

Cephalometric Evaluation of Dental and Skeletal Changes in the Vertical Dimension During the First Stage of Treatment using Preadjusted Brackets and the MBT Technique

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Abstract:

Statement of Problem: Some vertical changes might be observed during the first stage of orthodontic treatment, aligning and leveling.

Purpose: The aim of this study was to evaluate dental and/or skeletal vertical changes occurring in the first stage of preadjusted orthodontic treatment.

Materials and Methods: Fourteen patients with an average age of 14.1 years were selected for this study. Preadjusted appliances were used and a lateral cephalogram was taken, subsequently. All patients were treated with four first premolar extractions. After 8 weeks of aligning and leveling, a second cephalogram was obtained.

Results: No statistically significant changes including extrusion of all teeth except maxillary incisors were observed during this phase. Skeletal vertical changes also showed a slight non-significant decrease.

Conclusion: The results of this study showed minimal vertical changes during the first stage of fixed orthodontic treatment with preadjusted appliances; therefore use of such appliances in patients with a tendency towards increased vertical dimensions could be justified.

Key Words: Cephalometrics; Vertical dimension; Preadjusted brackets

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INTRODUCTION

As with any other field of science, orthodontics has experienced outstanding changes and evolutions. Since the appearance of edgewise brackets and further improvement of the technique, many developments have been made. One of the most interesting advancements in orthodontics was the introduction of preadjusted brackets [1]. The Straight Wire Appliance (SWA) presented by Andrews is known to be the first generation of these appliances. Since then, many minor adjustments have been made by different

clinicians, resulting in different designs which have been termed "prescriptions". One prescription of particular interest is the Roth prescription developed by Roth [2,3]. After evaluating and studying the SWA, he made modifications and corrections in the appliance, making it one of the most popular appliances worldwide [4].

Another outstanding development can be seen in the works of McLaughlin and Bennet [5-9]. The MBT system and technique has been introduced by these orthodontists along with Trevisi, and has recently gained popularity.

One basic concept in this system is the use of light forces throughout treatment as much as possible.

It has been argued that different extraction treatment plans may have different effects on the vertical dimension (VD) [10-19]. Some have recommended extraction in cases with an increased VD whereas others have shown that extraction does not necessarily result in a decrease of vertical dimensions. It is also known that orthodontic mechanics have an extrusive nature. Therefore, it can be proposed that some of the vertical changes occurring in orthodontics may be seen during the first stage of treatment (aligning and leveling), since this phase somehow deals with tooth movements in the VD.

The purpose of this study was to evaluate the changes in vertical dimensions occurring after aligning and leveling, using preadjusted appliances and light forces according to the concepts of the MBT technique.

MATERIALS AND METHODS

The present investigation was performed as a before-after clinical trial. Fourteen patients, including 10 females and 4 males were selected for this study. The age of these patients ranged from 11 to 21 years, with an average age of 14 years and 1 month (SD = 2.279). The cases were selected from the patient registration list of the orthodontic department, Faculty of Dentistry, Tehran University of Medical Sciences, based on the following inclusion criteria:

- Fixed appliances in both arches as a requisite for treatment
- Moderate crowding
- Eruption of all permanent teeth except for the second and third molars
- Requirement of four first premolar extractions as part of their treatment plan.

Patients with any evidence of systemic or metabolic disorders, periodontal disease, and previous history of orthodontic treatment or

extreme vertical discrepancies were excluded from the study.

Records were obtained from all patients and treatment began with banding and bracketing the teeth. Preadjusted appliances with a 0.022" slot dimension were placed according to the bracket placement chart recommended by Bennet and McLaughlin [7]. Banding was performed by one operator and direct bracket bonding by another. A pretreatment cephalogram was obtained at this stage (T_0) for each patient, with appliances in place. All cephalograms were taken on the same radiographic unit. A segment of 0.019"×0.025" stainless steel wire was formed into the shape of an L and inserted into the upper and lower right molar tubes during radiographic exposure. This wire served as a marker for measuring tooth position and inclination which resulted in a more accurate detection and recording of tooth movement. Such markers were not necessary in the anterior section, because of the visibility of anterior teeth and a minimal superimposition of anatomic structures. At this stage, premolar teeth were extracted and treatment started according to the MBT technique and concepts. Lacebacks were tied from the molars to the canines using 0.010" steel ligature wires. A preformed superelastic 0.016 inch Nickel Titanium archwire was inserted and bendbacks placed immediately distal to the molar tubes, as a mean to prevent flaring or protrusion of the incisors. The archwire remained in place for 8 weeks. No other auxiliaries (headgears, palatal bars or elastics) were used during this period. All patients were recalled every 2 weeks for retying or replacing the lacebacks. Any accidental bracket loosening was managed within 48 hours of the event. The archwires were removed after the 8-week period, the same L-shaped markers inserted in place again, and the second (T_1) cephalogram was obtained. The treatment of patients continued thereafter according to the MBT

technique. Any need for banding of second molars was accomplished as necessary.

Radiographic analysis: All cephalograms were traced and the following landmarks selected for evaluation: the mandibular plane angle between SN and Go-Gn; and the anterior facial height, measured as the linear distance between Nasion and Menton.

In order to assess dental changes, the palatal and mandibular planes were used as reference lines for the upper and lower teeth respectively. Lines were drawn from the incisal edge perpendicular to these planes. The tips of the L-formed wires were used as a reference for the molar teeth and perpendicular lines were also drawn from these points to their corresponding reference plane.

In addition, the amount of movement of molar teeth effecting vertical dimensions was also recorded. In order to do so, a reference point was required. This was done according to Pancherz's analysis by dropping a line plumb from Sella to the occlusal plane [20]. The resulting point was used as the reference point (Fig. 1).

Tracings of the T₀ and T₁ were superimposed in order to measure the possible changes. A 0.5mm graduated steel ruler and a protractor

with an accuracy of 1° was used for the linear and angular measurements, respectively.

Wilcoxon signed rank test was used for statistical analysis of the collected data using the SPSS 10 software.

RESULTS

The average skeletal and dental changes of the study group are shown in Tables I and II, respectively.

Table I: The average of vertical skeletal changes.

Variable	Average change	SD	p value
GoGn-Sn	-0.22°	0.66	0.19
S-Go	0mm	0.82	-
N-Me	-0.46mm	0.96	0.12
Jarabak Index	0%	1.03	-

According to Wilcoxon signed rank test, the results were not statistically significant, but the following changes were observed:

- 1- Maxillary and mandibular molars and lower incisors had a slight increasing effect on the vertical dimensions (p=1, p=0.5 and p=0.35 respectively),
- 2- The changes on upper incisors slightly decreased the VD (p=0.89),
- 3- Vertical dimensions, including the linear measurement of N-Me and the GoGn-SN angle were reduced (p=0.12 and p=0.19)
- 4- The changes in S-Go and Jarabaks' index were so small that could be essentially considered zero.

Table II: The average of vertical dental changes

Tooth	Average change (mm)	SD	p-value
Upper Molar	0.05	0.69	1
Upper Incisor	-0.09	0.61	0.89
Lower Molar	0.19	0.87	0.51
Lower Incisor	0.23	0.81	0.35

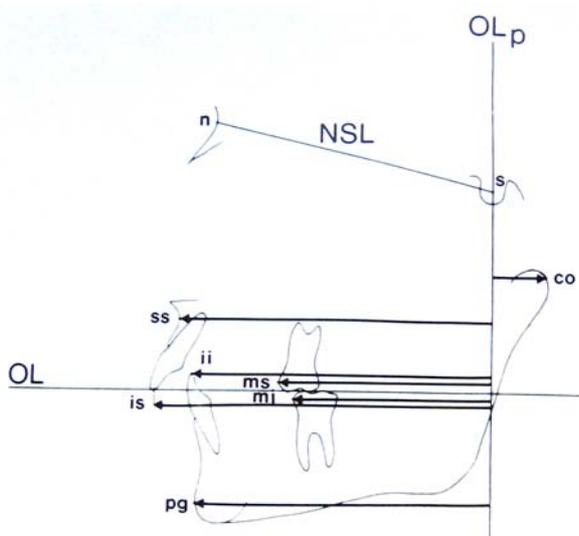


Fig. 1: Measuring points used in Pancherz' analysis

DISCUSSION

Orthodontists have paid much attention to vertical changes occurring during orthodontic treatment. In some studies, treated cases have been compared with untreated cases and others have emphasized on clinical evidence by comparing extraction and non extraction treatment protocols [13,16]. Yet some have based their study on the type of tooth selected for extraction [10,14,17]. The results of these studies have shown no decrease or even a slight increase of vertical dimensions, and more increase observed in non-extraction treatment plans. The changes in VD seem to be more dependent on forces acting on teeth and do not correlate with the type of extraction pattern.

Few studies have shown a decrease in mandibular plane angle after orthodontic treatment. For example, Pearson treated high angle cases and used a vertical chincup during treatment, resulting in a 3.9 degree decrease in the mandibular plane angle [21].

This study differs from the previous investigations in several ways:

First, only changes occurring in the first stage of treatment were evaluated. This was chosen because it can be proposed that some vertical changes could occur during leveling of the teeth. Further stages are to be studied in the future.

Second, the preadjusted appliances have been used with the MBT technique. This technique is a more recent method which differs from its predecessors. One major difference is in its bracket positioning. Previous studies have not used this technique.

Third is the short time span, which minimizes the effects of growth from taking act.

The slight decrease observed in this study may be due to mesial movement of the molars that may have prevailed the vertical changes. The reason could be the use of preadjusted brackets and probably a superior technique (such as using lacebacks) which might have minimized

the unwanted vertical effects.

One point worth mentioning is that no attempt had been made to control anchorage, but the results were satisfactory. Maybe it could be stated that preadjusted brackets would be more suitable when a decrease in vertical dimensions is desirable, and other devices such as standard edgewise brackets may be more effective in opening the bite. This assumption needs further investigation.

CONCLUSION

Within the limitations of this study, during the first stage of treatment, using preadjusted brackets and the MBT technique, the following changes may identify:

- A slight but insignificant decrease in skeletal vertical dimensions.
- Extrusion of first molars and lower incisors but slight intrusion of the upper incisors,

Mesial movement of the molars prevail their vertical movement in this technique, which could explain the slight decrease in the vertical dimension.

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ارزیابی سفالومتریکی تغییرات دندانی و استخوانی در بعد عمودی در طی درمان مرحله اول با براکت‌های از قبل تنظیم شده و تکنیک MBT

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چکیده

بیان مسأله: تغییرات چندی در بعد عمودی در حین درمان مرحله اول ارتودنتیک (aligning و leveling) ممکن است اتفاق بیفتد.

هدف: مطالعه حاضر با هدف ارزیابی تغییرات دندانی و استخوانی در بعد عمودی در طی درمان مرحله اول ارتودنسی با براکت‌های از قبل تنظیم شده، انجام شد.

روش تحقیق: تعداد ۱۴ بیمار با میانگین سنی ۱۴/۱ سال انتخاب شدند. براکت‌های از قبل تنظیم شده برای آنها به کار رفت و یک رادیوگرافی نیم‌رخ جمجمه (لترال سفالوگرام) استاندارد از آنها تهیه شد. در تمام بیماران هر چهار دندان پرمولر اول کشیده شد. پس از گذشت ۸ هفته و انجام مرحله اول درمان ارتودنسی (aligning, leveling) مجدداً یک کلیشه سفالومتری تهیه شد.

یافته‌ها: هیچ تغییر معنی‌داری (شامل extrusion تمام دندانها به جز ثنایاهای فک بالا) طی این مرحله مشاهده نشد؛ شاخصهای اسکلتالی عمودی نیز پس از درمان و به طور غیر معنی‌داری کاهش یافتند.

نتیجه‌گیری: از آنجا که مطالعه حاضر تغییرات اندکی را در بعد عمودی در طی درمان ارتودنتیک با براکت‌های از قبل تنظیم‌شده، نشان داد، استفاده از این ابزار در بیمارانی که تمایل به افزایش اندازه‌های عمودی اسکلتی دارند، مناسب است.

واژه‌های کلیدی: سفالومتری؛ ابعاد عمودی؛ براکت‌های از پیش تنظیم شده

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