Conference paper

Biometrics of Jaw Models Analysis in Treating Tooth Position Anomalies with the Use of Orthodontic Shape Memory Apparatus

I.A. Turetskova[1*], M.A. Zvigintsev[2], V.E. Gunther[3,4]

*Corresponding author: I.A. Turetskova, email: dentalcentr@sibmail.com

[1] LLC MEC, Clinic of Dental Implantology, Tomsk, Russia
[2] Medical care and prophylaxis center for diabetes mellitus associated problems, Krasnoyarsk, Russia
[3] Tomsk State University, Tomsk, Russia
[4] Research Institute of Medical Materials and Implants with Shape Memory, Tomsk, Russia

Received: 23 March 2017
Accepted: 9 April 2017
Published: 16 July 2017

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the SMBIM Conference Committee.

OPEN ACCESS

Abstract

The paper presents the results of research in the field of orthodontic treatment of patients with the use of conventional bracket system methods as well as with the orthodontic thread and hollow tube made of superelasticnickelid titanium (TiNi) alloy, the method of measurement of plaster jaw models introduced by L. Persin. The study reveals the advantages of our newly developed apparatus for orthodontic tooth movement in the transverse and sagittal directions.

1 Introduction

One of the most important and fundamental aesthetic considerations in smile design is the form of jaws. The widespread introduction of the bracket system in the orthodontic practice marked a new epoch in orthodontics [1]. The development of superelastic shape-memory alloys played a special role in the advance of this sphere [2]. The orthodontic apparatus with the use of the orthodontic thread and hollow tube of superelasticTiNi alloy has shown good results in the histological and

morphological preclinical tests on adult male Wistar rats. The study showed that this construction has some physiological effects within the adaptive capacity of the organism without necrotic zones, thus, can be used in orthodontic treatment [3]. The findings of the study indicate that it is appropriate and perspective to adopt the new orthodontic apparatus in the orthodontic practice, but it requires a preliminary analysis at the clinical stage, i.e. studying control and diagnostic jaw models. The occlusal relationship of premolar and molar teeth and the spatial orientation of the front group of teeth have a direct impact on the quality of food mastication [4].

2 Experimental

The orthodontic treatment of 23 patients aged 13-16 of both sexes was carried out with application of the conventional bracket system method (11 people) as well as our apparatus with the use of the orthodontic thread and hollow tube made of superelasticnickelid titanium (TiNi) alloy (RF Patent No 2463991). To assess changes in the shape of dentition we used the jaws measurement technique introduced by L. Persin (2004) [5].

3 Results and discussion

When measuring control and diagnostic jaw models we revealed some certain size changes in transversal as well as in sagittal planes (Table 1).

Table 1.Changes in the parameters of jaws in orthodontic treatment

Distance between points (mm)	Conventional treatment		Using orthodontic thread	
	Before treatment	After treatment	Before treatment	After treatment
13-23	37.50±1.29	35.55±2.44	37.13±1.79	36.07±1.49
14-24	32.99±0.81	37.02±2.33	33.96±1.82	42.55±2.23
16-26	45.0±2.16	49.0±3.39	44.25±1.5	50.62±3.72
33-43	26.5±1.78	26.7±3.14	24.5±2.67	28.02±1.51
34-44	35.0±2.94	37.03±2.33	36.0±2.7	42.67±2.24
36-46	47.0±3.36	49.0±3.39	43.87±2.42	50.62±3.72
11=21-14=24	13.0±1.08	16.75±0.5	12.87±1.75	19.85±0.23
34=44	12.37±1.31	14.75±0.5	11.75±0.71	17.5±0.71

The analysis of the results of the jaw parameters change study both when using the conventional treatment and when applying our newly developed apparatus showed no significant change in the transverse sizes between the canine teeth of the upper and lower jaws, as well as between the first premolars of the lower jaw p> 0.05 (Fig. 1, 2, 4). As for the sizes in the area of movable premolars of the upper jaw, we reveal that before the treatment the patients in both groups do not demonstrate any difference in size between 34 and 44 teeth (p = 0.31). In the conventional treatment there is a significant movement of 14-24 teeth from 32.99 ± 0.81 to 37.02 ± 2.33 (p = 0.019653). The treatment with the use of our apparatus showed changes from 33.96 ± 1.82 to 42.55 ± 2.23 (p = 0.000033). At the same time there is a significant difference in the final result of the treatment (p = 0.029540) that proves the advantages of our newly developed apparatus.

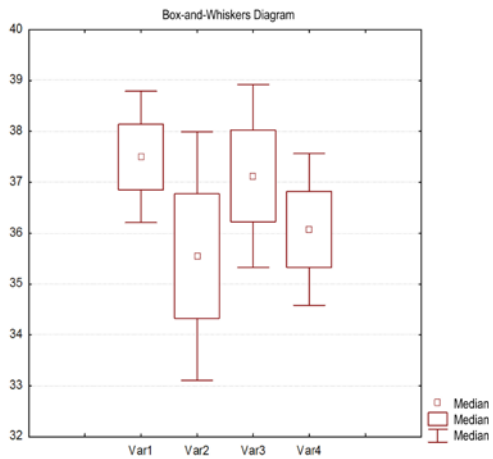

Fig. 1. Change in size at points 13-23

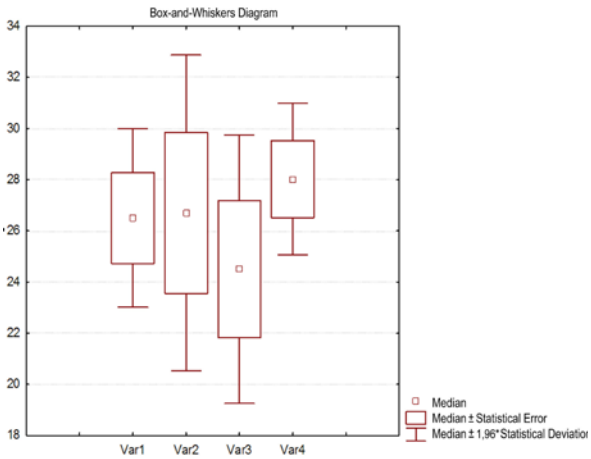

Fig. 2. Change in size at points 33-43

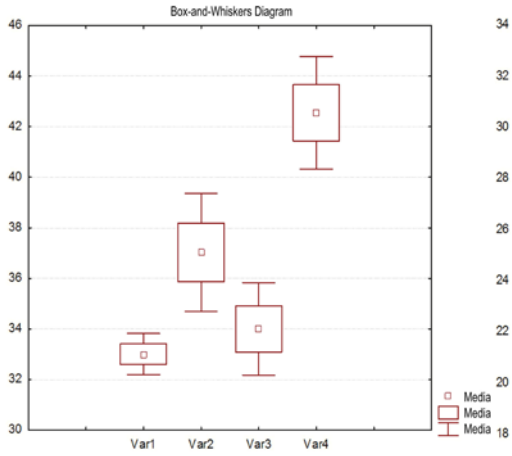

Fig. 3. Change in size at points 14-24

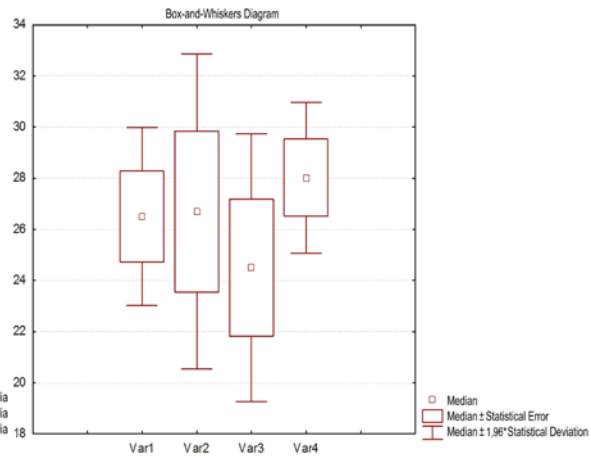

Fig. 4. Change in size at points 34-44

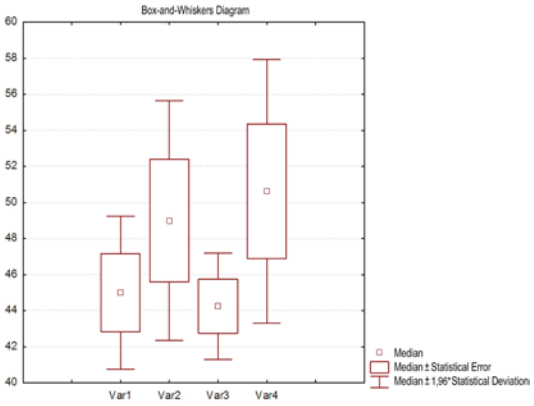

Fig. 5. Change in size at points 16-26

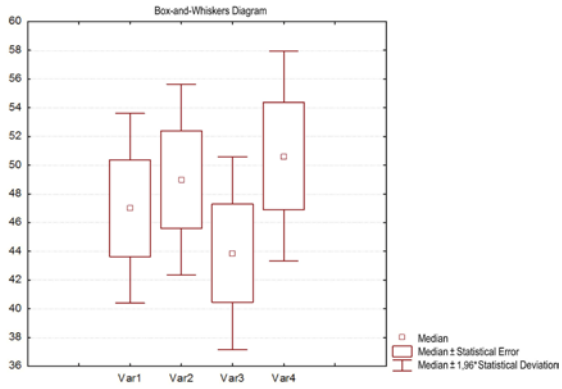

Fig. 6 Change in size at points 36-46

The results of the analysis of the size measurement parameters in the area of molar teeth of the upper jaw (Fig. 5) showed a significant measure increase in the process of conventional treatment ($p = 0.009683$) as well as when applying our newly developed apparatus ($p = 0.022339$), with no significant difference in the final results ($p = 0.143826$). As for the lower jaw, the increase in the size between molar teeth is due to growth of jaws and has no statistical significance (Fig. 6).

Of particular interest are measurements of the increase in the size of the position of the front teeth in the sagittal plane (Fig. 7, 8).

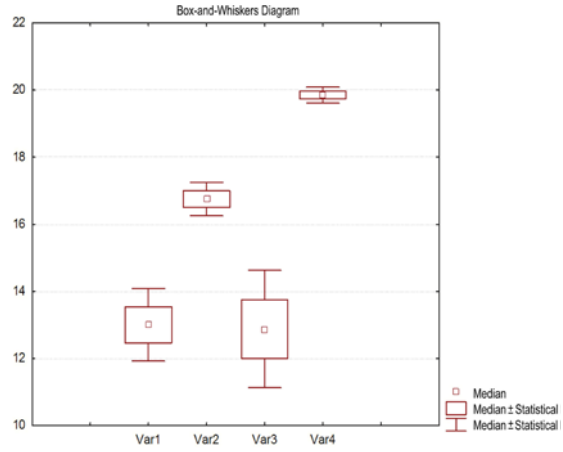

Fig. 7. Change in size in planes 11-21 and 14-24

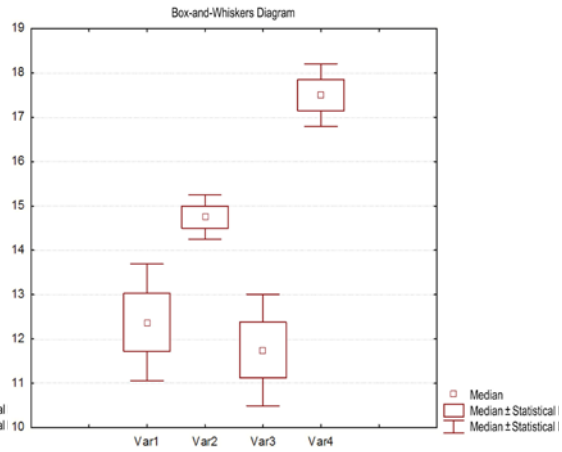

Fig. 8. Change in size in planes 31-41 and 34-44

The analysis of sagittal measurements showed that before the treatment the patients demonstrate no significant difference both in terms of the upper ($p = 0.926530$) and the lower ($p = 0.546203$) jaws indicating that the study results are comparable. The use of the conventional apparatus showed a significant shift of the front teeth in the sagittal plane on the upper jaw from 13.0 ± 1,08 to 16.75 ± 0.5 ($p = 0.005509$), on the lower one from 12.37 ± 1.31 to 14.75 ± 0,5 ($p = 0.0233365$). The use of our apparatus showed increase in the size in the sagittal plane on the upper jaw from 12.87 ± 1.75 to 19.85 ± 0.23 ($p = 0.004394$), on the lower one from 11.75 ± 0.71 to 17.5 ± 0.71 ($p = 0.000386$), with a significant advantage of using our apparatus both on the upper ($p = 0.000853$) and on the lower ($p = 0.003396$) jaws.

4 Summary

The results of jaw model measurements revealed significant advantages of our newly developed apparatus for orthodontic tooth movement in the transverse and sagittal directions. And the results we obtain are stable, especially in the sagittal plane, with decrease of standard deviations (SD) as a result of final treatment being its evidence. At the same time the jaws continue to grow according to the age of patients (13-16 years old), with a slight increase in all measures being evidence of it.

References

[1] F. Ya. Khoroshilkina, Elimination of functional, morphological and aesthetic violations in the treatment of dental-maxilla-facial anomalies by Edjuays equipment [in Russian], Moscow, 1995.

[2] V.E. Gunther, G.Ts. Dambaev, P.G. Sysoliatin, Delay Law and New Class of Materials and Implants in Medicine, MA: STT, Northampton, 2000.

[3] I.A. Turetskova, M.A. Zvigintsev, I.P. Zhurakovsky, M.G. Pustovetova, V.E. Gyunter, The morphological restructuring of periodontal tissues during dynamic impact ortoniti of TiNi. Medical education in Siberia [in Russian], 3 (2012) 35-39.

[4] S.V. Ryabov, T.V. Murzova, Study of occlusion factors in order to improve the quality of orthopedic treatment, Research and Education Gazette. Health and education in the 21st century [in Russian]. 10 (2012) 320-321.

[5] L.S. Persin, Orotodontiya. Diagnosis and treatment of dentoalveolar anomalies: a guide for physicians [in Russian], Medicine, Moscow, 2004.