

PRACE ORYGINALNE
ORIGINAL ARTICLES**THE EVALUATION OF TEETH LOOSENING OF THE UPPER JAW
IN ADAPTIVE PERIOD OF ORTHODONTIC TREATMENT BY BRACES****OCENA ROZLUŻNIENIA UKŁADU ZĘBOWEGO SZCZĘKI W OKRESIE
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HIGHER STATE EDUCATIONAL ESTABLISHMENT OF UKRAINE "UKRAINIAN MEDICAL STOMATOLOGICAL ACADEMY", POLTAVA, UKRAINE**ABSTRACT****Introduction:** Tooth loosening is divided into physiological and pathological one, but there is tooth loosening that occurs during orthodontic treatment (OT) and depends on the tissues of parodontium and strength of orthodontic apparatus.**The aim** of the research is to evaluate teeth loosening of the upper jaw during adaptive period in patients with permanent bite who were treated by braces.**Materials and methods:** Periotometry (device «Periotest») of teeth to 30 patients who are from 14 to 27 years old with the pathology of the first type based Angle's classification. The evaluation of teeth loosening was done before OT, in 1 month, in 3 months and in 6 months.**Results:** The average index of teeth loosening before OT in patients included $3,08 \pm 1,29$, so it corresponded to norm indices. In 1 month after braces fixation indices of tooth loosening were increased. Middle index of teeth loosening on the third month of OT was $5,84 \pm 0,77$ relative units, that in 1,9 times more than periotometric indices before OT.**Conclusions:** Changes of teeth loosening during OT by braces during the first month after fixation. It should be noted that during the first month of OT data of periotometry determine the enlargement of teeth loosening of all teeth in 1,38, in 3 months there is decrease of teeth loosening for all types of teeth. On the 6th month of OT indices of teeth loosening continue decreasing but with lesser intensity and not achieve such level which was to the beginning of OT.**KEY WORDS:** orthodontic treatment, adaptation, periotestometry, "Periotest"

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INTRODUCTION

Tooth loosening is divided into physiological and pathological one, but there is tooth loosening that occurs during orthodontic treatment (OT) and depends on the tissues of parodontium and strength of orthodontic apparatus.

In dental clinic there are such types of diagnostic treatment as electroodontodiagnostics, gnathodynamometry, reoparodontography, periotometry [1, 2, 3].

Periotometry is the evaluation of supporting tissues of tooth and their functional possibilities by the device «Periotest» [4], which is widely used in dentistry and measures the reaction of parodontium by microcomputer tooth percussion [5, 6, 7]. Results of periotometry determine the condition of parodontium health which is biophysical volume such as blood pressure [8], that is why this type of evaluation of tooth loosening is very important and objective index of loss of bone mass of parodontium [6, 8]. This comparatively new method is used to diagnose periodontal diseases, to measure physiological tooth loosening, to evaluate periodontal tissues during orthodontic treatment, to determine primary stability of orthodontic mini-implants and also to define osteointegration of dental implants [9, 10, 11, 12, 13, 14, 15].

Periotest demonstrates high stage of accuracy, responsibility and repetition [5, 17]. English scientists determined that due to periotometry there are more abnormalities of periodontal tissues than due to modern methods [9].

Measurements of the device «Periotest» are characterized by accuracy and depend on tooth loosening so they depend on peculiarities damping of parodontium, age and sex of the patient [16, 17], length, number and stage of root resorption [13], that is determined by dental inclination [10, 12, 18]. At healthy parodontium indices of tooth loosening are stable and do not have differences between left and right sides [7, 16], but with age they can decrease [17].

During retentional period of orthodontic treatment the tendency of tooth loosening continues 12 months [7, 19], but it doesn't approach to initial indices, that's why Tanaka E. recommends using Periotest to determine individual terms of retentional period [3, 12], but frontal teeth loosening depend on type of the replacement of middle line [20].

At orthodontic treatment by removable dental plate teeth loosening increases during its activation, but tendency to decrease occurs after in only three weeks [21], that is scientifically manifested term for the next activation of removable apparatus.

«Periotest» is the device to determine changes of teeth loosening during different stages of orthodontic treatment. Teeth loosening during orthodontic treatment (OT) define pain sensations and discomfort in patients. M.S. Drohomiretska considers that maximal teeth loosening occur on the 4th-6th months of OT [22].

It has been proved that one of the cause of treatment interreption is patient's adaptation to orthodontic apparatus. But these factors have not studied yet [23].

Table I. Indices of the level of teeth loosening based on Gulden

Level of teeth loosening	Indices Periotest
norm	- 08 - +09
I	- 10 - +19
II	- 20 - +29
III	- 30 - +50

Table II. Dynamics of changes of average indices of tooth loosening of the upper jaw in patients during 6 months of OT (in relative units)

Teeth Measurement term	16	15	14	13	12	11	21	22	23	24	25	26	Average indices of all teeth
Before OT	1,83 ± 1,29	3,97 ± 1,27	3,33 ± 1,77	1,47 ± 1,79	4,75 ± 1,80	3,75 ± 2,79	4,17 ± 2,96	4,08 ± 1,86	1,33 ± 1,18	3,09 ± 1,97	3,58 ± 1,86	2,17 ± 1,70	3,08 ± 1,29
In 1 month	2,57 ± 1,26	7,29 ± 1,70	6,14 ± 1,46	4,77 ± 1,73	8,74 ± 3,50	9,73 ± 1,80	10,41 ± 3,16	8,99 ± 2,64	5,30 ± 3,99	7,00 ± 2,80	8,74 ± 3,03	4,79 ± 2,79	6,87 ± 1,76
Difference in 1 month	1,38**	1,86*	1,84*	3,37*	1,94*	2,46*	2,50*	2,70*	3,97*	2,76*	2,30*	1,98*	2,23*
In 3 months	2,99 ± 1,07	6,79 ± 1,04	7,01 ± 1,04	3,95 ± 0,88	7,18 ± 1,77	8,10 ± 1,77	7,17 ± 0,93	5,98 ± 1,40	3,61 ± 0,54	7,20 ± 1,51	7,14 ± 2,15	3,58 ± 0,97	5,84 ± 0,77
Difference in 3 months	1,65*	1,66*	2,11*	2,76*	1,66*	2,16*	1,71*	1,46*	2,71*	2,33*	1,99*	1,65*	1,90*
In 6 months	2,00 ± 0,71	7,25 ± 1,79	6,25 ± 1,30	3,75 ± 1,64	7,50 ± 1,17	8,50 ± 1,17	8,51 ± 1,56	6,75 ± 1,79	2,75 ± 0,83	4,50 ± 1,80	8,00 ± 4,36	2,74 ± 0,57	5,60 ± 0,74
Difference in 6 months	1,00***	1,85*	1,88*	2,29*	1,75*	2,77*	2,04*	1,55*	2,07*	1,46***	2,23***	1,03***	1,83*

* - statistically accurate

** - statistically inaccurate

THE AIM

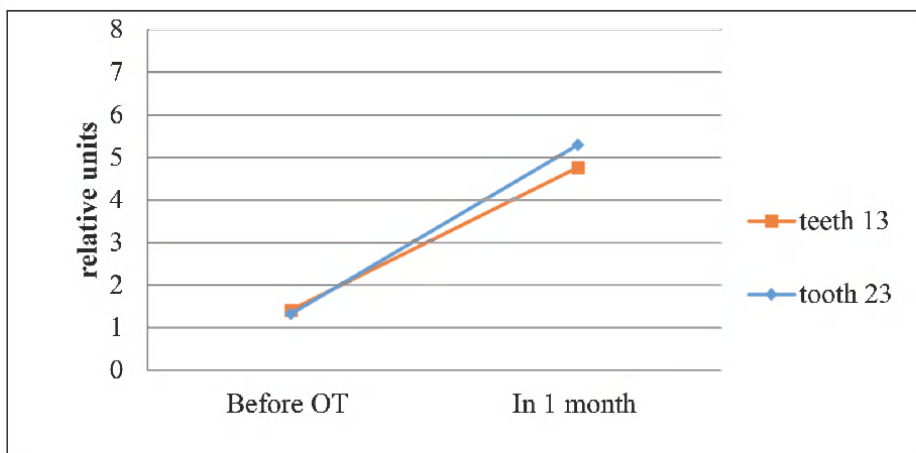
The aim of the research is to evaluate teeth loosening of the upper jaw during adaptive period in patients with permanent bite who were treated by braces.

MATERIALS AND METHODS

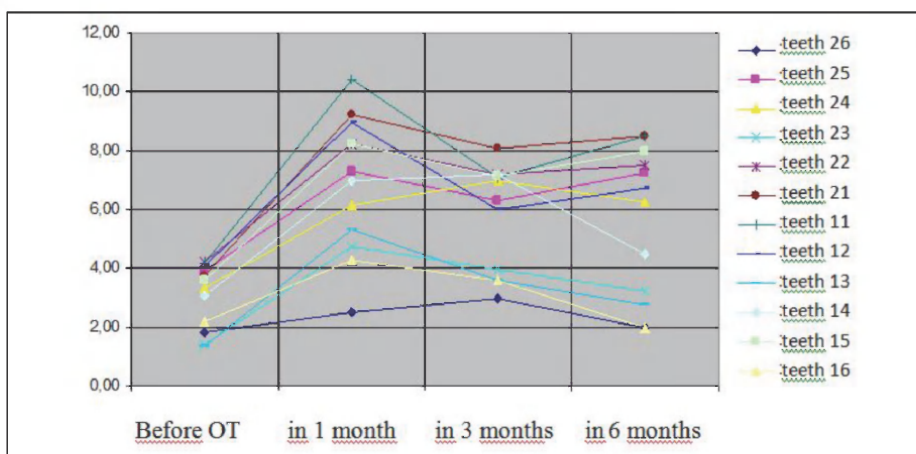
Periostometry (device «Periotest») of teeth of the upper jaw to 30 patients who are from 14 to 27 years old with the pathology of the first type based Angle’s classification without concomitant diseases was done. The evaluation of teeth loosening was done before OT (10 patients), in

1 month (7 patients), in 3 months (7 patients) and in 6 months (6 patients). Patients were treated by similar fixed orthodontic apparatus (braces), sequence of arches was similar: 0,012 NiTi, 0,014 NiTi, 0,016 NiTi. 360 measurements were done.

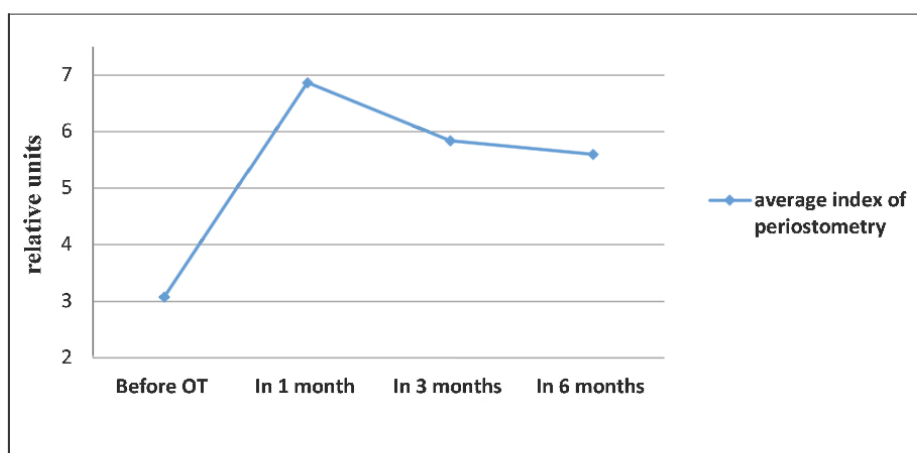
Periotest – is modern electromechanical device of Germany (Gulden) production to determine damped peculiarities of periodontal tissues [10, 11, 20]. The working element of the device is adapter with piezoelectric element, the frequency of mechanical impulses contains 4 ranges per 1 sec., and duration of all cycle for each tooth – 4 sec. or 16 impulses.



Picture 1. Diagram of tooth loosening of the 13th and the 23d teeth in 1 month of OT



Picture 2. Dynamics of teeth loosening of the upper jaw during OT



Picture 3. Dynamics of average index of teeth loosening of the upper jaw during 6 months during OT

Healthy periodontal tissues have more flexible peculiarities in comparison with tissues that were affected by pathological factors or orthodontic treatment. Damping of mechanical ranges from Periotest in healthy tissues occurs quicker than during pathology, that's why this difference [17] uses Periotest-method to evaluate reformation of bone mass [3].

Clinically Periotest indices correspond to the stage of teeth loosening and the limit of measurements is from -08 to +50 relative units. The lesser index for each tooth was defined, periodontal tissues are in the better condition (table I). Inaccuracy during recurrent measurements for

each tooth in each period of time doesn't exceed ± 1 relative units, and it can coincide with such measurements [5].

Percussion was done according to the instruction between contour and tooth cutting edge, patient's head was slightly inclined downwards during the investigation of upper frontal teeth.

RESULTS

The average index of teeth loosening of the upper jaw before orthodontic treatment in patients with permanent

bite was from $1,33 \pm 1,18$ to $4,25 \pm 1,8$ relative units and on average included $3,08 \pm 1,29$, so it corresponded to norm indices (table II).

The least tooth loosening was observed in canines both right ($1,42 \pm 1,29$) and left ($1,33 \pm 1,48$) and it is associated with root length. The second part of tooth loosening included the first molars from both sides ($1,83 - 2,17$), the next one – the first premolars ($3,09 - 3,33$). Indices of incisors and the second premolars loosening were the largest but they differed depending on the side: from the right side the largest lateral incisors loosening was the biggest one ($4,25 \pm 1,80$ relative units), and from the left one the biggest index in the central incisors was observed ($4,17 \pm 2,96$ relative units, on $0,59$ relative units). There is not statistically difference between indices of the right and the left sides and it coincides with scientific information [12, 16].

In 1 month after braces fixation indices of tooth loosening of the upper jaw were increased. Before orthodontic treatment average indices of teeth loosening included $3,08 \pm 1,29$ relative units, and in 1 month they increased with statistically accuracy in 2,23 times and indices included $6,87 \pm 1,76$ relative units (table II).

The biggest influence of teeth loosening before OT was observed in frontal group of teeth. So, tooth loosening increased on the 13th and the 23^d teeth in 3,37 times in 3,97 times correspondingly (table I). In general from the left side dynamics of teeth loosening of the upper jaw is higher than from the right one.

Middle index of teeth loosening of the upper jaw on the third month of OT was $5,84 \pm 0,77$ relative units, that in 1,9 times more than periostometric indices before orthodontic treatment. The biggest increase of indices of teeth loosening was observed in the frontal part of teeth: incisors of both right ($8,10 \pm 1,22$ relative units) and left sides ($7,12 \pm 0,93$ relative units) and canines (table II). But, comparing indices in 1 month of orthodontic treatment with indices in 3 months one can see frontal teeth loosening, the second premolars and the left first molar decrease and indices of the first premolars of both sides and the right first molar increase. Average indices of teeth loosening on the third month in comparison with indices of the first month of OT decreased in 1,03 relative units (table II). Dynamics of teeth loosening from the left side decreases and from the right one increases.

In 6 months after orthodontic device fixation, indices of teeth loosening were observed in the frontal group of teeth: both in canines on the right side and on the left one increased in 2,29 and in 2,07 correspondingly, and in central incisors in 2,27 and in 2,04 times correspondingly. But the biggest index of tooth loosening was observed in central incisors and included 8,5 relative units, that increased in 2 times, than before OT.

Index of the first molars loosening approaches to indices before OT and include correspondingly 2,0 and 2,24 relative units (from the left and the right sides), that on 0,17 units and on 0,07 units is lesser than at the beginning of orthodontic treatment. During 6 months of OT the first premolars, the first molars and canines loosening decreases and loosening of the second premolars and incisors starts

increasing in comparison with results in 3 months from the beginning of OT (table II).

In general analysis of dynamics of changes of average indices demonstrates that the most increase of periostometry is observed during the first month from the beginning of treatment that coincides with clinical signs in patients: pain in teeth, discomfort and others and it doesn't coincide with information based on M.S. Drohomyretska who determined maximal loosening on 4-6 months of OT. During the next 5 months indices of teeth loosening decrease, clinical signs in most cases disappeared and in general periostometric indices do not approach to indices before OT (picture 2).

Changes of teeth loosening of the upper jaw during OT by braces during 6 months have the next tendency: during the first month frontal teeth loosening increase, in 3 months loosening of frontal teeth reduces, but loosening of masticatory teeth continues increasing, besides the 15th and the 25th teeth, and periostometric indices decrease. In 6 months of orthodontic treatment loosening of such teeth as 11, 12, 21, 22, 15 and 25 increases and loosening of such teeth as 13, 23, 14, 24, 16 and 26 decreases, and it doesn't coincide with the level which was present before OT (picture 2).

CONCLUSIONS

So, changes of teeth loosening of the upper jaw during orthodontic treatment by braces in adults occur during the first month after fixation that is determined as the period of discomfort, tooth pain, and it is coincided with adaptation to fixed and can cause patient's refusal from further OT. It should be noted that during the first month of OT data of periostometry determine the enlargement of teeth loosening of all teeth in 1,38 (Picture 3), in 3 months there is decrease of teeth loosening for all types of teeth.

On the 6th month of OT indices of teeth loosening continue decreasing but with lesser intensity and not achieve such level which was to the beginning of orthodontic treatment.

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