turned off, they once again froze up. But after several weeks of stimulator treatment, simply the thought that the stimulator was on or off had almost as much impact on movement as the stimulation itself. When the patients were told that the stimulator had been turned off, their motor velocity decreased even though, in fact, the stimulator had remained on. When patients with asthma inhaled an innocuous substance that they were told was an allergen, their airways constricted; when they inhaled an innocuous substance that they were told was a bronchodilator, they began to breathe more easily. [9]

## **II. Factors related to the patient/physician**

A continuum of placebos has been suggested, ranging from tangible items such as pills, injections, white coats and procedures, to intangible features of healthcare delivery like touch, gesture, ambience and support. [10,11]

There are several factors which we can put together:

- patient characteristics
- physician characteristics
- patient- physician interaction
- treatment and treatment setting

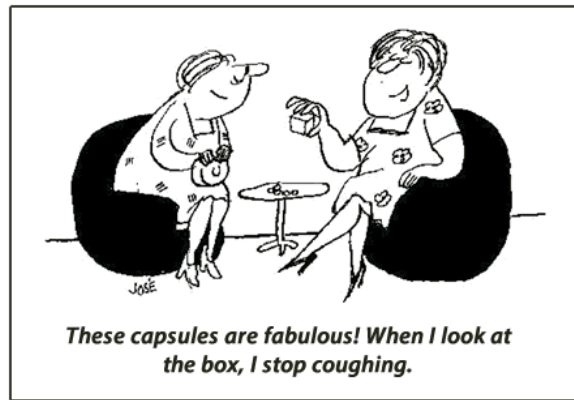


Figure 2. Factors related to the patient/physician

### Patient characteristics

Patients are likely to perceive environmental factors in different ways, and these differences are likely to contribute to the magnitude, duration, type of placebo responses.

Empirical studies which have sought to explain observed placebo effects entirely on the basis of patient characteristics have generally failed. Almost all people can react to placebo under certain conditions, which also applies to physicians and scientists. people.

If at the beginning, the researchers have postulated that people who react more easily to placebo have less intelligence or are more "neurotic", nowadays there are a lot of studies that suggest that **people with higher IQ are more likely to react to placebo.**

The patient's expectancy created in a particular treatment situation reflects her/his pre-existing beliefs. For example, the memory of previous experiences is likely to influence the experience of pain.

The prescribing framework, the ritual of the prescription that signifies the end of the consultation and the beginning of the care, certainly enhances the effect of the drugs.



Figure 3. Placebo Effects

### Physician characteristics

A practitioner who adopts a concerned, warm, supportive, caring and empathetic, attitude to her/his patients may inspire trust, confidence and rapport in the relationship. [14] So, a confident practitioner, displaying strong beliefs in the diagnosis and treatment, can enhance positive expectancy in the patient.

For example, KB Thomas randomly assigned 200 patients with symptoms of minor illness – most had cold symptoms or muscle pains – to receive either a “**positive consultation**” with or without treatment or a “**negative consultation**” with or without treatment. In the positive consultation, the patient was given a diagnosis and told that he would be better in a few days. If no prescription was given the patient was told that none was required; if a prescription was given the patient was told that the treatment would certainly make him feel better. In the negative consultation the doctor said: “*I cannot be certain what is the matter with you.*” If the doctor gave no prescription, he added: “And therefore I will give you no treatment.” If he gave the patient a prescription, he said: “*I am not sure that the treatment I am going to give you will have an effect.*” The negative consultation concluded with the doctor telling the patient to return if he or she were not feeling better in a few days. The treatment in both consultations was a prescription for thiamine hydrochloride tablets used as a placebo. Two weeks after the consultation, a card was sent to each patient asking if he or she had gotten better; 64% of the patients who received a positive consultation reported that they were better, compared to only 39% of those who received a negative consultation. [15]

The majority of studies show that when the physician conveys optimism about the treatment patients perceive the treatment to be more helpful. At this point we have to understand why it is so important that healthcare professionals receive training in how to communicate positive expectations effectively.

Anxiety reduction as a placebo mechanism may be a consequence of positive expectancy. Classical conditioning has been proposed as a mechanism for placebo effects. Repeated association of medical care with symptom relief results in a classically conditioned response of symptom relief after receiving care even when the therapy is nonactive. [16]

#### **Treatment and treatment setting**

Several analgesia studies have used the open-hidden paradigm, demonstrating that open administration of a drug is significantly more effective than hidden administration [17]

The way in which a medication is delivered may affect its perceived action. Injections have been perceived as more effective than pills, and capsules as more effective than pills. [18] Even the colour of pharmaceuticals can affect peoples’ perceptions of their action and their effectiveness. [19,20].

Interestingly, when a treatment is prescribed by a famous head of the department, whose waiting list is several months long and which represents the last hope, the therapeutic effect of the prescriptions can be amplified compared to of a modest physician to which the patient may have access at any time.

#### **III. Social support**

Patients taking part in clinical trials receive emotional support. We all want to be seen, heard and loved, and this can ease symptoms and stimulate physiological and psychological responses because of the mind-body connection. [21]

The presence of social support has been associated with decreased stress responsiveness.

### **CONCLUSIONS**

This paper shows that Placebo provides an indispensable tool for study the component of suffering. It is important to emphasize the role of physicians, because they might enhance the benefit of all kind of treatments by promoting patient’s positive expectation. In fact, all caregivers can enhance patients’ experiences by anticipating or even being able to use a placebo response, because always a positive attitude may help to strengthen the body’s resilience.

If in the past, Placebo have typically been identified as inert agent aimed to please the patient rather than exerts a specific effect, nowadays our understanding of this effect has changed. We can consider that Placebo has a real therapeutic intervention, having different physical and psychological effects and influencing the course of a disease.

The existence of placebo effects suggests that we must broaden our conception of the limits of our brain and our consciousness and to not forget that the mind and the brain are linked to the body.

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# Doppler Ultrasound of the Uterine Arteries in predicting Preeclampsia



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## Abstract

**Introduction.** Preeclampsia (PE) is one of the most important obstetric pathologies, due to the high risk of both fetal and maternal morbidity and mortality. One of the causes of this pathology is poor trophoblastic invasion, which leads to a restriction in utero-placental circulation. There isn't a safe noninvasive investigation for this disease. **Aim and objectives of the study.** We tested to see if we have an association between the body mass index (BMI) and the resistivity index (RI) on a group of 33 pregnant patients who have a high risk in developing preeclampsia.

**Material and methods.** The data for this study were collected using the Microsoft Excel software. For the statistical analysis we used two software's: Microsoft Excel and SPSSv17. All the patients were tested during the same period, in 2017. We have for each patient two measurements: during the first and second trimester of pregnancy. For this data we run some comparison studies in order to see if we can find an association between this medical variables.

**Results.** According to this study we can say that if the BMI is increasing then the Doppler values are increasing as well, which can conduct us to the idea that obesity can be considered as a major risk factor for the appearance of preeclampsia during pregnancies.

**Conclusions.** The epidemiology of preeclampsia reflects a wide range of risk factors as well as the complexity and heterogeneity of the disease. That is why, with the improvement of the first trimester pregnancy screening for preeclampsia and implicitly pregnancy progression, it would allow early diagnosis of cardiovascular risk factors, and careful monitoring of these cases would reduce perinatal and maternal morbidity and mortality.

**Keywords:** Doppler ultrasound, uterine arteries, preeclampsia, body mass index.

## INTRODUCTION

Preeclampsia (PE) is one of the most important obstetric pathologies, due to the high risk of both fetal and maternal morbidity and mortality. One of the causes of this pathology is poor trophoblastic invasion, which leads to a restriction in utero-placental circulation. There isn't a safe noninvasive investigation for this disease.

According to World Health Organization data, the disease is responsible for 72,000 deaths each year. [1-5]

Primary EP prophylaxis refers to the identification of high-risk factors - a personal history of PE - and reduced risk factors - genetic factor, family history, partner change, pregnancy-related factors and maternal health factors such as age extremes, multiple pregnancy, chronic high blood pressure, renal disease, chronic inflammatory diseases (systemic lupus erythematosus), chronic infections, obesity (risk proportional to body mass index), presence of pre-existing diabetes mellitus.

Researchers have not yet accurately established which are the specific causes of triggering preeclampsia, but it is obvious that the problem is triggered by a disorder that affects the inner layer of the blood vessels. At the same time, there are abnormalities associated with placental development. In most cases, the onset of the disease is the result of a combination of genetic and environmental factors, because the risk that women with a family history are exposed to is higher. Nutrition factors, obesity, certain autoimmune diseases are also important risk factors. It is believed that the onset of preeclampsia may be the result of an abnormal immune response of the body to pregnancy and the conception product itself. [6-11]

Doppler ultrasound of the uterine arteries at 20-24 weeks of gestation to detect abnormal trophoblast invasion predicts nearly 40% of subsequent preeclampsia, although success in predicting early or severe preeclampsia onset is over 80%. Several predictive markers have recently been evaluated - including placental growth factor, soluble fms-like tyrosine kinase-1 (sFlt-1), plasma protein 13 and pregnancy-related plasma protein (PAPP-A) they are not commonly determined in medical practice. [12-15]

Obesity is a risk factor for both preeclampsia and cardiovascular disease. Exploring common mechanisms can provide insights into the pathophysiology of preeclampsia, potential areas for further investigation, and possible goals for therapy.

### *Aim and objectives*

We tested to see if we have an association between the body mass index (BMI) and the resistivity index (RI) on a group of 33 pregnant patients who have a high risk in developing preeclampsia.

## MATERIAL AND METHODS

In our study, we investigated the role of the Doppler ultrasound in the early detection of preeclampsia. At the Bega Obstetrics and Gynecology Clinic of the Emergency County Clinical Hospital, Timisoara, we investigated 33 patients with pre-eclampsia using the Doppler color method, following the flow curve on the uterine arteries. Doppler ultrasound in the uterine arteries can give us important information about disease progression and possible complications, persistence of protodiastolic incision after 23-24 weeks of gestation may suggest preeclampsia.

The data for this study were collected using the Microsoft Excel software. For the statistical analysis we used two software's: Microsoft Excel and SPSSv17. All the patients were tested during the same period, in 2017. We have for each patient two measurements:

during the first and second trimester of pregnancy. For this data we run some comparison studies in order to see if we can find an association between this medical variables.

## RESULTS

In the United States, the percentage of overweight or obese women has risen by about 60% over the past thirty years. The World Health Organization estimates the prevalence of obese and overweight women (body mass index  $\geq 25$  kg / m<sup>2</sup>) 77% in the United States, 73% in Mexico, 37% in France, 32% in China, 18% in India and 69 % in South Africa, with wide variations on every continent. [16-22]

The high prevalence of obesity and the expected increase have significant implications on pregnancy because obesity is associated with infertility, spontaneous abortion, fetal malformations, thromboembolic complications, gestational diabetes, fatal delivery, premature delivery, caesarean section, fetal superinfection and hypertensive complications - in our case.

Obesity increases the overall risk of preeclampsia by about 2 to 3 times. The risk of preeclampsia increases progressively with increasing BMI, even in the normal range. It is important that not only tardive or mild preeclampsia is increased, but also preeclampsia, early and severe, associated with greater perinatal morbidity and mortality. The increased risk is present in most cases indifferent to race. The association between the risk of preeclampsia and obesity has also been demonstrated in different populations around the world.

Supporting the concept that obesity can play a causal role is to find that weight loss reduces the risk of preeclampsia. Some studies suggest that excessive increase in maternal weight is associated with the risk of preeclampsia, although they may be confused with increased retention of fluid that contributes to weight gain. Although weight loss is discouraged during pregnancy, obesity is a potentially modifiable risk factor for preeclampsia. Pre-pregnancy weight loss is encouraged in overweight and obese women to reduce the risk of side effects.

For the studied patients we collected their age, height, weight (at 3 different moments) and the uterine Doppler values at the first and second trimester of pregnancy. From the height and weight we calculated the body mass index (BMI) of our patients at 3 different moments: before the pregnancy, in the first semester and in the second trimester. We have quite equidistant age distribution of our patients, this values are presented in Table 1 and Figure 1. In the first part of our analysis we wanted to see if we register statistical differences regarding the BMI of our patients. The goal of this study stays in the fact that obesity can favor preeclampsia. For this we applied the Friedman test, because the data are not normally distributed and the measurements are related to each other and we obtained significant differences ( $p < 0.001$ ), which conducts us to the idea that the patient's body mass index is increasing significantly.

Table 1. The descriptive statistics calculated for the mother's age variable

AGE - VARIABLE	
MEAN	31
STANDARD ERROR	0,88
MEDIAN	31
MODE	35
STANDARD DEVIATION	5,03
SAMPLE VARIANCE	25,34
RANGE	19
MINIMUM	22
MAXIMUM	41
SUM	1022
COUNT	33

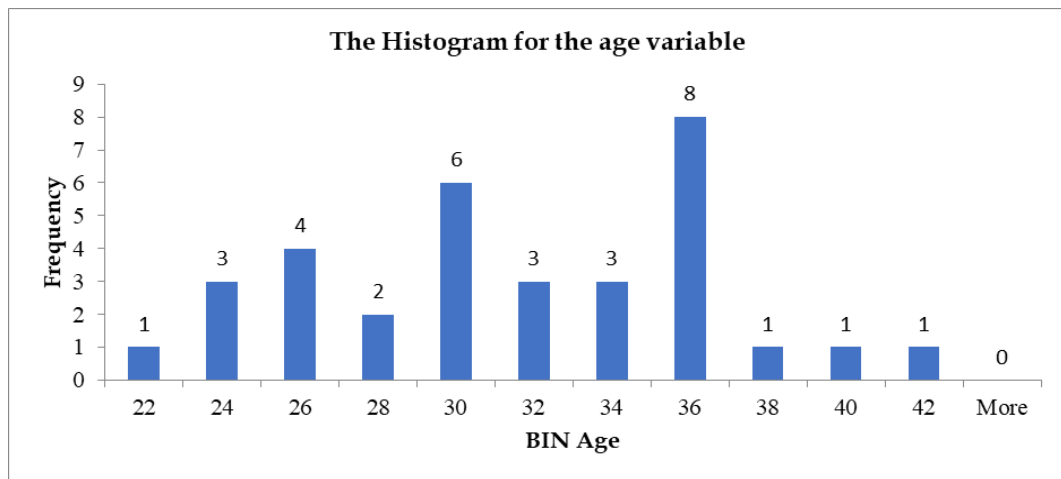


Figure 1. The histogram for the age variable

The main part of our statistics was to see if we can find any connection between the two Doppler measurements, or between the BMI and the Doppler values in the first and second trimester of pregnancy. For this we run a correlation model for all three cases and we obtained a positive strong significant correlation. For the statistical significance we applied a regression model. All the statistical data are presented in Table 2 and plotted in Figures 2,3.

Table 2. For the power of the association we calculated the Pearson coefficient –  $r$  and the determination coefficient –  $R^2$  and for the statistical significance we applied a regression model

Variables – the tested association	$r$	$R^2$	$p$
Doppler variable in the first and second trimester	0,97	0,95	$p < 0.001$
The BMI and the Doppler values in the first semester	0,88	0,76	$p < 0.001$
The BMI and the Doppler values in the second semester	0,90	0,81	$p < 0.001$

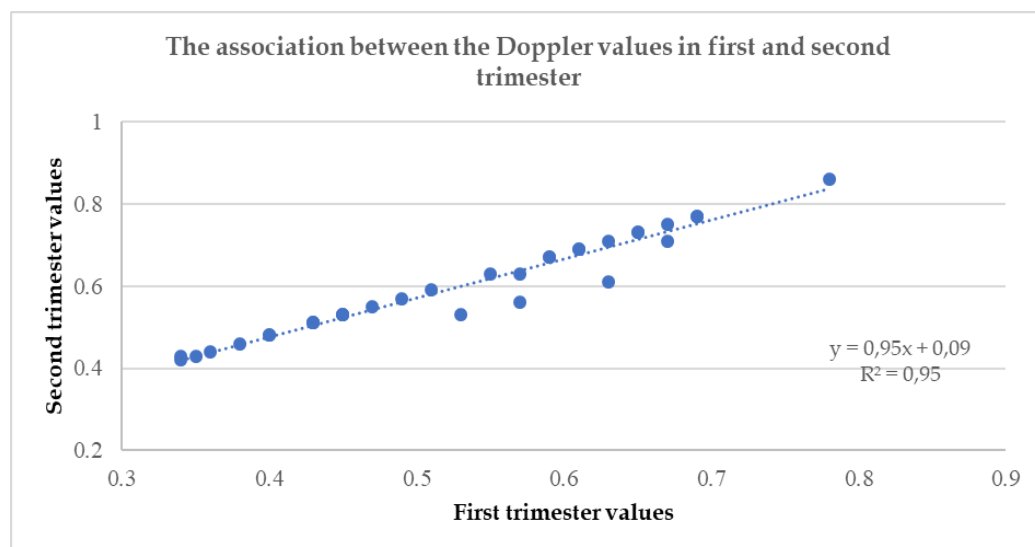


Figure 2. The association between the Doppler measurements obtained in the first and second trimester of pregnancy



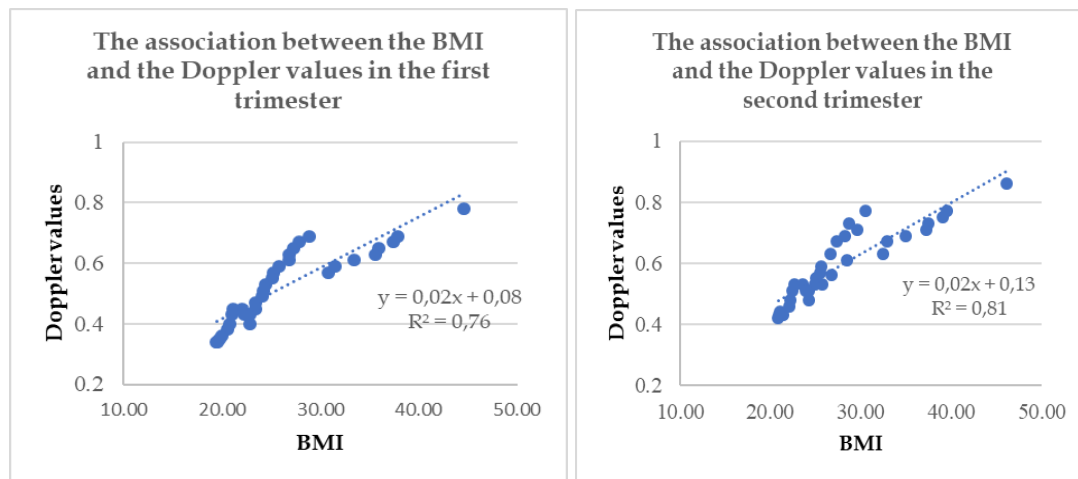


Figure 3. The association between the BMI of our patients in the first and second trimester and the Doppler values got from those periods

The best association obtained was between the Doppler values, but in all tested scenarios we have a very good relation. So, according to this study we can say that if the BMI is increasing then the Doppler values increase as well, which can lead us to the idea that obesity can be considered as a main risk factor for the appearance of preeclampsia during pregnancies.

## CONCLUSIONS

The effects of preeclampsia on the fetus vary across the world. Approximately 12 to 25% of intrauterine growth restrictions and low birth weights compared to gestational age, as well as 15 to 20% of all premature births are attributed to preeclampsia. The associated complications of prematurity are significant, including neonatal deaths and serious long-term neonatal morbidity. A quarter of the declared dead-born births and neonatal deaths in developing countries are associated with preeclampsia / eclampsia. Child mortality associated with preeclampsia is three times higher for low-resource countries compared to high-income countries, largely due to a lack of screening of preeclampsia and / or the need for new intensive care stations to support the viability of a premature of extreme age.

The incidence of mild and severe hypertension in pregnancy increases with increasing BMI. Escalating obesity rates can increase hypertensive pregnancy and perinatal morbidity.

The epidemiology of preeclampsia reflects a wide range of risk factors as well as the complexity and heterogeneity of the disease. That is why, with the improvement of the first trimester pregnancy screening for preeclampsia and implicitly pregnancy progression, it would allow early diagnosis of cardiovascular risk tasks, and careful monitoring of these cases would reduce perinatal and maternal morbidity and mortality.

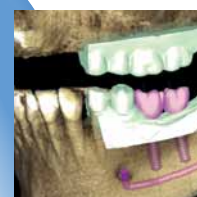
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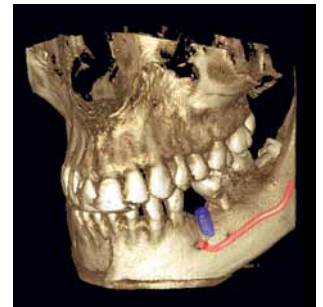
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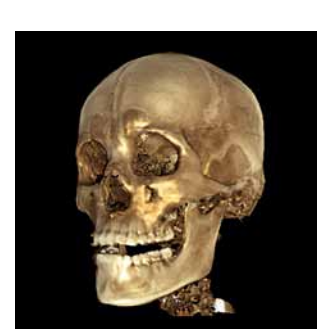
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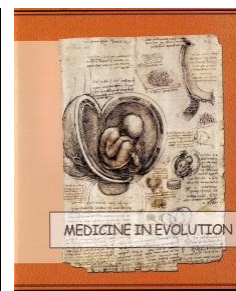
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# Interdisciplinary treatment of an extensive tooth wear case using measurable parameters



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## Abstract

Advanced tooth wear has been increasingly observed lately, especially in young people. Its etiology is varied: malocclusion, parafunctions, erosion and can determine functional discomfort, raising questions of treatment planning.

**Aim and objectives:** The present paper deals with the case of a 23 years' old patient suffering from severe generalised tooth wear with occlusal etiology and increased tooth sensitivity during mastication. The case was challenging because it proved impossible to increase the vertical dimension of occlusion (as shown by radiological and clinical examinations). Because the patient was young, in the absence of adequate space to accommodate the restorations, we wished to suggest the least invasive solution.

**Material and methods:** We decided for a therapeutic protocol involving orthodontic procedures to obtain space for the prosthetic reconstruction and, consequently, complete prosthetic adhesive reconstructions involving dental structure conservation.

**Results:** The esthetic and functional (including elimination of dentinal hypersensitivity) goals of the treatment were achieved without preparation of the dental structures. The patient did not experience subsequent complications, as shown during the follow-ups done at 6, 12, 24, 36 and 48 months.

**Conclusions:** Cephalometry assessment supplied key-data for subsequent prosthetic procedures. Interdisciplinary treatments were recommended to be combined so as the preferred treatment was minimally invasive to dental tissues in order to have a contingency plan for the patient in 10 years' time too.

**Keywords:** tooth wear, vertical dimension of occlusion, minimal invasive dentistry, adhesion, cephalometry, axiography.

## INTRODUCTION

Cases of advanced tooth wear are recurrently documented in the literature in the field. There are various situations, ranging from dental pain (when chewing) to esthetic issues (due to lack of visibility during speech and smile) and muscle-joint dysfunction (due to occlusal instability and absence of guidance). The cases recorded by the literature most often involve chemical erosion caused by psychological disorders (e.g. bulimia). They also mention mechanical etiologies generated by parafunctions (e.g. bruxism) or occlusal abnormalities, most of which can be found at a young age [1].

## CASE REPORT

### I. Anamnesis

The present case report discusses the condition of a 23 years' old male with generalised tooth wear and increased sensitivity to thermal and chemical stimuli, which makes chewing difficult and affects esthetics and lifestyle in general. The patient had previously experienced failed attempts at direct restorations with composite fillings and that was the reason why he came to the prosthetic department hoping for long-term solutions.

### II. Clinical examination data

The problems revealed by a thorough clinical examination were the following: skeletal and dental malocclusion (that caused worn teeth), absence of prosthetic space (the worn teeth being in contact with the consecutive egression), impossibility to increase vertical dimension of occlusion (because the existing open-bite might have worsened). Young age would also compel a minimally invasive treatment plan in order to preserve the remaining structure of the teeth and have a plan B solution for the next ten years. The respective case report managed to illustrate the therapeutic procedures and protocols employed to solve the problems and reach the aims.

The extra-oral examination evidenced facial asymmetry caused by right-sided deviation of the chin and a lower face height slightly increased as compared to the middle face height (fig.1).



Figure 1. Frontal extra-oral examination

The patient's facial profile was concave in relation to E-Ricketts-line [2]. The dento-labial analysis revealed the following: right deviation of the interincisal line, inversed incisal plane, asymmetric labial corridor visibility, uneven incisal edges, and commissural plane slightly inclined to the left (fig.2) [2].



Figure 2. Dento-labial analysis

The key-points of dental assessment were: the dental arch examination revealed lower crowding especially in the frontal area, while in the upper jaw the crowding areas were less obvious showing incisor rotation and buccal position of the canines.

The lower arch presented areas of tooth wear with exposed dentine in the molars and enamel wear in the premolars and front teeth. We could also see the partly conserved previous direct reconstructions of the molars (fig.3).



Figure 3. Lower arch wear

The upper jaw displayed a higher degree of tooth wear, involving the enamel and dentine of both anterior and posterior teeth [3]. At the same time, the composite fillings of the molars were partly fractured (fig.4).



Figure 4. Upper arch wear

The occlusal analysis in maximum intercuspation revealed the following: anterior teeth with minimal overbite and a tendency to open bite, absence of the overjet, a roughly 2 mm right deviation of the inter-incisal line; right canine: class I, with cross-bite and minimal overbite; left canine: class III; right posterior teeth: unilateral cross-bite (Fig.5).



Figure 5. Maximum intercuspation

The centric relation revealed the presence of premature contacts between 16 and 46 with a slight rearrangement of the inter-incisal lines, which proved that the chin deviation noticed during the extra oral examination was also functional [4].

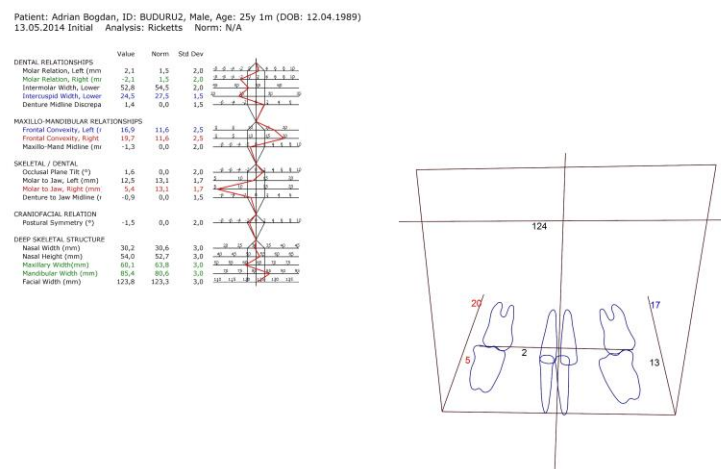
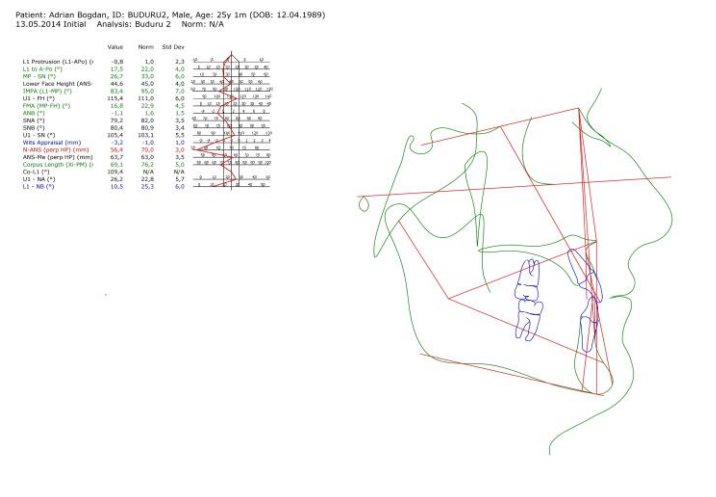
Dynamic occlusal analysis showed the following: on the right side, there was a canine guidance but the malposition of 31 caused interference with 11 and 21, which produced the wear of the incisal margin; on the left side, there was an anterior-lateral guidance, which determined the same interference and had the same consequences in the anterior region. The anterior guidance displayed active interferences with similar etiology and results.

The aforementioned examinations determined us to refer the patient to the orthodontist. The specialist was supposed to assess whether: a. it was possible to increase the VDO in order to obtain space for the prosthetic reconstruction; b. it was possible to correct the cross-bite and align the teeth in order to eliminate all the interferences and stop tooth wear.

### III. Additional paraclinical investigations

#### Radiological examination and diagnosis

Final diagnosis was achieved after carrying out orthopantomography and frontal and lateral cephalometry. The data yielded by the orthodontist's assessment led to the following orthodontic diagnosis: Class I with Class III tendency malocclusion, bimaxillary crowding, mandibular laterognathia with unilateral right posterior cross-bite, skeletal class III and open bite tendency. As far as the prosthodontist was concerned, the following data relevant for the treatment plan was still needed: a. VDO: was at the superior limit when measured with McNamara (N-ANS/ANS-Me) [5] and Slavicek techniques [6]; side by side with the open-bite tendency, the previously measured VDO hindered us to increase it more; b. The position of the inferior incisor in relation to the occlusal plane: was normal which hindered us to increase the length of the crown because it would lead to the overeruption of the anterior mandibular teeth; c. the torque of the inferior incisor: was retruded which enabled the orthodontist to align the mandibular anterior teeth by protruding them; d. the transmission of forces in the inferior incisor according to the orthogonality law: showed a paraxial transmission of forces, which the aforementioned orthodontic protrusion would correct; e. the torque of the maxillary incisor: was normal, so the maxillary anterior teeth could be orthodontically aligned only by minimal protrusion. The frontal cephalometry showed different distances from the midline of the upper and lower molars, which meant a right lateral deviation of the mandible (fig. 6,7) [7,8].





and to provide the patient with occlusal comfort by multiple posterior contacts. In the absence of posterior occlusal support, temporo-mandibular joint tension might have occurred during the 16 months when the orthodontic treatment was carried out (fig. 8, 9).



Figure 8. Composites applied on occlusal surfaces of lower posterior teeth during orthodontic treatment



Figure 9. Composites applied on occlusal

After the orthodontic treatment was completed, a retainer was used for 3 months in order to maintain the results. Then we initiated the prosthetic treatment.

To begin with, the posterior composites placed during the orthodontic treatment and the old composite fillings were removed. The prosthetic reconstructions decided for the for each tooth were as follows: 14 combined occlusal table top with inlay, 15 occlusal table top, 16 mesio-occlusal overlay, 17 occlusal table top, 24, 25, 27 occlusal table tops, 26 distal-occlusal overlay, 34, 35, 36, 37 occlusal table tops; 44, 45, 47 occlusal table tops, 46  $\frac{3}{4}$  endocrown (fig.10,11) [9].



Figure 10. Teeth preparation upper arch surfaces of upper posterior teeth during orthodontic treatment



Figure 11. Teeth preparation lower arch

The table top restorations were made without preparation, the overlays involved the exclusive removal of tooth decay, and the  $\frac{3}{4}$  endocrown, on 46 (which previously had a root canal treatment) was performed with complete cusp reduction.

In order to complete the respective restorations, after a polyether impression (Monophase, 3M Espe), a face bow was used. The information was transferred to the lab and the models were mounted on the Artex CR articulator (Amann Girbach). Computer-aided axiography (Cadiax Compact 2, Gamma) was used in order to program the condylar parameters of the semi-adjustable articulator. Centric relation was recorded with special occlusal hard wax by maintaining the anterior antagonistic teeth contacts at the initial VDO [10]. In the lab, the additive modeling technique [11] and the Broadrick flag method [12] to decide the Spee curve were used (fig. 12,13).



Figure 12. Spee curve using the Broadrick flag



Figure 13. Additive wax-up

Luting was performed after assessment of each prosthetic restoration one by one, in antagonistic pairs and, finally, altogether. Prosthetic restorations were made of lithium disilicate (Emax Ivoclar) HT A1 with staining. The adhesive protocol was performed under rubber dam insulation by using seventh-generation adhesives (Single Bond 3M Espe) and dual cure resin (Relyx A2 U200 3M Espe) [13]. Occlusal contacts were assessed with 40 microns articulation paper (Bausch) and stable contacts were noted. Each occlusal contact was checked with 12 micron metallic articulating film (Arti-Fol, Bausch).

In the upper anterior area, from 13 to 23, lithium disilicate oral veneers (Emax Ivoclar) HT A1 with staining were made. The anterior lower area did not require prosthetic treatment because the tooth wear was limited and the esthetics was not affected (fig. 14,15).



Figure 14. Final restorations on the upper arch



Figure 15. Final restorations on the lower arch

The treatment was finished by applying a night protective maxillary splint. In order to objectively assess the results, the patient was recommended a new set of x-rays (orthopantomography, frontal and lateral cephalometry).

## DISCUSSIONS

At the end of the treatment every initial objective was achieved: elimination of dental sensitivity to any stimulus, occlusal comfort, and esthetic rehabilitation. As far as the occlusion was concerned, the following parameters were attained: point centric with stable, simultaneous, multiple, equally strong contacts, bilateral canine guidance without interferences, functional anterior guidance without interferences. The overbite was approximately 1.5 mm, enough to make posterior disocclusion possible. The right crossbite was corrected by modifying the torque and by prosthetic reconstructions. In the anterior area, the uneven and inverse incisal plane was corrected and the optimal proportions of the central and lateral incisors were restored.

By comparing frontal and lateral cephalometry before and after treatment, we noticed that: the VDO remained within normal limits, the difference from the initial value being 1 mm and the molar distances to the midline were improved (fig.16,17).

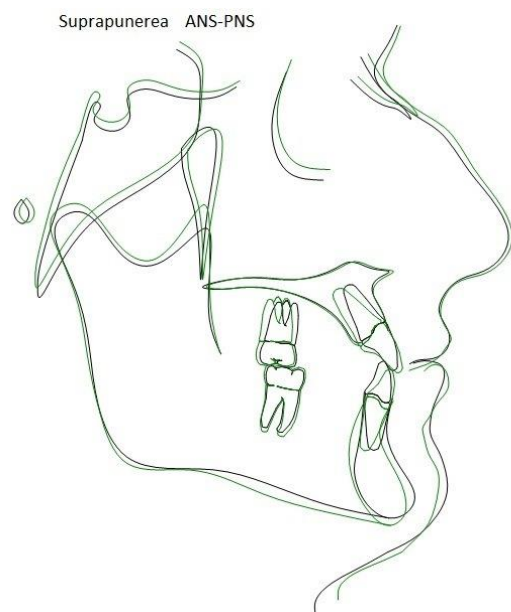


Figure 16. Superposition of the final and initial lateral cephalometry

Patient: Adrian Bogdan, ID: BUDUR12, Male, Age: 25y 1m (DOB: 12.04.1989)  
13.05.2014 Final Analysis: Ricketts Norm: N/A

	Value	Norm	Diff
<b>DENTAL RELATIONSHIPS</b>			
Upper Incisor, Left (mm)	2.5	1.5	1.0
Upper Incisor, Right (mm)	1.5	1.5	0.0
Interincisor Width, Lower	80.2	80.2	0.0
Interincisor Width, Lower	24.2	27.5	-3.3
Overjet, Right (mm)	1.2	0.0	1.2
<b>MAXILLO-MANDIBULAR RELATIONSHIPS</b>			
Frontal Curve, Left (°)	12.5	10.5	2.0
Frontal Curve, Right (°)	10.5	10.5	0.0
Maxilla-Mandible Angle (°)	2.4	0.0	2.4
<b>SKELETAL / DENTAL</b>			
Occipital Plane, Left (°)	2.5	0.0	2.5
Occipital Plane, Right (°)	25.0	25.0	0.0
Plane to Line, Left (mm)	2.8	1.2	1.6
Plane to Line, Right (mm)	-2.5	0.0	-2.5
<b>CRANIOFACIAL RELATION</b>			
Posterior Symmetry (°)	4.8	0.0	4.8
<b>DEEP SKELETAL STRUCTURE</b>			
Nasal Height (mm)	29.2	30.8	-1.6
Nasal Height (mm)	59.0	59.2	-0.2
Maxillary Width (mm)	59.7	59.0	0.7
Maxillary Width (mm)	82.2	77.5	4.7
Maxillary Width (mm)	107.2	117.4	-10.2

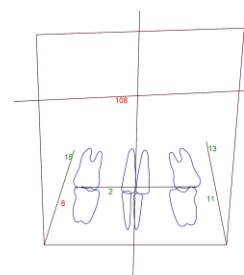


Figure 17. Final frontal cephalometry

In the frontal area, according to the ACE classification described by the literature in the field, the patient could have been ranged with class III or IV [14]. The difference consisted in the degree of incisal wear (smaller or bigger than 2 mm). ACE class III involved only oral veneers, while class IV suggested a sandwich approach with oral and buccal veneers for the sake of esthetics. In our patient's case, it was difficult to determine whether the wear was bigger than 2 mm. However, considering that he was pleased with his esthetics after applying oral veneers we gave up the idea of buccal veneers for biological reasons (fig. 18,19) [15].



Figure 18. Final restorations



Figure 19. End of the treatment

We chose lithium disilicate as reconstruction material for several reasons: its resistance, its capacity to etching and adhesive cementation, its esthetic properties as we worked with HT ingots [9,16].

There are several authors who recommend composite materials in the occlusal impact area and ceramics only in the areas esthetically significant, while others agree that the latter should be used irrespective of area [9]. We did not take into consideration zirconia due to the absence of an appropriate adhesive protocol at that time. Testing with provisional restorations was not necessary because we did not modify the VDO and the centric relation was checked for 16 months while we carried on the orthodontic treatment.

The night guard was regarded only as an additional protection and control for the centric relation. During the 6, 12, 24, 36 and 48 months follow-ups, no sign of occlusal or

temporomandibular dysfunction was noticed, no damage of the prosthetic elements or relapse of dentinal hypersensitivity [17].

The decision to combine the two treatments might raise the question why we did not opt for a singular prosthetic treatment that could have been shorter and cheaper?

PRO singular prosthetic treatment:

Increase of occlusal height can be performed in class III and hypodivergent skeletal pattern situations, favoring anterior occlusal relations in sagittal plane by creating overjet as well and the required prosthetic space in a short amount of time and with low costs [18,19].

CON singular prosthetic treatment:

Although the initial VDO was at the upper limit, some authors believed that it could be furthermore increased anyway because the VDO would return to the initial value as it is determined by the length of the masticatory muscles [7,10]. However, the VDO increase would have to be around 0.8 mm (minimal width for occlusal lithium disilicate restoration, as recommended by the manufacturer) for each molar, that is a total of 1.6 mm in the molar region. This would generate an anterior 3.2 mm incision that needed to be compensated for by maxillary oral veneers because we decided not to treat the incisal margins of the anterior mandibular teeth. Consequently, the excessive thickness of the oral maxillary veneers would lead to speech impairment and general discomfort.

We could not have corrected the axes of the lateral teeth on the right, the transmission of forces in the axis of the mandibular teeth, and this treatment plan could not have solved the crowding and malpositions of the mandibular anterior teeth without subtractive methods.

## CONCLUSIONS

In conclusion, cephalometry assessment supplied key-data for subsequent prosthetic procedures. Interdisciplinary treatments were recommended to be combined so as the preferred treatment was minimally invasive to dental tissues in order to have a contingency plan for the patient in 10 years' time too.

The 6-12-24-26-48 months follow-ups proved that the planning, its implementation and completion were correct.

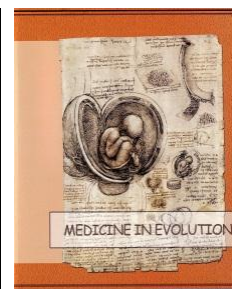
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# In-vitro evaluation of masking capacity of lithium disilicate veneers in discromic teeth



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## Abstract

**Aim and objectives:** Discoloured teeth represent a challenge for any dentist. Minimally invasive prosthetic reconstruction in these particular cases, aiming for top aesthetics might frequently be almost impossible or not? Covering the discoloured teeth implies the use of an opaque ceramic that also needs to reproduce the translucency of the natural teeth. The balance between these two objectives is difficult to reach and involves multiple try-ins. In this in-vitro study, a comparison of the blocking ability of ceramic lithium disilicate ingots was evaluated.

**Material and methods:** The ceramic ingots used were divided in three groups, depending on the degree of translucency/ opacity: LT (low translucency), MO (medium opacity), HO (high opacity). In each group, three different thickness veneers were designed: 0.4 mm, 0.6 mm and 0.8 mm, that were applied on two different shade abutments: one was the control group, ND1, and the other one, ND9. The colour was registered with the VITA Easy Shade V spectrophotometer and also clinically determined by 3 examiners.

**Results:** Veneers designed from LT ingots registered significant colour differences in all three thickness cases. For MO ingot veneers, 0.8 mm thickness proved to be more efficient in covering the darkest colour of the abutment. HO ingot veneers, even in a 0.4 mm thickness offered a complete coverage of the abutment colour.

**Conclusion:** Dark colour abutments can be completely covered by the lithium disilicate veneers in cases of MO ingots with 0.8 mm thickness. A question arises in terms of adhesion, due to dentin exposure secondary to tooth preparation. For HO ingots, the dark colour is completely covered by the 0.4 mm thickness, but, unfortunately, the final aesthetic results are no longer satisfying.

**Keywords:** lithium disilicate veneers, ceramic ingots, discoloured teeth, minimally invasive dentistry



## INTRODUCTION

In the last decade, the minimally invasive concept has become a goal in each of the current dentistry branches. Many of the prosthetic restorations have to be done on teeth which may have colours on a wide variable spectrum and may reach a very dark shade. Discoloured teeth represent a challenge for any prosthodontics specialist in achieving high quality, and at the same time minimally invasive, aesthetic restorations. Masking dyschromia imposes usage of opaque ceramics which simultaneously ensure the natural translucency of the tooth. From a practical perspective, we must keep a balance between minimally invasive prosthetics, covering a chromatically dark dental structure and obtaining an aesthetic result that reproduces the optical properties of the natural tooth. Finding the perfect balance between these parameters is often quite difficult and involves multiple clinical try-ins.

### *Aim and objectives*

In this in-vitro study we wished to evaluate the capacity of lithium disilicate veneers to mask dental dyschromias. Multiple ceramic ingots with different optical properties were selected and restorations with different thicknesses were obtained. Two abutments were chosen: one with a lighter shade and the other with a darker shade. Every restoration was applied on each abutment successively and colour evaluation was carried out using an objective method (the VITA Easy Shade V spectrophotometer) and a subjective method (three examiners in the same ambient conditions). The minimal thickness required to ensure total coverage of the dyschromia and specific natural translucency was determined.

## MATERIALS AND METHODS

In this study we used two groups. The witness group was represented by the light shaded abutment (ND1) – according to the Ivoclar Vivadent colour key, and the other group, the case study, was performed on, namely the ND9-colour (fig. 1). The latter is, according to the key, the darkest (we wanted to perform the study on the most difficult situation that can be encountered in clinical practice).

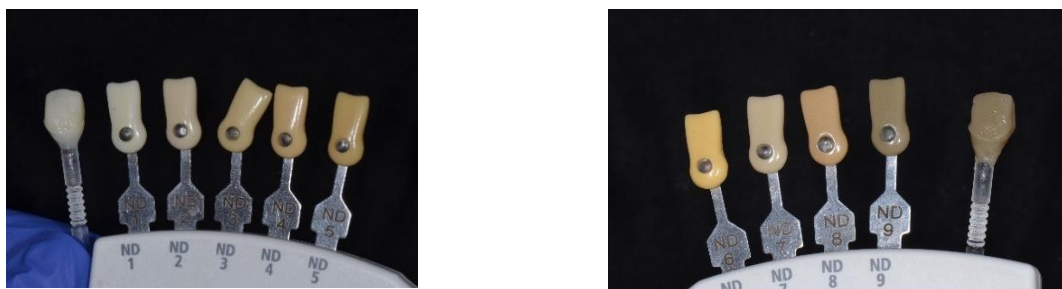


Figure 1. Abutments ND1 and ND9, respectively

Lithium disilicate ceramic currently offers multiple translucency and opacity variants. Due to it being nowadays the most used ceramic for its optical, physical and chemical qualities, it was the only ceramic considered in this study in order to avoid introducing other variables.

Three types of ceramic ingots were selected with different grades of opacity/translucency: LT (low translucency), MO (medium opacity) and HO (high opacity). Veneers of the following thicknesses were manually pressed from each ingot: 0.4 mm, 0.6 mm and 0.8 mm (fig.2). The colour of these ingots was A2 (LT A2, MO 2, HO 2).

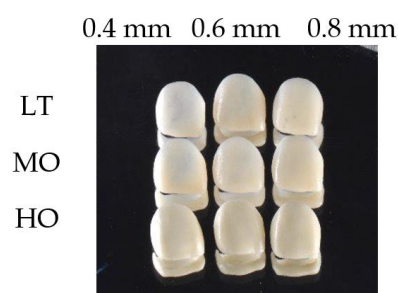


Figure 2. The ceramic veneers with progressive thicknesses obtained from the three ingots

Evaluation of the colour was carried out in two ways: objectively – spectrophotometer (VITA Easy Shade V) and subjectively (3 different examiners using the VITA 3D Master key). Both determinations were carried out in the same ambient conditions, namely 1200-1400 lux (measured using the Trotec BF06 luxmeter). For reproducibility reasons, the measurement using the spectrophotometer was done on the same spot (in the middle third of the veneer – a position determined using the digital calliper – both mesio-distally, as well as cervico-incisally).

Colour determination using the 3D Master key was done according to the protocol suggested by the manufacturer (VITA).

## RESULTS

For the LT ingot on the light shaded abutment (ND1), the spectrophotometer had a good concordance for all thicknesses in relation to the A2 colour initially taken into consideration. The subjective examinations had good concordances as well (table I).

For the MO ingot, both objective and subjective concordances were good for the light shaded abutment (table I).

For the witness group, the HO ingot had a lower performance regarding the subjective analysis, having no concordance between examiners. However, the spectrophotometer showed the same value each time (2M1 – corresponding to A2), regardless of veneer thickness.

Differences proved to be significant in the case of the dyschromic abutment (table I).

Table 1. Results obtained by colour determination using the VITA Easy Shade V spectrophotometer and the concordance between examiners

ND1	0.4			0.6			0.8		
	LT	MO	HO	LT	MO	HO	LT	MO	HO
Concordance	good	average	average	average	average	average	good	good	average
Determination	3M1	3L1,5	2M1	2M2	2R1,5	2M1	2R1,5	2L2,5	2M1
ND9	0.4			0.6			0.8		
	LT	MO	HO	LT	MO	HO	LT	MO	HO
Concordance	weak	weak	average	weak	weak	average	weak	average	good
Determination	4M1	4M1	3M1	4M1	3M1	3M1	3M1	3M1	2M1

For the LT ingot the spectrophotometer showed different values according to the thickness and also different in relation to A2. There was no concordance between the examiners. It was observed that these veneers displayed high variations between their final colours regardless of their thickness.

In the case of MO, the objective concordance was average, but the subjective concordance proved to be inferior to the objective one. The veneer obtained from this ingot was 0.8 mm thick and proved to be more efficient in masking the dyschromia.

The HO ingot obtained both in the case of the objective, as well as in the case of the subjective evaluation a superior concordance that was directly proportional to the increase in thickness of the veneer. The 0.4 mm thickness already displayed a complete masking of the discolouration.

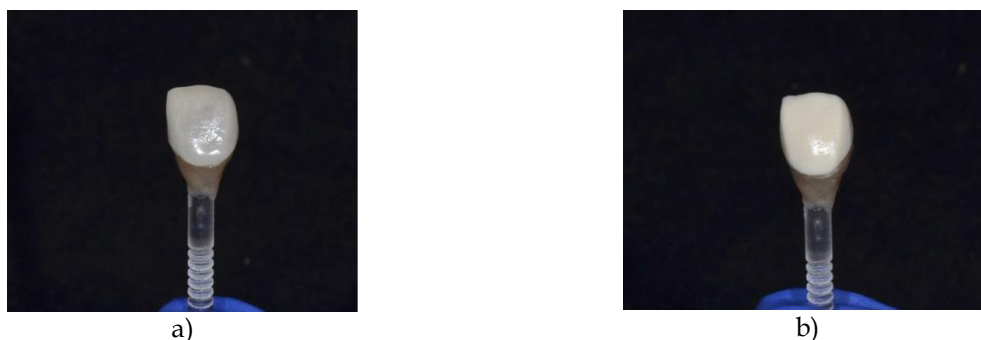


Figure 3. Aspect of the a) LT 0.4 mm veneer, b) HO 0.8 mm veneer, applied on the ND9 abutment

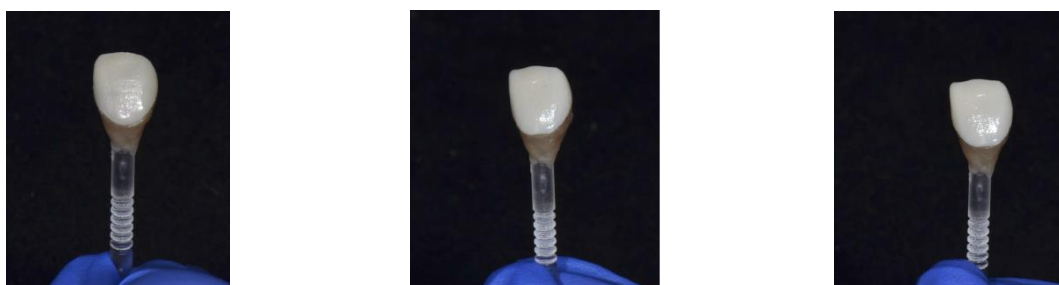


Figure 4. Aspect of the a) MO 0.4 mm veneer, b) MO 0.6 mm veneer, c) HO 0.8 mm veneer, applied on the ND9 abutment

## DISCUSSIONS

Wang's study evaluated 8 types of glass ceramics and 5 types of zirconia using the spectrophotometer in order to evaluate the translucency parameter. Zirconia proved to be less sensitive in regard to the thickness when compared to glass ceramics [1].

Barizon et al conducted a study with 0.7 mm-thick samples using 9 different ceramic materials. Their conclusions were that thickness and colour of lithium disilicate affect its translucency, but the thickness of the restoration has a more significant influence on the translucency than the colour per se [2, 3].

Shanyu Zhou et al have shown in their study that samples with thicknesses of 0.6, 0.8 and 1 mm obtained from HO ingots could mask a metallic substrate, and the thickness of 0.6 and 0.8 had an acceptable colour match in regard to the final colour that was desired to be achieved [4].

Chaiyabutr et al used greater thicknesses in their study (1, 1.2 and 1.5 mm, respectively), adding the resin cement as an evaluation parameter [5].

Rafael et al's study referred to leucite restorations and used thicknesses of 1.5 mm. They evaluated the colours of the substrate, which ranged up to A3,5 and C2. Even in the context of 1.5 mm thickness of the ceramic, a complete masking of the dyschromia could not be obtained [6].

Azer et al stated in their study that they had obtained 0.5 mm veneers starting from translucent and up to opaque, concluding that at this reduced thickness, both variants were strongly influenced by the colour of the substrate [7].

Concerning the method of colour evaluation, Paul et al have concluded that the analysis with the spectrophotometer was more precise and more reproducible when compared to the human evaluation of the colour. On the other hand, Kim's study suggested differences between the same spectrophotometers belonging to the same producer [8, 9].

Radaelli et al have demonstrated in their study that the MO ingots' ability to mask very dark substrates using a minimal thickness recommended by the producer was not sufficient, as polycrystalline zirconia had a superior aesthetic effect [10].

## CONCLUSIONS

This study has demonstrated that, in the case of very dark shaded abutments, chromatic modifications may be totally concealed by lithium disilicate ceramics, if MO ingots of a 0.8 mm thickness are used. This situation raises concerns regarding adhesion due to some cases where a 0.8 mm preparation may be excessive and lead to dentine exposure. Regarding the HO ingot, dyschromia proved to be completely masked at a 0.4 mm thickness, but the final aesthetic results are not adequate due to the lack of its translucency. These results raise further questions regarding clinical indications of veneers in the case of extremely dyschromic teeth, when the mentioned ingots are available.

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# Esthetic and orthodontic correction of posterior and canine crossbite. A case report.



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## Abstract

Crossbite is a form of malocclusion that can affect a single tooth or a group of teeth, which are misaligned in a more buccal or lingual position, compared to the corresponding antagonist tooth or teeth.

Crossbite can be classified according to location, in anterior and posterior crossbite and according to nature, in skeletal, dental and functional crossbite.

Crossbites can have substantial esthetic and functional implications, such as: a less pleasing smile, premature abrasions of the teeth, gum disease, dysfunctional mastication patterns, asymmetrical growth of the jaws. Considering the implications, early correction of crossbites is recommended.

In this case report we present the orthodontic treatment of a patient with bilateral posterior crossbite and canine crossbite, due to an ectopic mandibular canine.

**Keywords:** crossbite, ectopic, orthodontics, esthetic.



## INTRODUCTION

Crossbite is a form of malocclusion that can affect a single tooth or a group of teeth, which are misaligned in a more buccal or lingual position, compared to the corresponding antagonist tooth or teeth. For example, a crossbite is characterized by one or more of the lower teeth biting outside, in a more buccal position of the opposing upper teeth or vice versa. [1,2]

Crossbite can be classified according to location, in anterior and posterior crossbite and according to nature, in skeletal, dental and functional crossbite. In the anterior cross bite, one or more of the maxillary frontal teeth occlude lingually to the mandibular frontal teeth when in centric relation. The posterior crossbite involves lateral teeth and is characterized by an atypical occlusion between the upper and lower arch in the transversal plane. [1,4]

The etiology of crossbites includes: an abnormal eruption pattern of the upper frontal teeth and displacement of the permanent tooth bud due to dental trauma to the primary teeth, thumb sucking habit, mouth breathing, narrow maxilla, crowding. Posterior crossbites are usually caused by a narrow maxilla, which is the source of problems in the transversal plane, whereas anterior crossbites are caused by problems in the sagittal plane. [1, 3, 4, 5]

Crossbites can also be caused by an ectopic eruption, a displaced position of the tooth. Any permanent tooth can be ectopic, but the most frequent are the canines, due to the sequence of eruption. Crossbites are caused by ectopic canines that erupt buccally in the mandible, or palatally in the maxilla. [5,6,7,8]

Crossbites can have substantial esthetic and functional implications, such as: a less pleasing smile, premature abrasions of the teeth, gum disease, dysfunctional mastication patterns, asymmetrical growth of the jaws. Considering the implications, early correction of crossbites is recommended. [1,3]

In this case report we present the orthodontic treatment of a patient with bilateral posterior crossbite and canine crossbite, due to an ectopic mandibular canine.

## CASE REPORTS



Figure 1. Initial extraoral photographs

A 15-year old female patient reported for orthodontic treatment, with the chief complaint of crowding in the lower teeth and poor smile esthetics. She presented good conditions for treatment, no caries and reasonably good oral hygiene.

The patient presented with an oval, apparently symmetrical face, competent lips and a straight profile. (Fig.1.)



Figure 2. Initial intraoral photographs

Intraoral examination revealed the greatest problems in the transversal plane, with bilateral molars and premolars in crossbite, with the buccal cusps of the upper molars occluding in the fosa of the lower molars, or cusp to cusp. The midline in the lower arch was deviated 2 mm to the left. There was also a crossbite between the lower right canine and the upper right lateral incisor, caused by the ectopic eruption of 43. In the vertical plane, the overbite was normal for the incisors, but there was no contact between the lower and upper left canines, due to the infraocclusion of the upper left canine.

The lower arch asymmetry is evident. The shape of the arch is square, with the interpremolar width smaller than the intermolar width. The incisors are positioned in a straight line, and the left lower canine is ectopic. There is a lingual inclination of the lateral teeth. The upper arch has mild crowding and is a bit narrow, especially in the first molars area. (Fig. 2.)

The panoramic radiograph showed no pathologies. The third upper and lower molars were developing. (Fig. 3.)



Figure 3. Initial panoramic radiograph



Figure 4. Initial frontal cephalometric radiograph



Figure 5. Initial state of treatment



Figure 6. Treatment progress and shape of the lower arch after 6 months of treatment



#### *Treatment objectives*

The treatment objectives were to level and align the arches and correct the lateral crossbite by obtaining a normal form of the lower arch, with a narrower width between the lower molars and by widening the upper arch. Other objectives included correcting the canine crossbite and the mandibular midline deviation and improving smile esthetics.

#### *Treatment progress*

Treatment was started in the lower arch first, by bonding a fixed orthodontic metallic appliance. (Fig. 5) Leveling and alignment were obtained using 0.012, 0.014 and 0.016 NiTi arch wires. During this period, the bite was kept open using composite bite blocks, in order to avoid interference and permit the lower right canine to move lingually. The treatment was continued with 0.016x0.022 NiTi arch wire and then 0.016x0.022 Stainless Steel arch wires.

After 6 months, an obvious improvement of the shape of the lower arch could be observed. The lower right canine was aligned and the lateral teeth occluded cusp to cusp. (Fig. 6)



Figure 7. State of the treatment after bonding the upper orthodontic appliance

The treatment was continued with fixed esthetic appliance for the upper arch, in order to achieve expansion and normal occlusion in the transversal plane. (Fig. 7.) The patient refused a metallic appliance in the upper arch. Esthetic NiTi arch wires were used for leveling and alignment until 0.016x0.022 NiTi arch wire.

The treatment progressed to stainless steel arch wires in both arches, until 0.019 x 0.025 SS.



Figure 8. Final result - Intraoral photographs and panoramic radiograph after treatment





Figure 9. Final result - Extraoral photographs

#### *Treatment results*

Satisfactory dental alignment, occlusion, normal overjet and overbite were achieved. The posterior crossbite was corrected, obtaining a normal relationship between the arches in the transversal plane. Also, the canine crossbite and the midline deviation were resolved. The radiographic records revealed integrity of alveolar bones and teeth and parallel roots. (Fig. 8.)

The duration of the treatment was approximately 3 years. The patient was satisfied with her smile.



Figure 10. Initial and final smile esthetics

## DISCUSSIONS

In the case of posterior and anterior crossbites, the affected tooth/teeth can be aligned using orthodontic appliances and a pleasant smile can be achieved. Composite bite blocks and intraoral elastics may be needed in the progress of the treatment.

The results achieved in this case correspond with the initial objectives of the treatment and may be considered a success.

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# Oral health knowledge and behavior in a group of preschool children in Bucharest



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## Abstract

Taking into consideration that children have low dental care skills, hence they need sustained guidance, oral health education is imperative to be started at an early age, in the family, as well as in the children's play and learn environment.

**Objectives:** The objective of this study was to assess preschool children's behavior and knowledge regarding oral hygiene, foods that cause tooth decay and their addressability to the dentist.

**Material and methods:** 90 preschool children aged 4 to 6 years, from three kindergartens in Bucharest, were enrolled in the study. A questionnaire on oral health knowledge and behavior was administered, the questions were read to the children and the answers were noted. Ethical approval was obtained from the parents and kindergarten directors.

**Results:** 45.6% of the subjects brushed their teeth once a day; 48.9% performed dental brushing alone, one third (38.9%) assisted by the mother and the rest (12.2%) by the father. 57.8% have not seen a dentist, neither for treatment nor for consultation. 36.7% declared they have experienced dental pain, and 18.9% missed kindergarten due to it. 44.4% had knowledge of foods causing dental caries, and 35.6% knew what dental caries are - they have heard the term and explained it in their own words.

**Conclusions:** Most preschool children display a low level of knowledge and incorrect oral hygiene behavior. Taking into consideration that long-term healthy behaviors develop at young ages and young children depend on their family and kindergarten educators as behavior role models and sources of information, health education should be directed towards families and educators.

**Keywords:** oral health education, preschool children, dental care knowledge, dental care behavior



## INTRODUCTION

Oral health education should begin during early childhood because this life stage is one of intense information accumulation and long-term healthy lifestyle behaviors (1-5) are acquired now. The oral health status is influenced by behavioral factors (daily dental hygiene, nutrition, addressability to the dentist, etc.) along with social factors (2, 6). Moreover, the development of the child's personality also depends on the lifestyle of the social environment in which he lives, plays and learns. That is why the process of health education in children targets parents along with educators (1,4). Involvement of the adults responsible for childcare should be done through methods that motivate them to continue the organized education process within kindergartens through oral health promotion programs (1, 7, 8).

Parents and educators are behavior role models for preschool children, but often have a limited level of oral health knowledge themselves, so they need proper training, all the more so as young children have low dental hygiene skills and thus need support and guidance (9). Kindergartens can provide an engaging environment for parents and educators in the process of promoting oral health to young children (4, 10). Studies report a high prevalence of dental caries in the temporary dentition (13), preschool children being a population with high-risk of dental caries (especially those with poor oral hygiene and nutritional status and those in families / living environments with poor oral health knowledge and non-healthy behaviors) (9, 11,12).

It is desirable that dental brushing be performed or at least supervised by the child's parents (14), who are also responsible for adopting correct behaviors as regards personal oral hygiene, nutrition and addressability to the dental office.

### *Objectives:*

- To assess preschool children's behavior related to oral hygiene and addressability to the dentist;
- To assess the subjects' knowledge of dental caries and types of foods that may induce dental caries;
- To describe the information retained by the respondents following an oral health education lesson.

## MATERIAL AND METHODS

The study included 90 pre-school children aged 4 to 6, the mean age being 5.13 years (DS = 0.72), enrolled in three kindergartens in Bucharest. The gender distribution of preschoolers is relatively equable, 52.2% being girls (N = 47). The present study was carried out with the involvement of 6th year students of the Faculty of Dental Medicine within "Carol Davila" University of Medicine and Pharmacy in Bucharest, trained and supervised by the authors. Students presented preschoolers a questionnaire on knowledge and behavior related to oral health, by reading the questions to the children and noting their answers. The questions were designed in simple terms, easily understood by young children - the target group of the study - and were explained, if necessary, by the students, in order to avoid possible misinterpretations. After administering the questionnaire, an oral health education lesson was presented to the children in the form of an animated educational film offered by Colgate-Palmolive, "Travel in the kingdom of the tooth", which addresses important topics: tooth brushing (frequency, brushing of the "back teeth", the use of fluoride toothpaste and the soft-bristled brush); reducing the number of snacks between meals; a description of the dental microbial plaque in an easy-to-understand language; the importance of regular visits to the dentist, who should be perceived by the child as a friend. Preschool children were shown the age-appropriate brushing technique and then practiced the right movements on models. Finally, they were offered oral hygiene products and an oral health information sheet for

parents, provided by Colgate-Palmolive. After watching the film and discussing the information, the children were asked a question to assess the retention of newly received information.

The ethical protocol was observed, in the sense that the written agreement of the kindergarten directors was obtained, and the children's parents were informed about the educational lesson, the purpose of the study and the application of the questionnaires. All those involved were given assurances regarding the confidentiality of the data.

## RESULTS AND DISCUSSIONS

### *A. Results on the behavior of pre-school children included in the study*

Regarding the individual tooth brushing frequency, most children declared they clean their teeth daily; no gender difference was observed. In another study conducted in our country, 41% of the children interviewed affirmed they brushed their teeth every day (6). In our sample a percentage of 45.6% brushed once a day, 40% twice daily and 11.1% more often, while 3.3% affirm they do not use to brush their teeth every day. The distribution of responses for the whole sample and by gender is shown in Table I.

Table I. Subjects' behavior regarding the frequency of tooth brushing

Frequency of individual tooth brushing	Total subjects		Subjects' gender (N)	
	N	%	♂	♀
Once daily	41	45.6	21	20
Twice daily	36	40	16	20
Several times a day	10	11.1	6	4
More rarely	3	3.3	0	3

As regards brushing monitoring/aid, 48.9% of the children interviewed claim they do their own dental brushing without help / supervision of an adult. Of those who are monitored during brushing, little over one third (38.9%) are assisted by the mother, the rest (12.2%) by the father (see Table II). The results are similar to those published in another analogous study conducted in Bucharest, where 48.75% of preschoolers were reported to be assisted in performing tooth brushing (14).

Table II. Surveillance / help during tooth brushing given to children by adults

Aid in tooth brushing	Total subjects		Subjects' gender (N)	
	N	%	♂	♀
No aid	44	48.9	23	21
Mother	35	38.9	16	19
Father	11	12.2	6	5

As concerns addressability to the dentist, 42.2% declare that they visited a dental office at least once, while 57.8% did not see a doctor, neither for treatment nor consultation (Table III).

Table III. Behaviors regarding addressability to the dental office

Visits to the dentist	Total subjects		Subjects' gender (N)	
	N	%	♂	♀
Yes	38	48.2	15	23
No	52	57.8	28	24

Concerning the presence of dental pain, 36.7% of the children admitted they had a history of pain, and of these, 18.9% were absent from the kindergarten because of dental pain (Table IV).

Table IV. The presence of dental pain in the subjects' personal history

History of dental pain	Total subjects		Subjects' gender (N)	
	N	%	♂	♀
Yes	33	36.7	18	15
No	57	63.3	25	32

*B. Results concerning the children's knowledge of two oral health subjects* are presented in Table V.

Approximately one third (35.6%) of the children knew what dental caries are, they have heard the term and explained it in their own words.

Table V. Preschool children's knowledge related to dental caries and foods with cariogenic potential

	Total subjects		Subjects' gender (N)	
	N	%	♂	♀
Knowledge related to dental caries				
Yes	32	35.6	17	15
No	58	64.4	26	32
Knowledge of cariogenic foods	N	%	♂	♀
Yes	40	44.4	21	19
No	50	55.6	22	28

Less than half of the respondents (44.4%) have knowledge of cariogenic foods.

*C. Results regarding the retention of new information after watching the educational animated film*

The idea most retained by the children was that that they had to brush twice a day (mentioned by 31.1% of the respondents). Moreover, 22.2% also mentioned the fact that all teeth should be brushed (detail specified several times in the film presented). A percentage of 22.3% retained the message that sweets are not good for teeth and that they should be consumed as rarely as possible.

By anticipating the relationship between knowledge, attitudes and the social environment, the coordinates of an oral health education program can be outlined, especially as the level of medical knowledge is a precursor of health behavior. Interrelations between parents, kindergarten and community are extremely important. Health promotion projects should actively involve children, parents and educators.

## CONCLUSIONS

The level of knowledge of preschool children is relatively low - one third of the children surveyed have the correct knowledge regarding dental caries and less than half of them regarding foods that promote tooth decay. Dental brushing habits are incorrect, as less than 50% of the children brushed their teeth twice a day. Most subjects have not visited a dental office so far, while one third have experienced dental pain. Given the dependence of preschool children on their family and kindergarten educators, it is recommendable to focus oral health education on parents and educators, as behavior role models for children, especially as long-term healthy attitudes and behaviors are formed during childhood. In addition, it is desirable to involve all decision makers, including healthcare professionals and the media, in the implementation of oral health promotion programs at community level.

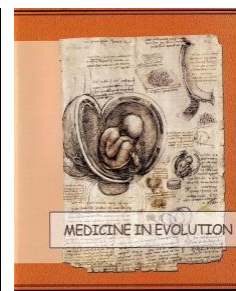
### *Acknowledgment*

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# Color stability of CAD/CAM hybrid versus leucite -reinforced ceramic blocks: an in vitro study.



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## Abstract

**Purpose.** Aim of the present study is to compare the color stability of CAD/CAM hybrid and glass ceramic blocks, after immersion in different beverages.

**Material and methods.** CAD/CAM leucite reinforced ceramic blocks (Empress CAD, Ivoclar) and hybrid ceramic blocks (Cerasmart, GC) were cut in 2mm thick samples. A total of 20 specimens, 10 of each group of material, were prepared and immersed in five different beverages (coca cola, green tea, coffee, red wine and distilled water-control). After one month of storage at constant temperature (37°C), the samples were analyzed with a spectrophotometer.

**Results.** Color changes ( $\Delta E$ ) after immersion of CAD/CAM blocks in different beverages were calculated. Compare to distilled water, a clinically detectable difference of color ( $\Delta E > 3$ ) was found for coffee, red wine and green tea for both test groups.

**Conclusion.** Within the limitation of this study, it can be concluded that usual beverages may affect the color stability of CAD/CAM hybrid and glass ceramic blocks, which may consequently compromise the esthetics of restorations.

**Keywords:** glass ceramic, hybrid ceramic, CAD/CAM blocks, spectrophotometry, color changes.



## INTRODUCTION

Today patient's esthetic demands are increasing continuously. The digital era brought major developments in the field of technologies and materials used in dentistry. CAD/CAM (computer-aided design/computer aided manufacturing) has become an efficient and reliable method of fabricating ceramic restorations. A large variety of esthetic CAD-CAM materials have been introduced in the last decade. Monolithic restorations can be prepared in final form by using CAD-CAM devices and materials such as zirconia, lithium disilicate ceramic, zirconia-reinforced lithium silicate ceramic, feldspathic ceramic, leucite-based ceramic, and ceramic/glass polymer materials [1]. Glass-ceramics may be fabricated in block form and machined into final form from a digital file of the restoration, developed using intraoral scans of the preparation or model scanning after a traditional impression. Resin-ceramic polymer-based materials have been released for use with CAD-CAM systems, as an alternative to ceramic machinable blocks [2,3]. Hybrid resin-ceramic polymer-based materials are intended to combine the advantages of dental ceramics and composite resin materials [4]. All these materials feature natural opalescence and harmonious fluorescence to enhance the esthetics of the restoration [5]. Optical properties, color stability, and translucency throughout the functional lifetime of a restoration are important parameters for the esthetic outcome of ceramic restorations [5].

Esthetic restorations are influenced by different conditions in the oral cavity, like temperature modification and pH modifications, that are related with the consumption of different beverages and foods. Color stability and stain resistance are important to the esthetic outcome and the long-term use of prosthetic restorations [6].

Spectrophotometers are digital instruments used to evaluate the color parameters using the *Commission Internationale de L'éclairage (CIELab)* system [7]. Hue (h) is the name of any color as found in its pure state in the spectrum. Chroma (Ch) is the degree of the amount of pure color in the object. Value (L) indicates the lightness-darkness of the color;  $a^*$  is a measurement of redness or greenness, while  $b^*$  is a measurement of yellowness or blueness [8]. Using all those color parameters, the color changes ( $\Delta E$ ) can be calculated.

The purpose of this study was to evaluate the optical properties of two different esthetic CAD-CAM materials after four weeks immersion in usual beverages.

## MATERIAL AND METHODS

CAD-CAM blocks from two different materials, leucite-based ceramic (Empress CAD, Ivoclar,) and hybrid ceramic (Cerasmart, GC), the same shade A2, were evaluated in this study. (Fig.1)

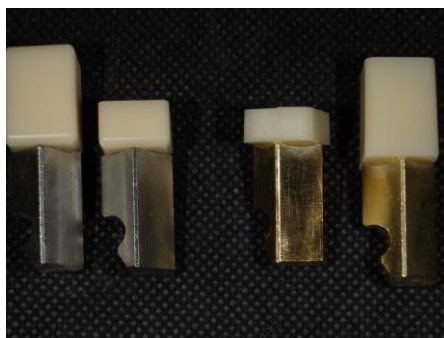


Figure 1. Empress CAD(left) and Cerasmart CAD/CAM blocks(right)

CAD-CAM blocks were sliced by using a low-speed hand piece and diamond disc under water cooling (Fig.2). The thicknesses of the specimens were evaluated by using a

digital caliper. A total of 20 specimens (12x14x2mm), 10 per each material were selected and manually polished, by using medium and fine abrasives and polishing pastes on a bristle brush.



Figure 2. Samples of CAD/CAM blocks after manual polishing

Baseline color measurements were carried out by using a spectrophotometer (Vita Easyshade Compact, VITA). The device was calibrated before each measurement, and the probe tip was placed perpendicular to the center of the specimens.

According to the CIELab color system L1\*, a1\*, b1\*, C1, h1 values were obtained.

Then the specimens were immersed for four weeks in different usual beverages: *coca cola*, *red wine*, *green tea*, *coffee* and *distilled water*(control). Each specimen was immersed separately in a closed individual vial containing 5 ml of the immersion solution and were stored in an incubator (Cultura, Ivoclar) at 37°C. (Fig.3).

In order to avoid bacteria or yeast contamination, each specimen was rinsed with distilled water and immersed in a fresh solution every 48 h. Second spectrophotometric color measurements were made after this storage period (Fig.4)



Figure 3. Samples stored in an incubator (Cultura, Ivoclar)



Figure 4. Spectrophotometric measurements with Vita Easy Shade after staining in vitro

The CIELab color differences ( $\Delta E$ ) were obtained from the equation:

$$\Delta E = ((L^*1 - L^*2)^2 + (a^*1 - a^*2)^2 + (b^*1 - b^*2)^2)^{1/2}$$

Statistical analyses were performed by using statistical software (SPSS Statistics for Windows v17.0; SPSS Inc). Kolmogorov-Smirnov test was used to assess the data distribution. The effect of external factors (coffee, green tea, red wine, coca cola) was assessed for statistical significance ( $p < 0.05$ ) using independent t- test.

## RESULTS

The mean CIELab values for all specimens at baseline were listed in Table 1.

Table 1. Mean  $\pm$ SD values and statistical significance of L1\*, a1\*, b1\*, Ch1, and H1 at baseline

Group	L1	a1	b1	Ch1	Hue1
Empress CAD	83.45+/-0.47	0.14+/-0.17	7.78+/-0.61	8.29+/-0.28	89.25+/-0.54
Cerasmart	80.23+/-0.32	-1.10+/-0.2	11.7+/-0.51	13.28+/-0.78	93.21+/-0.32

The color parameters measured with the spectrophotometer for Empress CAD after immersion four beverages are listed in Table 2 and for Cerasmart in Table 3.

Table 2. Mean  $\pm$ SD values and statistical significance of L<sub>2</sub>\*, a<sub>2</sub>\*, b<sub>2</sub>\*, Ch<sub>2</sub>, and H<sub>2</sub> after staining for Empress CAD

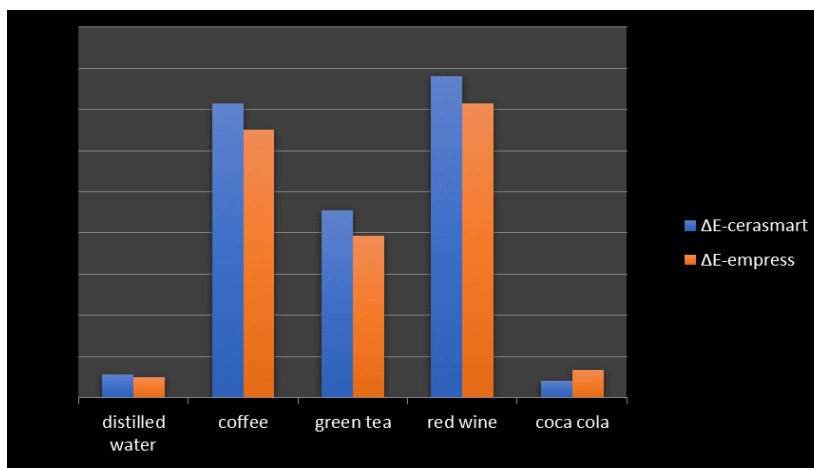
Empress CAD/ beverage	L <sub>2</sub>	a <sub>2</sub>	b <sub>2</sub>	Ch <sub>2</sub>	Hue <sub>2</sub>
distilled water	84.32+/-0.41	0.21+/-0.19	8.28+/-0.41	8.87+/-0.21	90.22+/-0.52
coffee	96.18+/-1.12	1.32+/-2.12	10.14+/-0.31	13.13+/-2.1	97.21+/-1.3
green tea	91.16+/-2.14	0.89+/-1.13	9.14+/-0.76	11.32+/-1.9	91.3+/-1.98
red wine	97.22+/-3.12	1.65+/-3.23	11.3+/-0.98	14.8+/-2.4	98.42+/-2.32
coca cola	82.14+/-1.56	0.19+/-0.12	8.13 +/- 0.25	8.32+/-0.16	89.98+/-0.46

Table 3. Mean  $\pm$ SD values and statistical significance of L<sub>2</sub>\*, a<sub>2</sub>\*, b<sub>2</sub>\*, Ch<sub>2</sub>, and H<sub>2</sub> after staining for Cerasmart

Cerasmart/beverage	L <sub>2</sub>	a <sub>2</sub>	b <sub>2</sub>	Ch <sub>2</sub>	Hue <sub>2</sub>
distilled water	81.23+/-0.62	-1.24+/-0.18	12.2+/-0.32	13.99+/-0.43	93.91+/-0.54
coffee	94.16+/-4.13	-2.21+/-1.13	14.6+/-0.76	15.32+/-1.8	96.3+/-1.98
green tea	89.22+/-3.18	-1.65+/-3.23	13.1+/-0.98	14.8+/-2.4	94.42+/-2.32
red wine	95.22+/-3.18	-2.98+/-0.12	15.7+/-0.25	17.24+/-0.16	97.54/-0.46
coca cola	80.12+/-2.98	-0.98+/-0.12	10.9+/-0.31	12.11+/-3.2	92.45+/-1.65

After performing the calculations, the results of color change ( $\Delta E$ ) of both investigated materials (Empress CAD and Cerasmart), after 28 days of immersion in different beverages are shown in Figure 5.

Color difference ( $\Delta E$ ) results revealed that different beverages affect the color stability in the following decreasing order: *coffee*, *red wine*, *green tea* (Fig.5). Red wine and coffee revealed the highest  $\Delta E$ , for both CAD/CAM materials.

Figure 5. Comparative values of  $\Delta E$  for Empress CAD and Cerasmart after storage in different immersion liquids

Between test groups (Empress CAD and Cerasmart) there are color values changes for all immersion liquids, but are not statistically significant ( $p > 0.05$ ).

## DISCUSSIONS

Esthetic all ceramic restorations need to fulfill several characteristics in order to assure success and longevity. From an esthetic standpoint, color stability and a chameleon effect are very important [9].

New hybrid CAD/CAM materials combine characteristics of a high strength ceramic with a composite resin. Discoloration usually occurs as a result of water sorption by the resin component of the material and the type of resin matrix plays an important role in the color stability of the material [10,11].

In this study, the changes in color of glass ceramic compare with resin nano-ceramic CAD/CAM blocks were investigated following immersion in common beverages such as coffee, coca cola, green tea red wine, that are known of their abilities to stain resin-based restorative materials. Distilled water was used as the control throughout the study. It has been postulated that 24 h of staining *in-vitro* corresponds to approximately one month *in vivo* [12]. Therefore, an immersion period of four weeks in an incubator is equivalent to two and half years of clinical ageing.

To evaluate the color stability, a spectrophotometer was used, in order to measure the values in color space CIELab. Then with an equation,  $\Delta E$  (changes in color values) was determined. It is considered that values  $\Delta E < 1$  were undetectable by the human eye, but values  $> 3.3$  can be easily observed and not clinically acceptable. [8-11].

The results of our study revealed that both materials, Empress CAD and Cerasmart present a clinically unperceivable color change after immersion in distilled water ( $\Delta E < 1.7$ ). On the other hand, after immersion in coffee and red wine and green tea, both materials exhibit a value  $\Delta E > 3$ , that revealed a clinically unacceptable change.

Discoloration by coffee could be attributed to the ingress of the yellow colorant of the coffee into the microstructure of both materials. Several studies explained the connection between discoloration of materials and pH of the immersion liquids. Higher sorption values were reported in materials immersed in solutions with pH ranging from 4 to 6. Since the pH of coffee is over 5.5, this may have caused its increased sorption contributing to higher color change. The low pH of red wine  $> 4$  may have affected the surface integrity of nano-ceramic blocks, resulting in softening of the surface. This may further explain the surface discoloration of the resin part after immersion in red wine. [12-16]. Coca cola has a more acidic pH values compare to red wine, which explain the increased  $L_2$  value and reduced staining.

Acar [14] investigated the color changes of CAD-CAM and nano-composite resin materials at different thicknesses (0.5, 0.7, 1.0, and 1.2 mm) after coffee thermocycling and reported that the lithium disilicate material exhibited the best color stability among the tested specimens, regardless of thickness.

Other studies [17-21] concluded that resin-ceramic materials showed higher color change values than ceramics after UV aging and usual beverages staining.

The results of our study revealed significant color differences, with high value of  $\Delta E$ , after immersion in usual beverages, for both CAD/CAM materials. One explanation can be that Empress CAD and Cerasmart were only manually polished, without any glazing. Since glazed surfaces are more resistant to staining [19], it is recommended to glaze the Empress CAD ceramic blocks and to apply the final layer of glossy protective coating agent (Optiglaze, GC) on Cerasmart blocks, in order to increase the color stability.

## CONCLUSIONS

Within the limitations of this study, it could be concluded that coffee, red wine and green tea may adversely affect the color of manually polished Empress and Cerasmart CAD/CAM blocks, which may consequently compromise the esthetic of the restorations.

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# Thermographic evaluation of three dental light curing units



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## Abstract

**Aim and objectives.** The aim of this study was to evaluate the potential of dental light curing units to induce irreversible changes to the dental pulp (secondary pulpitis).

**Material and methods.** The study evaluated three dental light curing units: a LED unit, a plasma unit and a halogen unit. The experiments were performed using molars cut in halves. All the teeth had cavities that were filled with composite resin. Each procedure was visualized with the FLIR A40M thermographic camera.

**Results** have shown that the temperature gradient for the floor cavity is the highest for the LED unit. The temperature in the dental pulp for the LED unit exceeded the 4 °C threshold known to bring irreversible damage to the proteins of the dental pulp tissues.

**Conclusion.** The LED unit was the most harmful for the dental pulp.

**Keywords:** thermography, pulpitis, light curing.

## INTRODUCTION

The large mass of healthy dental pulp is contained within the pulp chamber, which is contained in and mimics the overall shape of the crown of the tooth. The coronal pulp is connected apical to the radicular pulp. Because of the continuous deposition of dentin, the pulp becomes smaller with age. Radicular pulp is that pulp extending from the cervical region of the crown to the root apex. The roots are not always straight but vary in shape, size and number. The central region of the coronal and radicular pulp contains neurovascular bundle

It is well known that decay affects teeth Dental treatment by drilling and cleaning of the cavities, followed by fillings with different direct restorative dental materials is usual done. The inflammation of the pulp which occurs sometimes is known as pulpitis. Pulpitis can be extremely painful and in serious cases calls for root canal therapy or endodontic therapy [1, 2].

Composite resin fillings are very common in the daily practice. The main advantages are represented by superior aesthetics, conservative preparation of the tooth, low coefficient of heat transfer and adhesion to hard dental tissues. Light curing is a polymerization process activated by external heat of electromagnetic radiation. The irradiation can be made with UV or visible (coherent or incoherent) radiation. The light curing of composite materials can be made with incoherent radiation (UV spectral-visible), laser and the lamp with plasma generator (polarized light) [3].

Recently thermography has become a respected tool of noninvasive imaging in the field of medicine [4]. Since now, 150 thermography diagnose criteria [5] have been elaborated for different afflictions and pathologies like: pathologies of the respiratory apparatus [6], detecting and management of benign and malign tumors [7], functional and structural imbalance [8], general screening and localization of pain [9], pathologies of the locomotors system, studies of the various glands.

The dental pulp can resist to small thermal variations for a while (30 - 60 seconds), without sustaining irremediable damages. Sometimes the pulp microcirculation spreads the heat in other areas and thus no modification of the pulp occurs.

When the temperature of the pulp tissue increases more than 4 °C an irreversible degeneration process of the pulpal proteins occurs, a corresponding inflammation of the exposed area develops. This inflammation is called secondary pulpitis due to the light curing process and it is considered an iatrogenic state of the pulp [10, 11].

The current study proposes a new direction of thermographic analysis regarding the dental procedure of light curing by using three different light curing units. The focus of this study was the thermal effects of each the light curing unit on the dental tissues. During light curing a temperature exchange takes place between the light cured material and the pulp cavity of the tooth (Fig.1).

The current study consists of an experimental program developed to measure the temperature of the filling material and the pulp cavity during light curing of a filled molar using the thermographic method.

## MATERIALS AND METHODS

Seventy-two periodontally affected extracted teeth (twenty-four for each curing light unit) were examined after cavity preparation and filling with light curing composite rein, by using a FLIR A40M thermographic camera. The FLIR A40M is a thermographic camera with 0.1°C sensitivity that is easy to use and allows good handling and positioning.

For the considered samples, there were prepared class I cavities 2 mm deep so, the maximum thickness of the composite layer was 2 mm. This condition was respected and applied to all the samples.

The study was done by using three kinds of light curing units: a halogen light curing unit (ASTRALIS® 3, Ivoclar -Vivadent Lichtenstein), a plasma light curing unit (APOLLO® 95E Dental/Medical Diagnostic Systems, USA) and a LED light curing unit (Dr's LIGHT® Wireless Curing Light, RF America IDS, USA), in similar conditions as in the dental practice. Seven molars were cut in halves and positioned in clay. Each molar had an occlusal cavity prepared in accordance to the minimum invasive dentistry principles. All the cavities were filled according to the normal light curing procedure (Fig. 1).

The filling composite resin used (RC) was IPS Empress Direct (Ivoclar-Vivadent-Lichtenstein), a nanohybrid filling material for direct esthetic restorative procedures. This composite resin provides a high gloss polish and a lifelike opacity, fluorescence and opalescence that is required to fabricate beautiful and naturally esthetic restorations with remarkable efficiency [12, 13]. As this composite resin is considerably less sensitive to operatory light than other comparable materials, it provides adequate time to carefully sculpt the restoration.

For the halogen and plasma light curing units, the composite resin was inserted into the cavity in three steps. After filling each cavity of the specimens involved in the study, the light curing was performed for each sample separately from 3 directions: mesial, distal and occlusal with an exposure time of 10 seconds on each side. The distance between the light curing unit and the specimen was 10 mm. The entire process was visualized with the thermographic camera and the maximum temperatures of the filling material and the pulpal cavity were determined (Fig. 2). The marked areas correspond to the areas where the maximum temperature was determined.

For the LED light curing unit, the filling material was applied in three layers and each layer was light cured for 10 seconds (Fig. 3). The entire process was visualized with the infrared camera and the maximum temperatures for the filling and the pulp cavity were determined.

All specimens had initially a temperature equal to the atmospheric temperature of the laboratory, around 23°C (T).

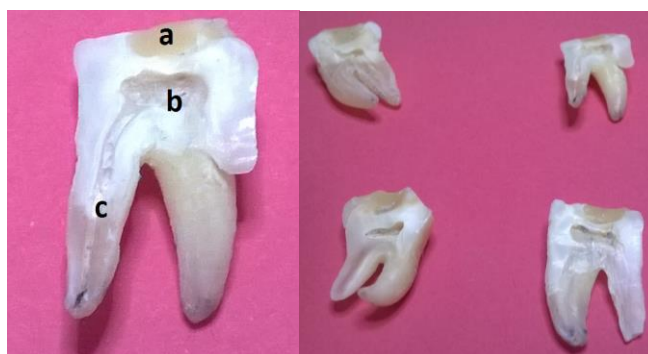


Figure 1. Structure of maxillary molar: dental cavity filled with composite resin (a), pulp cavity (b) and root canals (c)

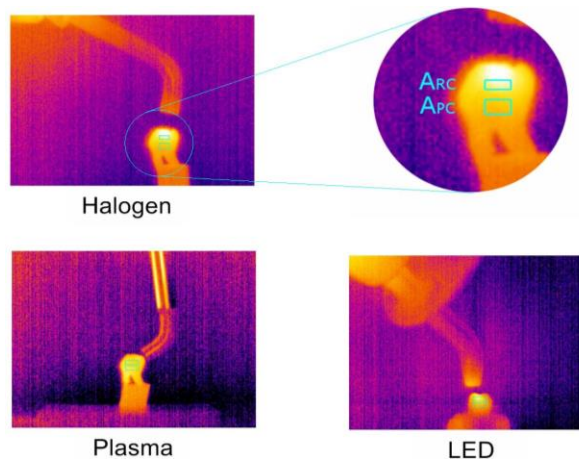


Figure 2. Thermographic images of each light curing unit during the light curing procedure; the areas of interest are marked in with blue

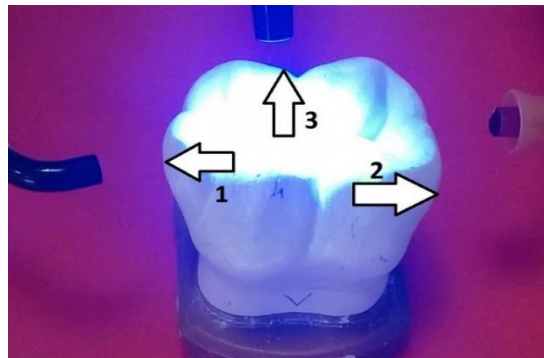


Figure 3. Three steps of layering for the LED light curing

## RESULTS

The temperature distributions of interest were interrogated in two rectangular areas one for the filling material ( $A_{RC}$ ) and one for the pulp cavity ( $A_{PC}$ ) as shown in Fig. 3. From these areas the maximum temperatures were determined and used for the current study.

To evaluate the increasing of the temperature in the pulp chamber, differences between the filling material temperature ( $T_{RC}$ ) and the pulp cavity temperature ( $T_{PC}$ ) were calculated using the formula:

$$RC(T_{PC}) = T_{max,RC}(T_{max,PC}) - T_i. (1)$$

All obtained values and the mean temperatures are shown in Table 1.

Table 1. Temperature gradients for the three evaluated curing lights

No.	Halogen		Plasma		LED	
	$\square T_{RC}$ [°C]	$\square T_{PC}$ [°C]	$\square T_{RC}$ [°C]	$\square T_{PC}$ [°C]	$\square T_{RC}$ [°C]	$\square T_{PC}$ [°C]
1	16.8	3.2	7.6	0.4	11.6	5.1
2	11.9	2.0	6.1	0.7	11.8	5.5
3	12.6	2.8	5.3	0.3	11.8	6.2
4	13.7	2.3	5.1	0.4	11.2	6.1
5	17.6	4.1	7.7	0.5	12.8	5.7
6	14.8	3.6	5.6	1.0	12.5	5.9
7	12.7	2.0	6.7	0.6	12.6	6.4
8	11.4	2.2	7.2	0.8	11.8	6.0
9	15.0	3.5	6.9	0.9	12.1	6.4
10	14.3	2.4	5.1	0.4	11.9	5.2
11	15.6	2.2	6.2	1.0	12.0	5.8

No.	Halogen		Plasma		LED	
12	15.0	4.4	6.1	0.5	11.4	6.4
13	10.6	3.0	6.1	0.3	11.3	5.3
14	15.1	2.3	6.0	0.2	12.7	6.2
15	14.5	2.1	7.2	1.1	11.7	6.5
16	11.7	3.2	6.5	0.7	11.9	6.8

Results showed that the plasma light curing unit is the one that radiates the smallest temperatures and is the light curing unit that determines the smallest damage of the pulp tissue.

As previously stated a temperature increase of over 4°C, in the pulp cavity, generates changes in the pulp tissue. Results showed that the LED light curing unit radiates a temperature above the 4°C with a mean value of 5.9 °C that is sure to determine the onset of irreversible damage of the pulp tissue (pulpitis). Both the plasma and the halogen light curing units are leading to temperatures under the 4°C critical value and thus can be considered safe.

## DISCUSSIONS

Nowadays the most common used light curing units in dentistry is the LED light curing unit even though other studies have also shown that the 4°C temperature is exceeded [14, 15] and it is one of the expensive solutions for light curing [16].

The influence of the preparation procedures on the pulp has been studied with histological techniques, as in Langerland [17]. The cavity depth is probably the most decisive factor when estimating the potential adverse effects of the features of the cavity design on the pulp tissue, as shown in Stanley [18]. It has also been demonstrated by Langeland and Ricucci [19] that it is methodologically difficult to distinguish between the effects of the cavity depth and other parameters, such as:

- the direct effects of the components in the tooth filling material [20];
- the possible remains of bacteria in the cavity [21];
- the marginal leakage around the restoration [22];
- the temperature changes due to damaging finishing of the restoration [23].

Pulp reactions to the tooth preparation techniques are still a major concern in restorative dentistry. The term “stressed pulp” used in the literature means a bad prognosis from the very beginning, because issues like caries, old restorations, occlusal trauma, abrasion or periodontal disease already exhausted the pulp adaptability. For such a tooth any, even a small additional trauma can cause a degenerative process in the pulp. According to many longitudinal investigations there is a high rate of vital teeth exhibiting typical signs of pulp complications, while there is a significantly increased frequency of endodontic treatments that have to follow dental preparation and crowns cementation [24 - 29].

In a previous study [13], the measurement of pulp chamber temperature changes during polymerization was performed with a thermistor inserted in the pulp chamber. The etching and adhesive steps were avoided just to offer the possibility to remove the filling material. An important condition is represented by the thickness of the composite layer. On the class I cavities' margins was made a mark that correspond to the maximum thickness of 2 mm composite layer. This condition was respect and applied to all the samples. The light curing was made with a halogen curing unit (DEGELUX®), LED curing unit (BLUPHASE LED® and MINILED® Dentsply DeTray) and plasma curing unit (APPOLO® Plasma curing unit). The light curing time was 20 seconds for the halogen lamp and 6 seconds for plasma. The obtained results were: maximum values of the temperature in the pulp chamber were registered by the halogen light curing unit, an average value was registered by LED light curing unit; the best result (low temperature in the pulp chamber) was obtained by plasma curing unit. The plasma curing units cost is tough higher than the ones of the LED's curing



units. The results of this study were in accordance with the current research regarding the plasma curing light, which determines the lowest temperature increasing in the pulp chamber. Otherwise, the costs of LED and halogen curing units are more economic than plasma curing units. This fact and the issues discussed above showed the need of further research regarding the effects of lights curing on the pulp tissue. It would be important to obtain strong statistical parameters regarding the medical procedure and the manufacturing specifications of these light curing units.

## CONCLUSIONS

This study has shown the temperature changes that occur in the pulp chamber are:

1. the LED light curing unit determines the higher temperature increase and the worth impact on the pulp tissue;
2. the halogen light curing unit and the plasma light curing unit both showed no negative impact on the pulp tissue.

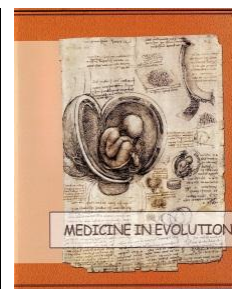
It would be of great importance to evaluate the effects of light curing units on the pulp tissue on many samples to obtain good information regarding the use and the design of the dental light curing units.

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# Comparing the facial beauty norms adopted by a young romanian population in comparison with a young french population



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## Abstract

The study aims to assess the dental esthetics awareness among dental students. A convenience sampling method was used. Subjects were given a set of questions and asked to give their opinion on dental esthetic awareness. The Shape of the Face was assessed to be important more for the Romanian participants. The same observation went for proportionality between the facial elements. While the French were not able to rank it with high discrimination, the Romanians considered it to be very important. While assessing the smiles of other people, the most displeasing aspects were considered to be tooth crowding and missing teeth for both populations. No statistically significant difference was observed for the two groups. This study shows that the subjects showed a high level of self-consciousness and the findings of the studies show that the males are less vulnerable to physiological consequences when compared to females.

**Keywords:** Aesthetic Questioner, Facial Norms, Populational observation.

## INTRODUCTION

In this competitive society that we live in, a pleasing appearance can represent the difference between success and failure in both our personal and professional lives. The world is in continuous globalization and modernization and the population is growing. Both genders are quite conscious about their facial appearance. The generation from nowadays is giving a lot of importance to their appearance in correlation with a self-perceived need to improve their personality. Because of advancement in dentistry, people are impatient to know about how the orthodontic treatment is going to improve their smiles. Esthetics and cosmetic dentistry strive to combine beauty and function with the individual values and needs of each patient. Esthetics is not only aiming to correct the smile, but also to change the profile and relationship between jaws [1]. In total esthetics plays an important role in a person's life by increasing their self-confidence. Esthetic dentistry is somehow characteristic to mankind; where a beast can be transformed into a beauty. Each person wants the recognition of others, and esthetics is one of the ways making it possible [1,2]. This study is an assessment of dental esthetic awareness of students in dental medicine from two universities. Esthetics is also a philosophical branch that focuses on the problems of beauty and artistic taste. Esthetics can also mean preoccupied by beauty or the assessment of beauty or a pleasing appearance or a set of principles regarding the work of an artist or artistic movement [3]. There are the physical, social, and psychological aspects that play an important role in a person's life [1,4]. The majority of people are undergoing orthodontic treatment to improve their smile and facial appearance [4,5]. As dentists, we consider to be essential knowing about the awareness upon dental esthetics. In order to preach what we practice, it is important that as teachers we assess the knowledge of students in this field of aesthetics and find which are their lacunas.

### *Aim and objectives*

This study wishes to assess the dental esthetics awareness of dental students in two universities from Romania and France.

## MATERIALS AND METHODS

The sample population was composed of dental students within a range of 19-35 years of age. A convenience sampling method was used. Subjects who were present in the lecture on the day of the study and were willing to fill the questioners were enrolled. From 900 students, a total of 622 students showed interest and therefore were enrolled into the study.

Students were presented with a set of questions and asked to respond, giving their opinion on dental esthetic awareness. Before the survey, consent regarding the questioner was obtained from the Ethical Commission from the Iuliu Hațieganu University of Medicine and Pharmacy, Cluj-Napoca.

The questionnaires were distributed to students from two dental universities from Romania and France, respectively, students from the Faculty of Dental Medicine from Iuliu Hațieganu University of Medicine and Pharmacy from Cluj-Napoca, and students from the UFR Odontologie, Bordeaux, France.

### **Data collection**

The investigation is basically a questionnaire survey. To design our questioner we used as a reference a proforma from an oral health-related questionnaire (McGrath and Bedi [6]). It consists of a battery of 15 questions related to dental esthetics awareness. Personal information was also demanded from all the subjects. Questions were asked upon physical, aesthetical, perception and knowledge aspects [7]. The questionnaire was given personally to all the students and collected on the next few days. Students were required to read carefully each question and asked to make their choice from the multiple-choice answers. Before the

study actually begun, the questionnaire was tested on a group of ten study subjects to validate it and the variability found of 0.7, meaning a fair agreement.

### Data analysis

Descriptive statistics on frequencies was used, the values for alpha and p being set at a significance threshold of 5% respectively 0.05%. Chi-square test was computed to analyze the statistical significance with respect to their country of origin, gender and their responses on dental esthetic awareness. As the number of female participants in the study was bigger than the males' and in situations like this the test will not be able to compare properly the results, logarithmic transformations of the variables employed in the study was done to avoid bias.

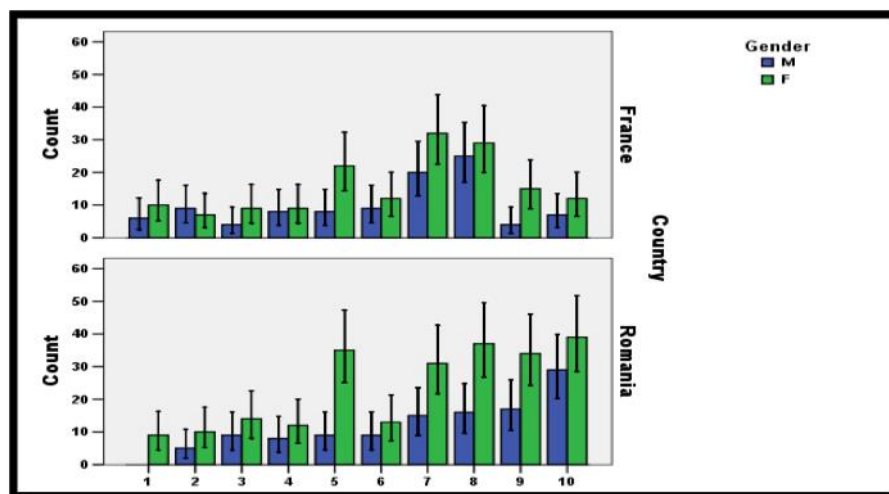
Assessment of normal distribution of data was done. The symmetry (skewness) and flattening (kurtosis) of data distribution were calculated, which revealed higher values of 0.8, which and suggested a non-Gaussian distribution. The statistical normality tests Kolmogorov-Smirnov and Shapiro-Wilks were applied. Non-Gaussian distributions were found for the second time.

Descriptive statistical analysis- Mean, median, standard deviation, minimum and maximum values for all parameters studied were calculated.

Inferential statistical analysis (significance of differences between groups) - because the data distribution was not a Gaussian, we used nonparametric statistical tests: Mann-Whitney test for comparisons between two groups and Kruskal-Wallis for comparisons between more than two groups.

## RESULTS

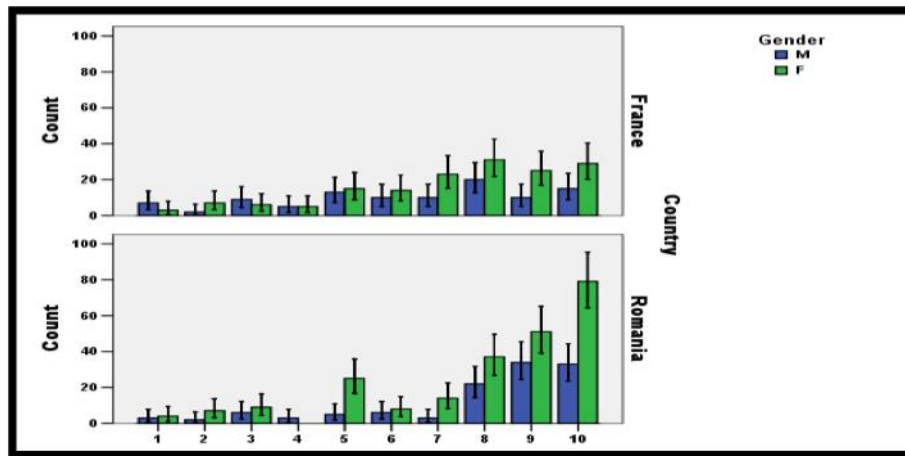
Asked to assess different aspects related to facial aesthetics there was not noted a very different approach regarding the elements of the face between genders.



Graphic 1. Graphical representation on the importance given to the shape of the face by giving scores from 1 to 10

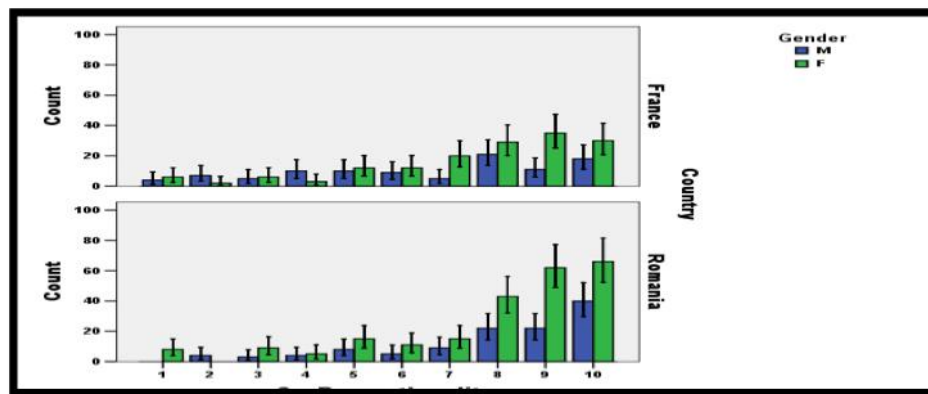
The Shape of the Face was assessed to be important more for the Romanian participants than the French participants.





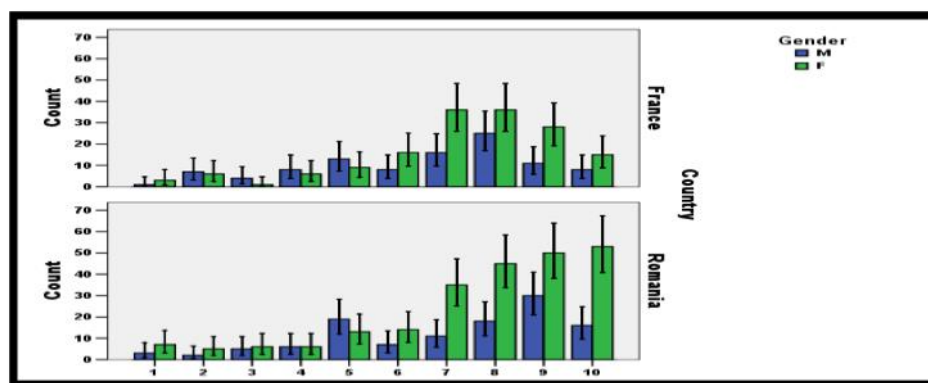
Graphic 2. Graphical representation on the importance given to the symmetry of the face by giving scores from 1 to 10

Also, while the French participants considered that facial symmetry is evenly distributed in rankings, the Romanians considered it to have higher rankings, grading it as 10 on an importance scale.



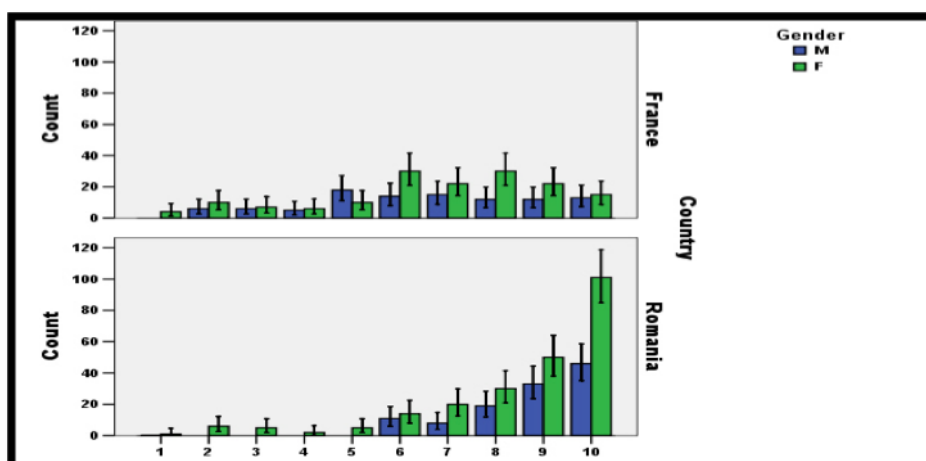
Graphic 3. Graphical representation on the importance given to proportionality of the face by giving scores from 1 to 10

The same observation went for proportionality between the facial elements. While the French were not able to rank it with high discrimination, the Romanians considered it to be very important.



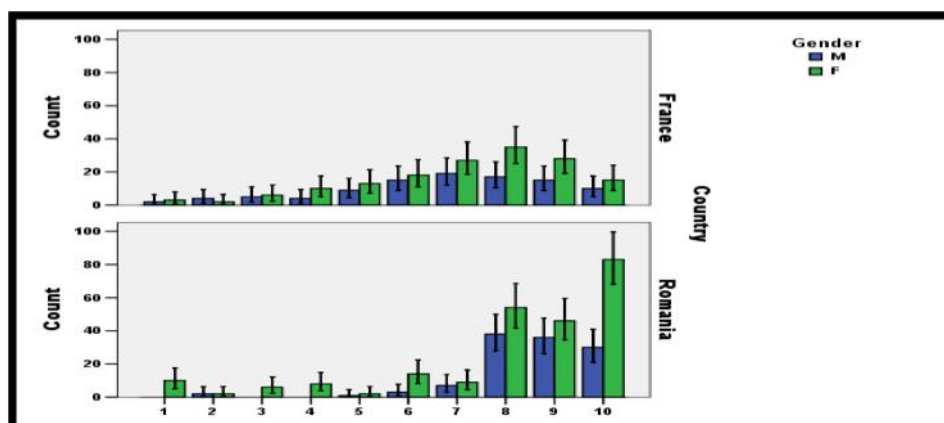
Graphic 4. Graphical representation on the importance given to facial profile by giving scores from 1 to 10

Facial profile was considered to be important with a ranking towards the 7 and 8 values for the French, while having values from 8 to 10 for the Romanians

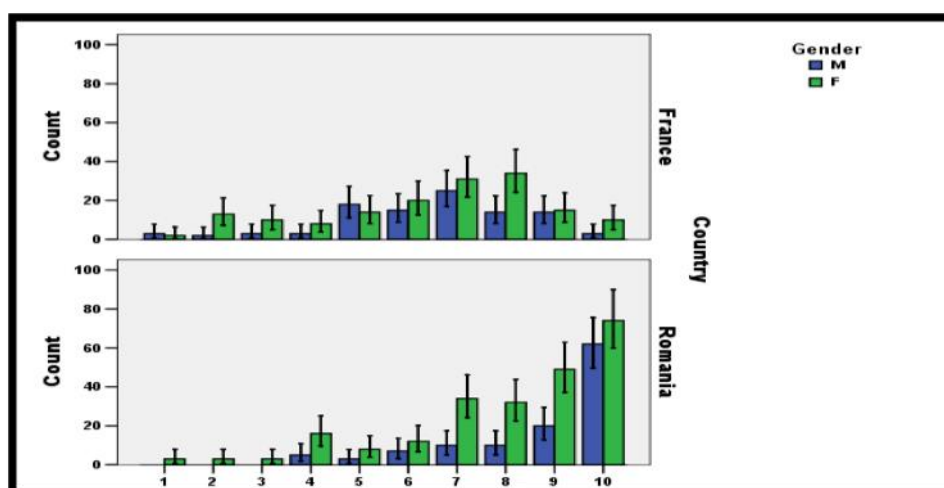


Graphic 5. Graphical representation on the importance given to dental arches by giving scores from 1 to 10

The shapes of dental arches were also considered to be important for the Romanians.



Graphic 6. Graphical representation on the importance given to tooth color by giving scores from 1 to 10



Graphic 7. Graphical representation on the importance given to dental shapes by giving scores from 1 to 10

Differences were noted between the two populations also regarding the importance that tooth color and shape should have.

Table 9 and 10. statistical Kruskal-Wallis test results showing lack of differences between the two dental students population regarding dental aesthetics

Test Statistics <sup>a,b</sup>						
	q6a_Shape	q6b_Simmetry	q6c_Proportionality	q6d_Profile	q6e_DentalArch	q6f_ToothShape
Chi-Square	2,750	3,325	5,723	,954	4,601	4,096
df	2	2	2	2	2	2
Asymp. Sig.	,253	,190	,057	,621	,100	,129

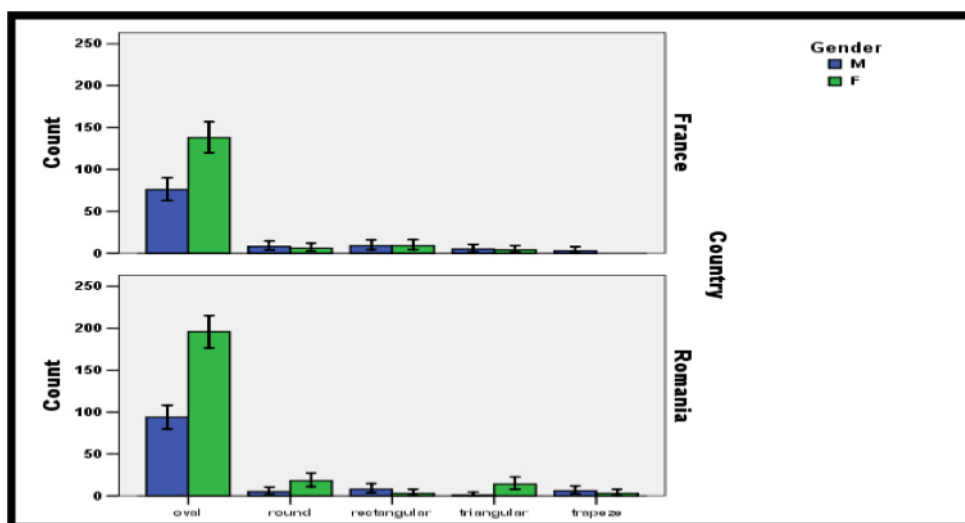
Test Statistics <sup>a,b</sup>						
	q6g_ToothDimension	q6h_ToothColor	q6i_Alignment	q7_FaceShape	q8_FacialSymmetry	q9_FaceTeethHarmony
Chi-Square	1,564	3,039	,641	6,771	,368	1,296
df	2	2	2	2	2	2
Asymp. Sig.	,457	,219	,726	,034	,832	,523

Table 11 and 12. statistical Mann-Whitney and Wilcoxon test results showing lack of differences between the two dental students population regarding dental aesthetics

Test Statistics <sup>b</sup>						
	q6a_Shape	q6b_Simmetry	q6c_Proportionality	q6d_Profile	q6e_DentalArch	q6f_ToothShape
Mann-Whitney U	309,000	278,500	243,500	415,000	402,500	376,000
Wilcoxon W	354,000	323,500	288,500	460,000	447,500	4747,000
Z	-1,308	-1,681	-2,101	-,042	-,192	-,515
Asymp. Sig. (2-tailed)	,191	,093	,036	,967	,848	,606
Exact Sig. [2*(1-tailed Sig.)]						

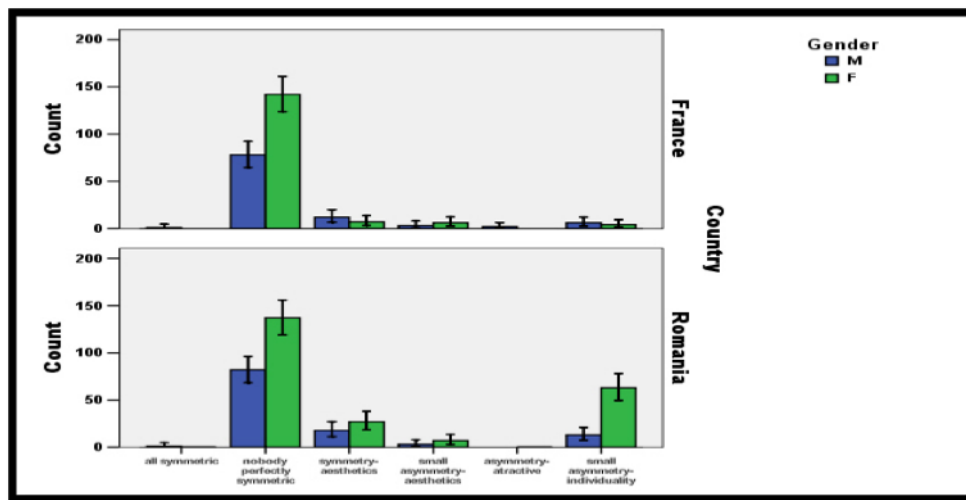
  

Test Statistics <sup>b</sup>					
	q6g_ToothDimension	q6h_ToothColor	q6i_Alignment	q7_FaceShape	q8_FacialSymmetry
Mann-Whitney U	318,000	286,000	393,000	303,000	398,000
Wilcoxon W	4689,000	4657,000	4764,000	4674,000	4769,000
Z	-1,199	-1,592	-,310	-1,968	-,373
Asymp. Sig. (2-tailed)	,231	,111	,757	,049	,709
Exact Sig. [2*(1-tailed Sig.)]					



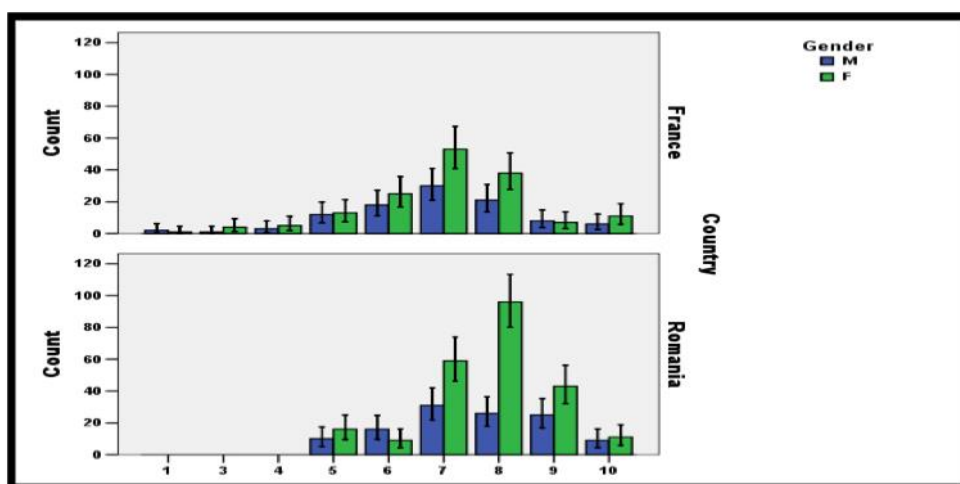
Graphic 8. Graphical representation of the most pleasing shape for the facial contour

The most aesthetic facial shape was considered to be the oval one, for both groups of students.



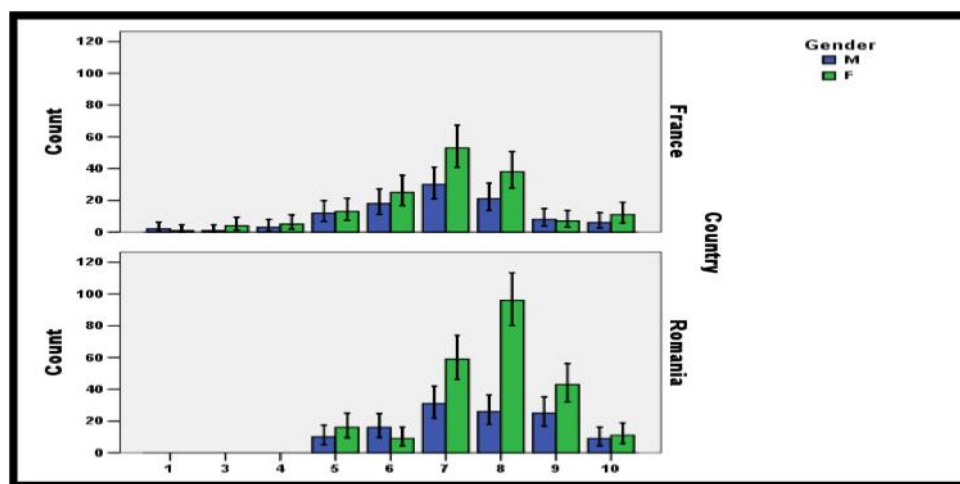
Graphic 9. Graphical representation on students' opinion about facial symmetry

While students from both countries and genders agreed that there is no such thing as perfect symmetry in Facial aesthetics, the Romanians also considered that small asymmetries offer individuality to each person.



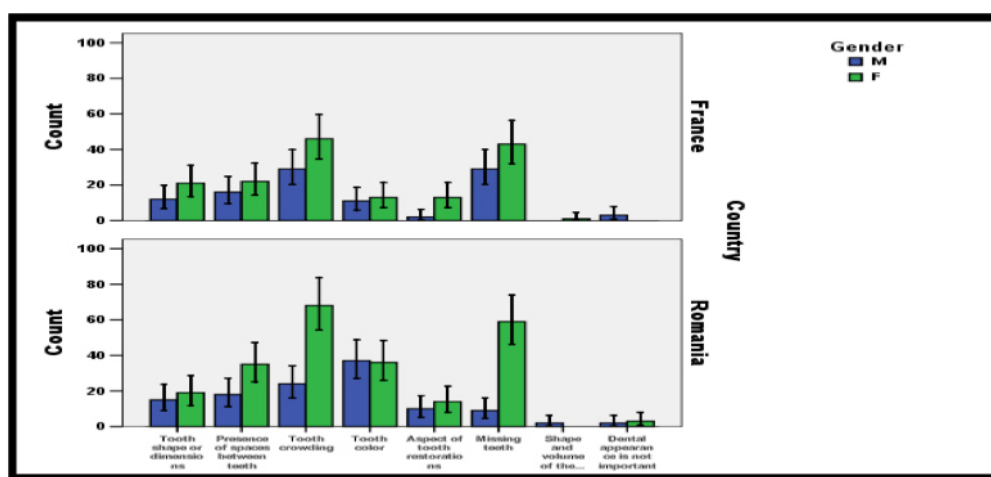
Graphic 10. Graphical representation of self-ranking of the smile for the two groups of students

Asked to rank their smiles, students were situated in a Gaussian asymmetric distribution with peaks around 7 and 8 values, revealing that their assessment was somewhat critical but also they considered their smiles pleasing to a certain degree.



Graphic 11. Graphical representation of the most displeasing aspect when assessing their smile

The most displeasing aspect of their smile appearance was considered to be tooth shape for the French and tooth crowding for the Romanians.



Graphic 12. Graphical representation of the most displeasing aspects when assessing other peoples' smiles

While assessing the smiles of other people, the most displeasing aspects were considered to be tooth crowding and missing teeth for both populations.

No statistically significant difference was observed for the two groups.

## DISCUSSIONS

The female participants represented the majority. The fact that female participancy was greater can be explained by the fact that the universities in question comprised more female students, or more females have chosen to participate in the study, but the differences were accounted for by the logarithmic transformations.

Similar studies emphasized the fact that malocclusions definitely influenced the young people satisfaction with personal appearance [8].

This study shows that the majority of participants, both females and males are pleased with their smiles.

The results of our study prove that personal appearance plays an important role in succeeding in ones career and personal relations. Dynamics of satisfaction, proven also by our study is clearly proved by similar studies [9,10]. This survey shows that that both majorities of females and males have a knowledge of cosmetic dentistry and the fact that as dentists they



can intervene to change smiles. Similar results were presented in studies developed by Peres *et al* [8]. These studies show that esthetics are important for the psychological development of each individual. Similar results were found by Klages *et al* [11].

## CONCLUSIONS

This study concludes that the enrolled subjects showed a high level of self-consciousness and the results of the study reveal that male participants were less vulnerable to physiological consequences than compared to females. This research demonstrates that even the slightest of variations can have a great impact on the psychological dimension, but also related to functional and physical aspects. Therefore, the need for training towards the same end still remains.

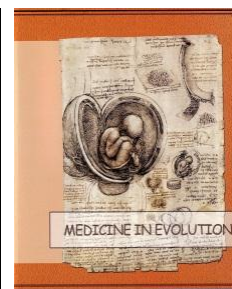
## Aknowledgements

All authors are considered to have equal contribution in this study and article.

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# Ability of Twisted Files and Twisted Files Adaptive in shaping canals with different angles of curvatures - an in vitro study



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## Abstract

**The aim** of the present in vitro study was to evaluate the shaping ability of two rotary nickel-titanium endodontic systems in canals with different angles of curvatures, on periapical X-rays.

**Material and methods.** 10 recently extracted human teeth with a total number of 15 canals were included in this study. Digital periapical X-rays were taken after the access cavities were performed and the degrees of curvatures were measured for each canal using a dedicated software program. Teeth were divided than into two Groups: Group 1 (n=5, 8 canals) - shaping was performed with Twisted Files and Group 2 (n=5, 7 canals) - shaping was performed with Twisted Files Adaptive. Only one set of instruments was used for all the canals belonging to one group. Post-instrumentation radiographs were taken, the curvatures were measured again, and the differences between the before/after angles were calculated.

**Results.** The region of the curvature was located in the middle third of the root canal for all samples. In both Groups, the reduction of the curvature's angle after shaping was observed, with variations between 0.5 and 11.5°, which is normal because of the enlargement of the body of the canal, done by the tapered instruments during shaping.

**Conclusions.** Both systems offer the capacity to shape canals with curvatures located in the middle third, without alterations of the original root canal anatomy.

**Keywords:** rotary nickel-titanium instruments, shaping, curved canals, periapical X-rays

## INTRODUCTION

The success of endodontic therapy is mainly dependent on several factors, including proper instrumentation, successful decontamination and proper irrigation of the root canal system, right to its apical terminus [1,2]. Both continuous rotation and reciprocation are nowadays used with nickel-titanium (NiTi) instruments in order to shape the root canal [3,4]. Although easier in straight root canals, shaping becomes difficult and challenging when encountering canal curvatures [5].

Because a significant risk of intracanal separation of NiTi rotary instruments was reported in the literature via torsional and cyclic fatigue [6,7,8], modifications of the alloy and of the manufacturing process of the files were introduced [8,9].

Twisted Files™ and Twisted Files™ Adaptive (Sybron Endo, Glendora, CA) instruments are manufactured by plastic deformation, a thermal process that allows twisting of the file during a so-called R-phase transformation of the NiTi alloy [9,10] resulting in superior physical properties of the instruments, which increase their flexibility and the maintenance of the original canal shape [3,9]. Moreover, the Twisted Files™ Adaptive system, which was recently introduced on the market, employs a patented unique motion technology, which automatically adapts to instrumentation stress, by changing the continuous rotational motion of the instrument into a reciprocation mode, with specifically designed angles of clockwise and counter-clockwise rotation [3,8,9].

Because of their advantages, these two systems were selected and compared in the present study, to shape canals with moderate curvatures.

### *Aim and objectives*

The aim of the present *in vitro* study was to evaluate the shaping ability of Twisted Files and Twisted Files Adaptive endodontic systems in canals with different angles of curvatures, located in the middle third of the canals, on periapical X-rays.

## MATERIAL AND METHODS

Ten recently extracted human teeth with moderate canal curvatures, mainly located in the middle third of the roots were digitally radiographed after the access cavities were made using the ProMax Planmeca Romexis Digital Software (Planmeca, Helsinki, Finland). The angle of the curvature was measured before shaping for each root canal using a dedicated software OnDemand 3DApp (CyberMed, USA) and the angle of the canal was calculated as the difference between the values obtained on the radiographs and 180 degrees.

Teeth were divided into 2 Groups: **Group 1** - 5 teeth and 8 canals, shaping of the canals was made using one Twisted Files Small Assorted set (Sybron Endo, Glendora CA, USA), which contains three instruments: 25/.08, 25/.06, 25/.04 (Fig. 1) of 23 mm length. The instruments were used after hand negotiation with K-files #10-15 and working length determination, in a crown-down technique, according to the producer's instructions. The final size for each canal was 25/.06.



Figure 1. The Twisted Files Small Assorted Set

**Group 2** - 5 teeth, 7 canals, which were instrumented using two instruments from one Twisted Files Adaptive Small (SM) set (Sybron Endo, Glendora CA, USA) 20/.04 and 25/.06 of 23 mm length (Fig. 2). Both systems were used with a dedicated endodontic motor Elements Motor (Sybron Endo).

The same irrigation protocol was used during the preparation of all teeth, alternating NaOCl solution 5.25% (Chloraxid, Cerkmamed, Poland) with 15% EDTA solution (Endo-Solution, Cerkmamed) between each rotary instrument and recapitulation with K-files#10 in patency.



Figure 2. The Twisted Files Adaptive SM Set

Postoperative radiographs were taken with the same program and the angles of curvatures were measured with the same software. Differences between the initial and final angles were calculated and the position of the curvature for each sample was recorded in a table for each Group (Tables I and II). The images of the measured values are represented in Figures 3 and 4.

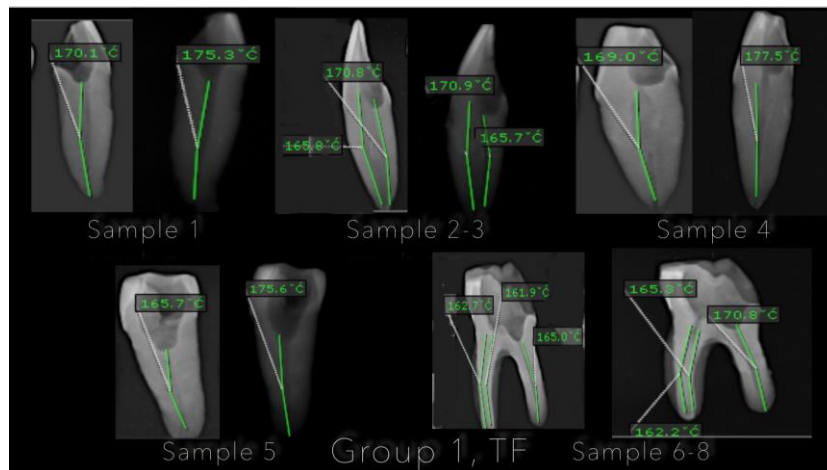


Figure 3. Initial and final angle values measured on the before/after radiographs in Group 1

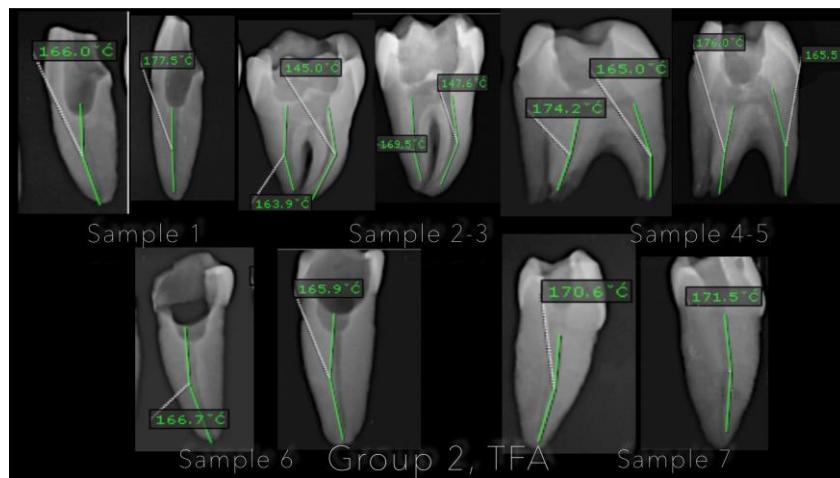


Figure 4. Initial and final angle values measured on the before/after radiographs in Group 2

## RESULTS

In Group 1, the initial curvature angle varied between 9.2 and 18.1 degrees. After preparation with Twisted Files, the reduction of the curvature's angle was observed in 6 of the 8 evaluated samples, and varied between 0.1 and 9.9 degrees (Fig. 3). In two of the evaluated samples (2 and 6) an insignificant increase of 0.1 and 0.5 degrees, respectively, was observed (Table I).

Table I. Variations of the curvature's angle in Group 1

Sample Number	Region of the curvature	Angle of the curvature before shaping with Twisted Files	Angle of the curvature after shaping with Twisted Files	Difference between angles
1	Middle third	9.9°	4.7°	5.2°
2	Middle third	14.2°	14.3°	-0.1°
3	Middle third	9.2°	9.1°	0.1°
4	Middle third	11°	2.5°	8.5°
5	Middle third	14.3°	4.4°	9.9°
6	Middle third	17.3°	17.8°	-0.5°
7	Middle third	18.1°	14.7°	3.4°
8	Middle third	15°	9.2°	5.8°



In Group 2, the initial curvature angle varied between 5.8 and 16.1 degrees. After preparation with Twisted Files Adaptive, the reduction of the curvature's angle was observed in 6 of the 7 evaluated samples, and varied between 0.9 and 11.5 degrees (Table II). In one of the canals (sample 6) an increase of 0.8 degrees was observed (Fig. 4).

Table II. Variations of the curvature's angle in Group 2

Sample Number	Region of the curvature	Angle of the curvature before shaping with Twisted Files Adaptive	Angle of the curvature after shaping with Twisted Files Adaptive	Difference between angles
1	Middle third	14°	2.5°	11.5°
2	Middle third	16.1°	10.5°	5.6°
3	Middle third	35°	32.4°	2.6°
4	Middle third	5.8°	4°	1.8°
5	Middle third	15°	14.5°	0.5°
6	Middle third	13.3°	14.1°	-0.8°
7	Middle third	9.4°	8.5°	0.9°

The highest reduction of angle was obtained in Group 1 (Twisted Files) in sample 5 (9.9°), and in Group 2 (Twisted Files Adaptive) in sample 1 (11.5°) (Fig. 5).

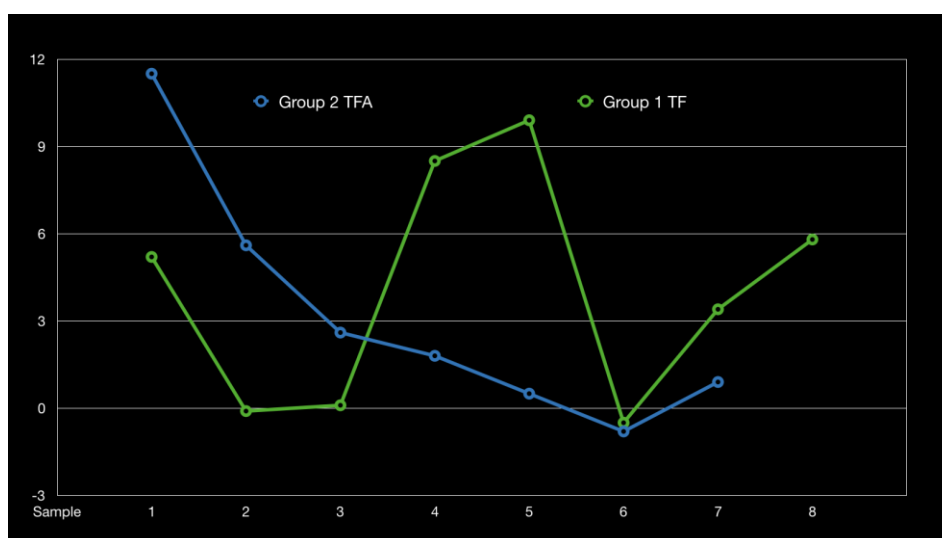


Figure 4. Graphic representation of the differences recorded between the before/after angles of the curvatures for each sample

## DISCUSSIONS

The results of the present study showed that both types of instruments respected during shaping the original anatomy of the root canals and the position of the apical foramen. The location of the curvatures in the middle third of the root did not represent a difficulty during negotiation and preparation. Because of the predictable glide path created before rotary instrumentation with hand K-files and because no curvature was encountered in the apical third, the stress on both types of instruments was reduced, so the motor used them in a complete rotational motion. When higher stress is encountered, the Twisted Files (TF) Adaptive instruments will be used in the adaptive motion, which is automatically changed by

the motors software, without the intervention of the clinician [3,9]. This did not happen during the shaping of Group 2 samples in the present study, because low stress was applied on TF Adaptive instruments.

Only one set of Twisted Files and one set of Twisted Files Adaptive were used during shaping of 8, respectively 7 canals, without instrument separation or major deformation of the files. This can be possible due to the advantage of the R-phase nickel-titanium alloy, and due to the manufacturing process of the instruments, which are twisted and not grounded by the machine [3,9].

In the present study, no instrument fractured, only slight deformations (unwinding of the flutes) were observed. This is considered to be a safety feature of these types of instruments due to the manufacturing process of the files, which explains the greater occurrence of plastic deformation before breakage and allows the clinician to avoid overuse, preventing instrument's separation in the canal during treatment [11].

Although a significant reduction of the angle was obtained in one sample for each group (Sample 5, Group 1 and Sample 1, Group 2), the results are not determined by the straightening of the root canal during instrumentation, but for both samples, the coronal reference point for the measurement was not the same in the before/after radiograph.

Moreover, the negative values recorded in three of the samples, which varied between 0.1 and 0.8°, are insignificant comparative to the initial measured angles, and they cannot be interpreted as an increasing of the canal curvature. Again, the explanation is the different position of the referring measuring point on the radiographs.

## CONCLUSIONS

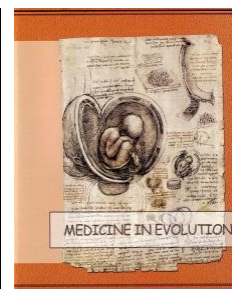
- Both systems are user friendly, with a reduced time of root canal preparation and easy sequences, even for un-experienced clinicians.
- No major modifications of the original root canal anatomy were observed; the reduction of the curvature's angles after shaping was due to the enlargement of the canals with the specific taper of .06 and size of the final instrument.
- Due to their increased flexibility, the instruments respected the initial position of the apical foramen, with no transportation and no instrument separation during the experiment.

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# Oral hygiene and consumption habits related to acidic beverages and their correlation with dental erosion and dentine hypersensitivity in 18-30 year-olds



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## Abstract

Due to the increasing availability and consumption of acidic beverages in the modern population, the problem of conditions other than dental caries has to be addressed.

Accordingly, the focus in this study is based on the correlation between acidic beverages and dental erosion and dentinal hypersensitivity in particular performed by assessing of people's general oral hygiene and current state of knowledge on this matter. Furthermore, the consumer's behavior, drinking habits or other contributing harmful factors for the oral environment will be evaluated. The participants' self-assessment and self-awareness on this topic also play a significant role and will be discussed.

Consequently, the need for further education and distribution of information about dental erosions and their development can be estimated.

**Keywords:** dental erosion, dentine hypersensitivity, acidic beverages.

## INTRODUCTION

Nowadays attention has to be raised with regards to dental erosions produced by acidic beverages because of their increased consumption throughout the recent years all over the world [1]. Acidic beverages not only have harmful effects on the general health but also on the tooth substance.

Dental erosion or erosive tooth wear is defined as the irreversible loss of dental hard tissue and particularly the dissolution of tooth mineral, such as enamel and dentin, due to acid solutions.

The term „erosion“ is derived from the latin verb „erodere“, meaning to wear or gnaw away, and is commonly referred to „the state of being worn away [...] by friction or pressure“ [2].

Dental erosion itself is regarded as a nonbacterial chemical wearing away. If the cause is unknown, the tooth loss can be referred to as an idiopathic erosion. Another synonym for dental erosion is odontolysis, which generally refers to tooth resorption [3].

Unlike common carious lesions that cause loss of tooth structure, these dental erosions occur only in the absence of plaque and do not result from bacterial involvement.

Tooth wear in general may refer similarly to erosion, abrasion and attrition. All three mechanisms result in progressive loss of tooth structure and may interact. Other than erosion, which is a chemical process, abrasion and attrition are mechanical ones [4].

Abrasive wear is produced by the interaction between teeth and other materials such as diet or abrasive brushing, while attrition refers exclusively to wear through tooth-tooth contact and can be both physiological as in the normal aging process or pathological as in parafunctional habits (i.e. bruxism).

Another mechanism of tooth wear is abfraction. An abfraction is produced by tensile stresses on the tooth causing microcracks which in turn lead to microfractures in the dental structure. Abfractions resemble erosive lesions presenting mostly wedge-shaped lesions on the gingival margin.

Dental caries on the other hand is generated by bacterial fermentation and the resulting acid destruction, thereby producing cavities on tooth surfaces.

The combination of both carious and erosive actions as well as attrition and abrasion promotes excessive decay.

Erosions are commonly observed on the cervical area of the teeth, but are also seen on occlusal surfaces and palatal surfaces of maxillary teeth.

The site of erosion is influenced by various factors. Erosive acids can be either of intrinsic or extrinsic origin.

The most important extrinsic source of acids is the consumption of acidic beverages such as fruit juices and soft drinks, but also industrial acid vapors or frequent swimming in heavily chlorinated water may have erosive effects. Diet in general plays a very important role in the maintenance of oral health, therefore acidic food such as yoghurt, fruits and vinegar as well as spicy food and heavy alcohol consumption should be taken into consideration.

There is various evidence from laboratory studies which have demonstrated the massive erosive potential of acidic beverages.

Erosions should be taken seriously because they may cause dentin hypersensitivity, altered occlusion and poor aesthetics as they proceed unnoticed and are left untreated. Once formed, erosions may aggravate carious activity, offering already demineralized weakened tooth structure.

Dentinal hypersensitivity itself may occur from various factors. Generally, it can be stated that it arises from exposed dentinal surfaces, which can be a consequence of erosive wear.



True dental hypersensitivity is characterized by short, sharp pain arising from exposed dentine in response to stimuli, typically thermal, evaporative, tactile, osmotic or chemical and which cannot be ascribed to any other dental defect or pathology [2].

Particular attention should be paid on the effects of acidic beverages on teeth, because of the numerous range of soft drinks and fruit juices on the market and people's drinking habits consuming them. People nowadays seem to be well aware of the sugar content in their food and drinks but do not pay attention to other harmful substances such as acids.

### *Aim and objectives*

The aim of this study is to assess the relationship between the participant's intake and consumption patterns of acidic beverage, their oral hygiene and their knowledge about the consequences on dental tissues such as erosions and dentinal hypersensitivity.

Connections between the participant's consumption and oral hygiene patterns are established taking into account their general knowledge and approach on this issue.

The consumer's attitude towards this topic, drinking habits as well as other contributing factors are assessed. Self-awareness of oral hygiene is also evaluated.

## **MATERIALS AND METHODS**

### **Data collection**

#### *Inclusion criteria:*

The participants chosen for the study were 18-30 years old European young adults and adolescents, male and female, all presenting their own teeth with or without prosthetic restorations (dental fillings, crowns, bridges, inlays/onlays, implants), but without edentulous areas and/or removable dentures. This age range was chosen because it was assumed that adults this age are fully aware of their oral health and able to provide a sufficient self-evaluation. Before receiving the questionnaire, they were asked for their consumption of acidic drinks in the first place and for their willingness to participate in the study. The probands had to be in a healthy physiological and psychological condition in order to answer the questionnaires appropriately.

The addressed group was supposed to be as unbiased as possible in order to obtain valuable and conclusive results from a diverse range of people. Gender and race did not play a significant role.

#### *Exclusion criteria:*

Young adults or adolescents who stated to exclusively drink non-carbonated and non-acidic beverages, the ones wearing a removable partial or complete denture, as well as the ones who showed an uncooperative attitude were excluded from the study.

The participants showed no previous known connection to professional dental education such as university students, doctors, dental technicians or assistants in the medical field.

The questionnaires were available in two languages, English and German, according to the adolescent's preference and speech comprehension. All the questionnaires were fulfilled anonymously.

The questions were structured in a consecutive order. The evaluation started with general questions about oral hygiene, i.e. regularity of dental check-ups, brushing frequency, type of toothbrush and additional hygiene products, followed by potential dental discomfort (sensitivity) and ultimately specific questions about the types of acidic beverages, drinking habits and their self-estimation about their consumption. For further information the participants were able to ask questions themselves during the interview.

All the answers were counted and converted into a representative percentage amount for comparative reasons.

For this statistical retrospective study, a target population of 50 participants was asked to complete a structured questionnaire containing 20 personal questions regarding their consumption behavior including type of acidic beverages, frequency, habits as well as questions about their knowledge concerning dental erosions and their self-assessment of their general oral hygiene. The interviews took place in public buildings in Germany and Romania in dental clinics and in the university.

The data was collected within one year starting from January 2017 until January 2018.

## RESULTS

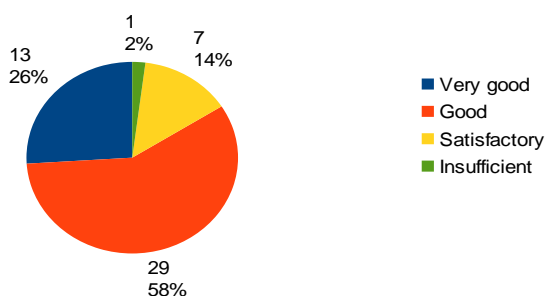
The results of the 50 questionnaires with 20 questions each are presented in the following part. The diagrams to the corresponding questions were selected and only the most representative ones are shown. The answers were counted and are represented in a percentage proportion.

For the first question it had to be stated by the participants how often they visit their dentist. The majority of the participants (34%) specified that they visit their dentist regularly (every 6 months), directly followed by the ones who visit once a year (30%) and the ones who go only when pain is present (26%). Only a small minority of 10 percent presents a frequency of trimestrial or more often regular check-ups.

Concerning the self-evaluation of their oral hygiene, most participants considered it to be „good” (58%), followed by the statement „very good” (26%). A slight minority regarded their hygiene as „satisfactory” (14%) or even „insufficient” (2%).

Graphic 1 gives a representation of the chosen answers.

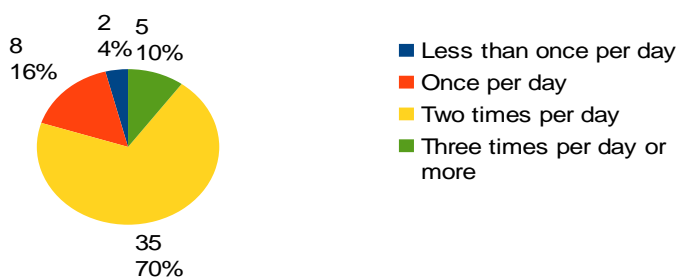
How do you consider your oral hygiene?



Graphic 1. Self-assessment of oral hygiene

The question of the tooth brushing frequency was answered with „two times per day” by a greater part (70%). The remaining people brush their teeth „once per day” (16%), „three times per day or more” (10%) or even „less than once per day” (4%). In Graphic 2 the brushing frequency is evidently depicted.

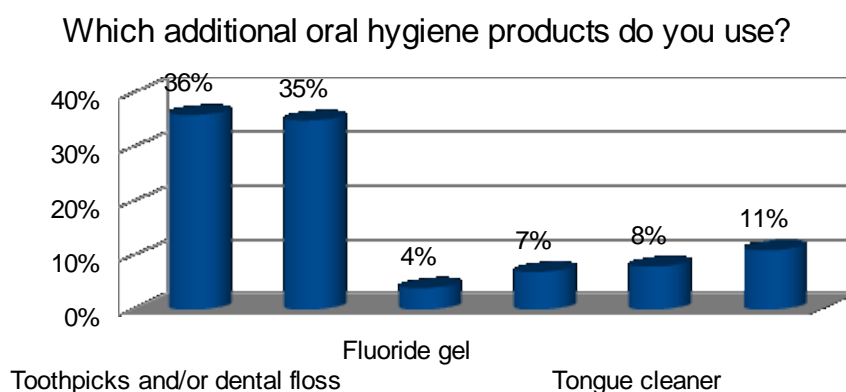
How often do you brush your teeth?



Graphic 2. Frequency of tooth brushing

Toothbrushes with medium bristles are preferred by many people (42%) but also the use of an electrical toothbrush was very common (40%). Less people choose the soft bristles (22%) or even the hard ones (4%).

The participants also had to state which additional hygiene products they use. They were allowed to give multiple answers. The most frequently used products were dental floss and/or toothpicks (36%), directly followed by mouth rinse (35%). Other products were tongue cleaners (8%), interdental brushes (4%) and fluoride gels (4%). A total number of 11% claimed not to use any additional oral hygiene products. Graphic 3 shows a representative diagram of the used oral hygiene products.



Graphic 3. Usage of additional oral hygiene products

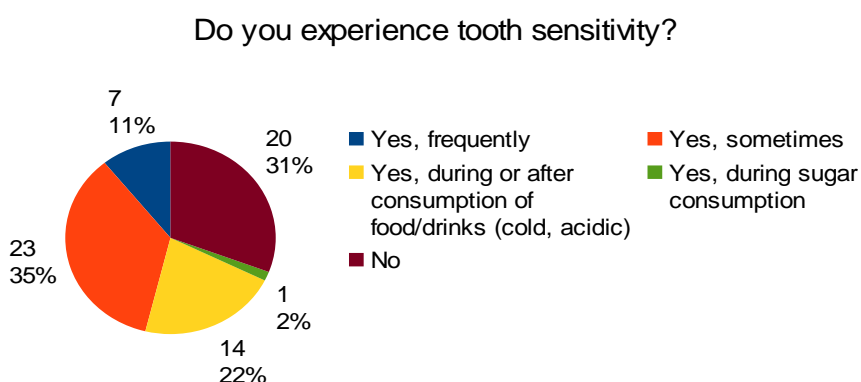
Afterwards they were asked to indicate if they suffer from dentinal hypersensitivity.

Most people say that they experience hypersensitivity occasionally (46%), some few people even often and ultimately another major part does not experience any hypersensitivity (40%).

The given affirmative answers could be specified into „Yes, frequently“ (11%), „Yes, sometimes“ (35%) and „Yes, when consuming acidic or cold drinks“ (22%).

The answers are shown in Graphic 4.

There was also the possibility to determine other conditions, one person listed dentinal hypersensitivity linked to sugar consumption.



Graphic 4. Experience of tooth sensitivity

Following the questions about oral hygiene, the questions now focus on acidic beverage consumption and habits.

The responses show that 34% of the probands consume acidic beverages such as soft drinks, fruit juices or carbonated drinks in general. Another great part of 30% consume them

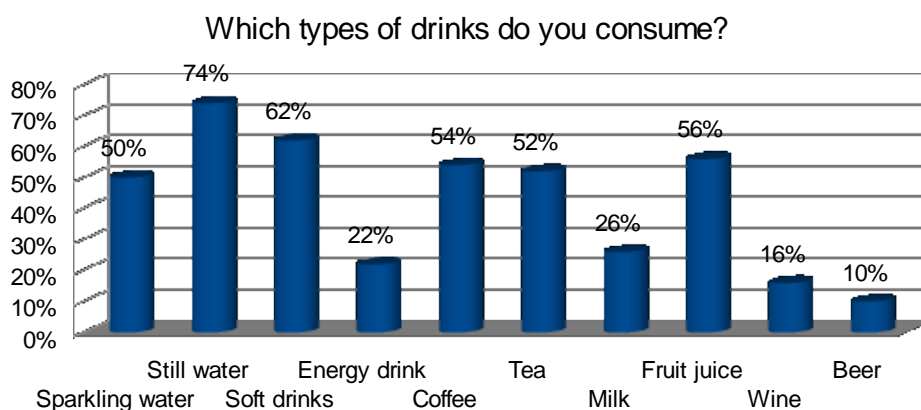
at least 4-5 times per week. A frequency of 2-3 times per week is seen in 14%, while 16% stated only once per week and 4% even once per month or less.

The types of beverages were investigated as well with multiple possible answers.

Out of all participants, most people drink still water (74%), which is directly followed by soft drinks with 62%. Also very common drinks are fruit juice with 56%, coffee with 54%, Tea with 52%, sparkling water with 50%. Less common drinks are milk (26%), energy drinks (22%), wine (16%) and beer (10%). The types of acidic beverages are presented in Graphic 5.

In general, the participants stated that they prefer still water (64%) over water with carbon dioxide (36%).

It also became obvious that overall regular soft drinks are consumed (62%), being aware that they contain sugar, compared to the corresponding light products which only contain sweeteners (38%).



Graphic 5. Types of acidic beverage

The reasons for drinking acidic beverages over non-acidic ones were assessed as well. For 70% of the people the taste is the most important cause, followed by the feeling of refreshment (60%), the feeling of carbon dioxide in the mouth (42%), group affiliation (20%) and accessibility (14%). Only 2% choose the drinks because of advertisement and another 2% declare a certain dependency.

The drinking habits were investigated next. 64% of the people drink their drink slowly, sip by sip, while 34% prefer to drink the whole drink directly. Furthermore 18% like the usage of a straw and thereby avoid contact with the teeth. Only a small number of 6% like to keep the drinks longer in the oral cavity and swill them.

The probands were also asked if they suffer from some conditions that might favour erosive dental lesions. A total number of 28% experiences gastroesophageal reflux or frequent vomiting, another 10% has a history of xerostomia and 18% suffers from bruxism of the teeth. 54% stated that they do not suffer from any of the aforementioned conditions.

Regarding a healthy diet, 60% of all the participants consider themselves to have one, while 40% do not.

Almost two thirds (66%) think that acidic beverages have an impact on their oral health, while the remaining third (34%) does not think that.

90% of the participants do not brush their teeth after the consumption of acidic beverages, 10% states that after 30-60 minutes the teeth are brushed. No participant brushes directly, meaning 0-30 minutes after drinking.

The participants responses to the question about the correlation between soft drinks or juices and oral health show wide-ranging results. Answers ranged from no knowledge at all to detailed responses.

The answers were categorized into various groups, similar answers were united to one representative answer.

26% of the probands stated to know that acid attacks the teeth or the enamel. 20% gave similar, but more vague responses like knowing that it can have an „unhealthy effect“ or is „unhealthy“, „bad for the teeth“ or could result in „damage to the teeth or oral health“.

6% were aware of resulting dental erosion or at least „degradation of the enamel“, while another 6% answered with „tooth sensitivity“. A minority of 4% wrote that caries will develop.

More specific answers were given as well. The given single answers about their knowledge about the correlation are listed:

„Disturbance of the acid-base balance“, „Acid attacks teeth only when general oral hygiene is bad“, „Sugar in combination with acid attacks the teeth“, „A higher risk for caries“, „Severe damage to the gingiva and teeth with regular daily consumption“, „Sugar in combination with acid attacks the teeth more“, „Teeth are only attacked when the general oral hygiene is bad“, „Teeth become sensitive, carious develops, enamel is broken down“, „Acidic drinks promote the formation of plaque“, „Discolorations“ might occur, „Acid leads to a higher vulnerability of the enamel“.

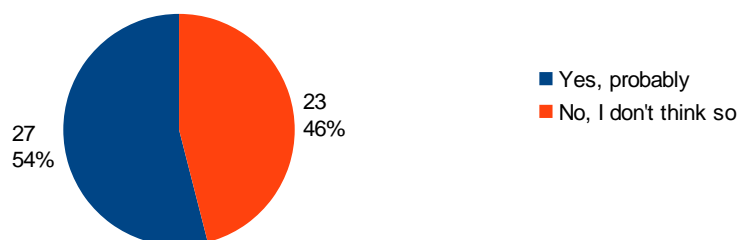
6% mentioned that acidic drinks are not healthy.

Almost half of the people (46%) stated to know nothing about it or were not sure to have sufficient information.

Information about this was mostly transmitted through the dentist (52%), the school (24%), family (30%) or by own experience (22%). Other sources consisted of advertisement or booklets (6%). 22% did not receive any information at all.

The term „dental erosion“ itself was known by only 34%, while 66% were not familiar with it. More than half (54%) of the people would reconsider their consumption of acidic beverages after receiving more information about it, only 46% states that it seems unlikely for them to do so. A diagram showing these ambivalent answers is represented by Graphic 6.

or your acidic beverage consumption if you received specific information about



Graphic 6. Reconsideration of acidic beverage consumption

## DISCUSSIONS

Treatment of dental erosion depends highly on the severity of the lesion and ranges from preventive measures to fixed or removable prosthodontic management. Single teeth as well as whole dental arches may be necessary to be restored.

Preventive treatment of erosions or prevention of further damage in the case of already existing erosions are of major importance.

The etiology and current activity of erosions should be established in order to determine a suitable approach since this may differ in each individual case. For this purpose, the patient's dental, medical, social and dietary histories have to be taken into account.

Fluoride administration seems to be a very important factor in the prevention of erosions. Fluoride minerals aid in the remineralization of enamel by exchanging natural hydroxyapatite with the more acid-resistant fluorapatite crystals. This process can be realized through systematic or local administration. Public water supplies often contain added fluoride for better dental health, mainly aimed at the improvement of dental caries incidence.

The World Health Organization (WHO) recommended a level of fluoride from 0.5 to 1.5 milligrams per liter (which also depends on other local, environmental or climate factors) [5]. Fluoridated milk, salt and tablets are also common sources for additional intake.

Benefits from fluoride can be obtained by local administration on enamel, which is achieved through use of fluoridated toothpastes, mouthrinses, gels and varnishes. Since most toothpastes already contain fluoride nowadays, the level of administration may need to be increased by prescribing toothpastes with a higher concentration.

Due to the fact that diet is a common cause of erosions, patients have to be aware of its impact on teeth and may need to modify their dietary lifestyle and habits and potentially receive nutrition education [6,7]. Consumption of highly sugared and acidic foods and drinks should be minimized just as the exposure time to the teeth. Regarding drinking habits, acid beverages should not be swished around in the oral cavity and the use of a straw is recommended to avoid teeth contact as much as possible. Anyway, plain water and milk are preferred over soft drinks etc. because of their almost neutral pH value [8].

There should not be too many meals throughout the day in order not to have constant alterations of the oral pH value. Teeth should not be brushed for at least one hour after consumption of food, since this time is needed to restore oral pH and remineralize the teeth.

Hydration of the body has to be ensured especially in patients with reduced salivary flow as in xerostomia. They are also advised to stimulate their salivary flow by chewing sugar-free gum, preferably with xylitol, which aids in maintenance of a neutral pH and prevents accumulation of bacteria on the teeth.

Generally, additional impacts on teeth such as abrasive forces should be avoided and non-abrasive toothpastes as well as soft toothbrushes are advised in softened enamel. A splint or mouthguard is useful in prevention of further damage due to bruxism.

To replace structural loss, restorative measures can be performed based on its extent and location.

If minor lesions are present and the teeth are considered to be esthetically compromised, adhesive tooth bonding with tooth-colored resin material represents a convenient method to improve the appearance.

In the case of exposed dentine, the surface can be covered with bonding agents to ensure protection of dentinal tubules and reduce hypersensitivity. Acid-protective barrier layers can as well be established by application of resin coatings, adhesives or fissure sealants. Fluoride gel or varnish can also aid in desensitizing treatment [9].

More invasive and severe lesions may be restored with conventional fixed or removable prosthodontic dentures such as veneers, inlays, onlays, crowns, bridges and partial or complete dentures if teeth are unrestorable and subsequently lost. Thus, esthetic demands can be fulfilled and functional benefits such as favorable occlusion and mastication or the reproduction of an adequate vertical dimension of occlusion (VOD) can be provided.

A multi-disciplinary approach is often needed. Patients with gastroesophageal reflux disorders such as GERD and Bulimia nervosa, but also for example bruxism related to psychological issues should be referred to other medical disciplines. Patients may consider nutrition counseling if there is evidence or a high probability that food and drinks are the main etiologic factors in the development of dental erosions. The dental practitioner has to monitor the existing lesions carefully in regular check-ups and perform preventive measures just as provide information to the patient.

The success of the treatment greatly depends on the compliance and cooperation of the patient.

However, the best solution is the prevention of erosions in the first place. Patients should be well informed about extrinsic and intrinsic causes of erosive impacts on teeth.



In general, they need to be more aware about nutrition and its effect on oral health. It seems that people nowadays know about sugar in their diet and associated caries, but did not receive sufficient education about acids and its consequences on their dentition.

Since dental erosions prevalence is increasing steadily nowadays in the modern population, it has to be correctly addressed [10].

The outcome of this study about the correlation of acidic beverages and oral health raises attention because significant conclusions may be drawn from the obtained information.

Although a minority of people were aware of the fact that acid can cause negative effects on the teeth and attacks the enamel, in general it can be stated that the majority did not receive enough information on this topic. Still almost half of the participants did know little or anything about the correlation or did not even know if a correlation exists after all. Some people believed that acid leads only to caries.

Compared to a similar study conducted in Oslo, Norway in 2013 with 18 year-olds, a greater majority of 88% was aware of dental erosive wear. Patients who presented erosive wear had less positive attitudes regarding a reconsideration of their consumption [11].

Taken into consideration the present results from this particular study, one can conclude that there is a backlog demand for specific information in this area.

The majority of the participants did not know about dental erosions. This indicates that there is need for oral hygiene education promotion by medical institutions or schools.

People should be given information to counteract the acid effects on teeth by further oral hygiene measures.

Still people seem to be aware of the susceptibility to caries in general and a certain enamel predisposition.

Interestingly, soft drinks were almost as frequently consumed as still water, which may lead to the conclusion that a high dependency among people might exist. This assumption can be validated by a study by Gambon, Brand and Veerman from 2012 which proves the continuously increasing consumption of soft drinks in developed countries [1].

The investigation of soft drink consumption in another study from 2014 showed a high association between this and general oral health and concludes an inferior general oral health with high consumption [10].

## CONCLUSIONS

In general, the oral hygiene of the participants can be regarded as good. The majority considers their oral hygiene as good (58%) and brushes twice per day (70%), followed by a frequency of once per day (16%).

The consumption behavior nevertheless and possible resulting hypersensitivity showed less favorable results. Among all participants 60% suffer from dentine hypersensitivity either sometimes (14%) or frequently (46%), out of which 28% suffer during or after the consumption of acidic or cold beverages. Hence, the overall consumption has to be minimized for oral health reasons.

It can be stated that the majority of the participants of this study know about some harmful effects on the dental tissue, but do not know the exact mechanism. Generally, there is a lack of information concerning this topic.

Slightly more than half of the probands would reconsider their consumption of acidic beverages. There seems to be further need for education and distribution of information concerning dental erosion and hypersensitivity among consumers.

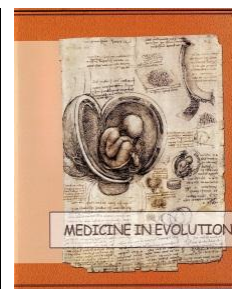
Prevention measures might have to be more promoted by medical institutions.

Further studies and interrogations on this topic are desirable as well.

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# Platelet-rich fibrin - an autologous alternative in osseous regeneration after cystectomy



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## Abstract

Platelet-rich fibrin (PRF) created by Choukroun's protocol concentrates most platelets from a blood harvest into a single autologous biomaterial. However, no current data is available concerning the use of PRF for the treatment of follicular cyst. A case of a large mandibular follicular cyst was reported. After cyst enucleation, the bony defect was grafted using PRF clots and a membrane of PRF was applied to serve as a membrane over the grafted defect. Recall showed completely healing of the bony defect, one year after surgery. These results suggested that PRF may be beneficial to enhance bone regeneration.

**Keywords:** platelet-rich fibrin; follicular cyst; tissue regeneration

## INTRODUCTION

Cystic lesions of the mandible are primarily ellipsoid, radiolucent, and clearly demarcated and may be odontogenic or nonodontogenic (1). The follicular cyst is the most common type of noninflammatory odontogenic cyst and the most common cause of a pericoronal area of lucency associated with an impacted tooth. The most important features of this cyst are its ability to expand asymptotically and its potential to resorb adjacent bone (2).

The second-generation platelet concentrate - platelet-rich fibrin (PRF) was widely tested in oral and maxillofacial surgery, as surgical adjuvants for the local release of platelet growth factors into a surgical or wounded site, in order to stimulate tissue healing or regeneration (3).

This case report presents an effective use of PRF in treatment of a follicular cyst with large bony defect in mandible.

## CASE REPORT

A 23-year-old male patient attended the clinic complaining about an painless swelling in right side of his mandible for a couple of months. The swelling was tender on palpation and measuring 3.5 cm × 4 cm on right mandibular angle region. Orthopantomograph revealed a deeply impacted 48 associated with a large unilocular radiolucency extending to the lower border of mandible, resorbing considerable amount of bone in the region, with lingual cortical bone losing its integrity 48 (*Figure 1*). The lesion was provisionally diagnosed as follicular cyst.



Figure 1. Radiography showing large cystic lesion involving right mandibular angle region

Cystectomy combined with removal of 46, 47 and 48, followed by placement of autologous PRF as a surgical adjuvant, was planned under general anesthesia. After explaining the associated risks and benefits, the patient accepted the treatment, though he was informed that it was not a routine procedure.

Extraction of 46 and 47 was done. Cystic site was exposed through intraoral approach and cystic lining was enucleated. Impacted 48 was removed (*Figure 2*).

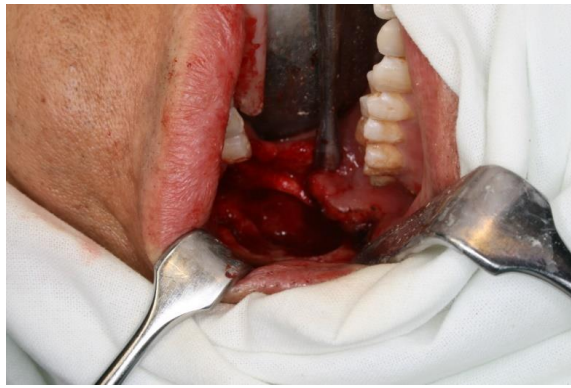


Figure 2. Intraoral view after cystectomy and extraction of 46, 47 and 48

A sample from patient's peripheral blood was collected immediately after venous stasis in four sterile Vacutainer tubes without adding anticoagulant and immediately placed in a preprogrammed centrifuge. The Vacutainer tubes were then centrifuged for 8 minutes at the speed of 1300 rpm (*Figure 3*).



Figure 3. Vacutainer tubes in the preprogrammed centrifuge

The PRF clots (*Figure 4*) was placed in the bone defect and a membrane of PRF was applied to serve as a membrane over the grafted defect (*Figure 5*). Hemostasis was achieved and primary closure was done using sutures.

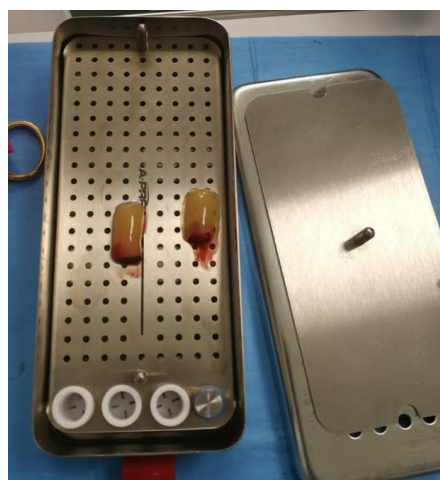


Figure 4. Platelet-rich fibrin clot placed in the A-PRF box



Figure 5. PRF membrane placed

The excised mass was submitted for histopathological examination. Histopathological features were consistent with the clinical diagnosis of follicular cyst. Sutures were removed after ten days. The patient was kept under regular clinical follow-up. After one year of follow-up, oral and radiological examination revealed complete bone healing.

## DISCUSSIONS

Follicular jaw cysts can grow undetected, and thus cause significant bone wounds. Cystectomy is an extirpation method, relying on the removal of the lesion, with consequent healing of the wound, when the cyst is surrounded by bone tissue on every side (4).

Platelets are involved in the process of wound healing through blood clot formation and release of growth factors promoting the healing (5).

The primary objective in healing of surgical wound with large bony defect is the bone regeneration inside the defect to fill the cavity. Various surgical adjuvants used to get best possible clinical results include materials such as autologous bone, allograft, xenograft and alloplastic materials (6).

In the present case, bone grafting was not done with the assumption of high healing potential of the young age. Many growth factors such as platelet-derived growth factor and transforming growth factor are released from PRF (7). Its use in promoting the healing of surgical wound with large bony defect was reported as surgical adjuvant along with bone graft biomaterial, offering several advantages including bone growth and maturation, graft stabilization, wound sealing, and hemostasis (8). PRF can serve as a resorbable membrane, which can be used in reconstructive surgery to cover bone augmentation site (9). Also PRF membrane can cause better proliferation of human periosteal cells thereby enhancing bone regeneration (10).

Thus, application of PRF as a surgical adjuvant yields new possibilities of enhanced bone defects healing, at least as good than other regenerative materials. However, with the clinical use of PRF as surgical adjuvant, more clinical and histologic studies are required to authenticate its stimulating effect in bone healing.

## CONCLUSIONS

On the basis of the results obtained in our case report, we hypothesize that PRF is an effective barrier membrane over large bony defects. Future human randomized clinical studies evaluating the role of PRF during hard tissue bone regeneration remain necessary.

### *Authors contribution*

All the authors equally contributed to this work.



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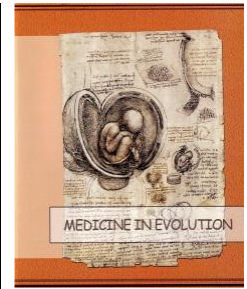
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