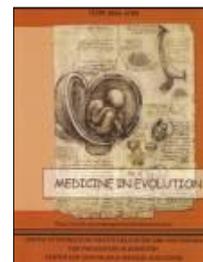


# ASSESSING EFFECTIVENESS OF CONTAINMENT AFTER FIXED ORTHODONTIC TREATMENT WITH PERIOTEST

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D. JUMANCA<sup>1</sup>, A. GALUSCAN<sup>1</sup>, A. C. PODARIU<sup>1</sup>, R. OANCEA<sup>1</sup>,  
R. SAVA-ROȘIANU<sup>1</sup>, R. A. POPOVICI<sup>1</sup>

1. Department of Preventive, Community Dentistry and Oral Health, Faculty of Dentistry, University of Medicine and Pharmacy "Victor Babeș" Timișoara

## ABSTRACT

After completion of fixed orthodontic treatment and removal of brackets, a period of several months is indicated for consolidation of results and preventing rebounds. During the period of treatment, teeth become mobile due to the applied forces. The assessment of dental mobility at the end of the orthodontic treatment and at the completion of the containment period and the comparison of results with the initial values offer information on the state of the tissues beneath displaced teeth. Thus, we may achieve a safe and longlasting orthodontic treatment.

The **purpose** of this study was to measure dental mobility at the time brackets were removed and further at the end of the containment period in order to assess the decrease of dental mobility. At the same time, a comparison was intended between fixed and removable contention.

**Material and method:** the study was performed on 48 patients aged between 14 and 26 years: 33 female and 15 male patients. At the time brackets were removed, dental mobility was assessed by Periotest (Ti). Measurements were performed on the 4 upper and 4 lower incisors. Patients were randomly classified into 4 groups of 12; each group benefited from a different type of contention. A 6 months contention period followed at the end of which dental mobility was again assessed (Tf).

**Conclusions:** Following the measurements we concluded that the degree of dental mobility decreased in all cases but patients who benefited from fixed contention had lower values at the end of the 6 months period.

**Key terms:** tooth mobility, orthodontics, retention, Periotest.

Correspondence to:

Jumanca Daniela  
Address: Department of Preventive, Community Dentistry and Oral Health, Faculty of Dentistry - University of Medicine and Pharmacy "Victor Babeș" Timisoara, Spl.T. Vladimirescu no.14A  
Phone: 0040-256-204950  
e-mail adress: proiectetm@yahoo.com

## INTRODUCTION

In order to move teeth into the chosen direction, during the fixed orthodontic treatment forces are applied on dental crowns. These forces are further transmitted to the dental root and then to the supporting tissue of the tooth: the periodontal space, periodontal ligaments and the alveolar bone. This way, the periodontal ligaments and the bone tissue around the tooth to be moved are being reshaped: a resorption process in the pressure area and an apposition in the traction area take place, respectively. In tissues subjacent to the tooth subjected to the applied force physiological and biochemical processes occur. During the first stage, immediately after application of the force, dental movement is stopped due to the occurrence of a tissue necrosis area. The tooth displacement through the subjacent bone starts only after removal of the necrotic tissue through phagocytosis by macrophages and osteoclasts. In the second stage, the dental displacement occurs in four steps: first, an increase in the tension of the fundamental substance of the periodontal space occurs, accompanied by an increase of the capillary blood pressure in the periodontal ligaments and in the subjacent alveolar bone.

Then, the deformation of cells in the tissues adjacent to the tooth occurs. As a reaction to cell deformations the activation and differentiation of fibroblasts and osteoblasts in the periodontal ligament, as well as of the osteocytes in the alveolar bone occur.

The last step is reshaping. This involves an association between the re-

shaping of periodontal ligaments and localized resorption and apposition processes of the alveolar bone. All these changes will prevent a future dental displacement. The osteolysis phenomenon under the action of osteoclasts is entirely initiated after 72 hours and for regeneration with the help of osteoblasts a 90 days period is required. After that, another period of several months is indicated for stabilizing the results and preventing rebound.

As long as the forces acting upon the tooth are kept within certain limits, the osteolysis and regeneration phenomena alternate, the tooth movement is under control and the supporting tissue regenerates. If the intensity of the force increases or the intervals needed for regeneration of the periodontic space are not provided, dental mobility increases.

The fact that during orthodontic treatment dental mobility increases is well known but it returns to the initial values after termination of the contention period. The assessment of dental mobility at the end of the orthodontic treatment and at the end of the contention period and the comparison between tested values and initial values provide information on the state of the tissues subjacent to displaced teeth. Thus, we may achieve a fixed orthodontic treatment with stable, longlasting results. In this study we measured dental mobility at the moment brackets were removed and at the end of the contention period in order to assess the state of the periodontal tissues and to decide which type of contention led to the best results.

## MATERIAL AND METHOD

In this study we included 48 patients aged between 14 and 26 years, 33

female and 15 male patients. All these patients were in the final phase of fixed

orthodontic treatment for both upper and lower dental arches. These cases were selected from patients with a good general status, without metabolic diseases and without periodontal diseases before or after fixed orthodontic treatment, without traumatism of dental-alveolar arches and who kept an adequate oral hygiene throughout the entire duration of the treatment. During the initial stage they had all types of dental maxillary abnormalities, all being treated by "straight wire" technique, the treatment being made by use of metal or ceramic brackets (simple or self-bonding) according to individual choice. During the treatment, a correct functional occlusion, supported by a healthy periodontium, but also an improvement of the esthetic aspect were pursued. The total duration of the orthodontic treatment was between 16 and 31 months, depending on the severity of the dental-maxillary disorder, the mean duration being 23.5 months. All throughout the treatment, accent was put on patient motivation for an adequate oral hygiene in order to maintain the integrity of dental-periodontal tissues. Professional dental cleaning was done every three months (Boyd and Baumrid 1992) or even more often in certain cases.

Immediately after brackets debonding, dental mobility was measured with the aid of the Periotest device. In this study we selected the four upper and the four lower incisors, this initial stage being marked as Ti. In order to obtain values as accurate as possible, each tooth was measured 3 times and the mean value was considered. A 6

months contention period followed, after which the mobility of the four upper and lower incisors was again measured; this final stage was marked as Tf. Measurements were performed by the same orthodontist in order to avoid possible deviations.

For monitoring tooth mobility we used the Clasic Periotest device (*Medizintechnik Gulden*). This device allows the early detection of periodontal reaction when routine examination does not reveal changes in the periodontium. During the orthodontic treatment, important changes in the tissues adjacent to displaced teeth are well known and radiographical checks do not always offer conclusive information. This device may be successfully used not only in orthodontics but also in implantology, periodontal surgery, etc. because measurements are simple, conclusive and reproducible. Also, the effectiveness of prophylactic measures can be monitored (scaling, oral hygiene lessons) without using radiographs during the treatment. The functioning principle of the device is electromechanical: the tip of the piece (electrically powered) transmits electronic impulses which percutate the dental surface 16 times in 4 seconds. The tip of the device has a very sensitive pressure sensor which records the duration of contact with the tooth. The more mobile the tooth, the longer the contact duration and the higher the recorded values. Stable and well implanted teeth give low contact times, meaning low values on the screen of the periotest. Recordable values by Periotest (from - 8 to +50) are given in table no. 1.

**Table 1.** Values recorded by Periotest are closely connected to the degree of dental mobility:

Degree of dental mobility	Periotest recorded values
0	-8 - +9
I	+10 - +19
II	+20 - +29
III	+30 - +50

In order to be sure to obtain real values, the Periotest must be correctly positioned in terms of distance from and inclination to the tooth. It is recommended that the patient adopts a standard seated position. The hand piece is maintained in a horizontal position, perpendicular on and in the centre of the tooth ( $\pm 20^\circ$  deviations are acceptable). For certainty reasons, more measurements are performed on the same tooth with the patient maintaining the same position. During measurements, maxillar and mandibular teeth must not come into contact with one another; the mouth must be slightly open. The tip of the piece is positioned a 0.7 - 2 mm from the dental surface, avoiding direct contact which might lead to erroneous results. With each impulse which can be evaluated a sound signal is heard. Thus, the clinician is warned if the hand piece is in an inadequate position (high tone), and if out of the 16 impulses less than 4 are conclusive, the obtained values will not be shown on the display and the procedure must be repeated.

Contention was maintained for 6 months. In order to decide on the most

effective contention variant, we classified the patients into four groups of 12 as follows:

- in the first group, contention was performed with the aid of mobile orthodontic appliances (palatal and lingual plate) which were worn during the night (around 8 hours) but also during the day around 2 - 3 hours;
- in the second group, contention was achieved by the use of mouthguards which were worn during the night for around 8 hours;
- in the third group, contention was achieved with glass fibre bands stuck with photopolymerizable composite flow on the palatal and lingual dental surfaces, respectively, in between canine teeth;
- in the fourth group, contention was achieved with laboratory made metal wire retainers, individually tailored for each case and cemented with photopolymerizable composite flow on the palatal and lingual dental surfaces, respectively, in between canine teeth.

## RESULTS

Following measurements, no significant differences were detected between right and left hemi-arches. Table no. 2 shows the values obtained with Periotest measurements in the group of 48, 33 female and 15 male patients.

In each and every case, the values measured at the final stage, Tf, were lower than those measured at the initial stage, Ti, which confirms the fact that the contention period was beneficial for stabilizing the results of the fixed orthodontic treatment and for decreasing dental mobility. In most cases, a decrease of dental mobility from grade I to grade 0 was obtained.

The results recorded for female and male patients are approximately the same; still slightly higher values were observed in the female gender.

Comparing the results obtained in maxillary incisors, the values recorded for the central incisor are lower than those obtained for the lateral incisor, which is concordant with the different dimensions of the two incisors.

In mandibular incisors, the recorded values for the lateral incisor are slightly lower than those of the central incisor, being also concordant with the different dimensions of the two incisors.

The lowest values were recorded in patients of the third and fourth group who benefited from fixed contention with glass fibre bands and retainers. These values indicate that by fixed con-

tention bone and periodontal tissue regeneration after tooth displacement occurring during fixed orthodontic treatment are more effective if treated teeth are immobilized.

**Table.2** Values obtained with Periotest measurements in the group of 48, 33 female and 15 male patients.

	Ti		Tf	
	female	male	female	male
UCI l.	11,7±2,8	11,3±3,2	9,8±3,5	9,8±3,1
r.	11,7±2,9	11,2±3,3	9,6±3,3	9,7±3,2
ULI l.	12,3±3,1	12,1±3,2	9,7±3,5	9,2±2,8
r.	12,2±3,5	12,1±3,3	9,6±3,5	8,9±3,7
LCI l.	13,5±3,9	13,2±3,8	9,8±3,2	9,4±3,8
r.	13,7±3,5	13,1±4,0	9,7±3,3	9,5±3,5
LLI l.	12,8±3,5	11,5±2,8	9,2±2,5	8,5±3,3
r.	12,7±3,1	12,1±2,7	9,3±3,1	8,7±3,1

## CONCLUSIONS

With the aid of the Periotest device, bone regeneration after orthodontic treatment can be easily measured and monitored.

Following this study, we concluded that a 6 months contention period after finalizing the fixed orthodontic

treatment is sufficient to consolidate the results and to decrease dental mobility.

All the four contention methods tested gave good results but the most effective remains fixed contention with dental inter-canine immobilization.

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