UDK 616.314-089.23

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The effect of tooth extraction on vertical dimension change in patients with class II malocclusion

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Aim: the purpose of our study is to evaluate vertical dimension changes in patients with the extraction and nonextraction of first four premolars of the skeletal Class II patients.
Materials and Methods. Our study's material is consisting of pre-treatment and post-treatment lateral cephalometric radiographs of 31 individuals between 12–25 ages with the average age of 15,95 who having skeletal class II malocclusion with ANB angle greater than 4°. 13 patients are treated with first four premolar extraction treatment and 18 patients were nonextraction.
Results. In the extraction group, SN-GoGn, MP-PP and Y-axis angle were decreased significantly ($P < 0.05$) after treatment. There was no change in vertical dimensions of nonextraction group except SN-PP angle ($P < 0.05$).
Conclusions. Four first premolar extraction orthodontic treatment is an effective way of decreasing vertical skeletal dimensions.

Key words: Class II malocclusion, vertical dimension, treatment with extraction, nonextraction treatment.

Introduction

Active function, esthetic appearance and balanced occlusion are the purposes of orthodontic treatment. To get more space if there is crowding and for the situations where incisors must be taken back for the correction of overjet, extraction of premolar teeth is applied. Extraction space is closed with the distalization of anterior teeth in the cases of maximum anchorage and with mesialization of posterior teeth in the cases of minimum anchorage. On the other hand, the space needed is obtained by molar distalization and protrusion of incisors in a nonextraction approach.

The effect of extracting permanent teeth on the facial vertical height is debated.

It is known the facial sagittal and vertical dimension would be changed by movement of molar teeth [1, 2[. The extrusion of molar teeth causes a clockwise rotation in mandibula. Accordingly, the backward of mandibular tip would increase lower facial height e and SN/MP angle, [3, 4, 5, 6].

In high angle patients, the premolar extraction is recommed to reduce the facial height [7, 8, 3, 6]. Some scientists states that, closure of molar teeth by moving to mesial without extraction cause decrease in vertical dimension decreasing mandibular angle. [1, 9, 2, 10, 6, 11]. On the other hand, in some other studies it is not an accepted that extraction teeth brings the counterclockwise rotation of the mandible and decrease in the facial vertical dimensions [12, 13, 14, 4, 15, 16, 17].

In this study, the changes of the vertical dimensions during the treatments with the extraction and without extraction of first four premolars of the skeletal Class II patients are evaluated. The pre and post treatment lateral cephalometric radiographs of Class II patients with ANB angle greater than 4° have been compared.

Table 1

Age, gender distribution of patients included in this study

Groups	Female	Male	n	Age, y
Extraction	10	3	13	15,06
Nonextraction	8	10	18	16,85

n: Samle size, y: year

Materials and methods

The data is collected from the pre and post treatment lateral cephalometric radiographs of the orthodontic patients of the Faculty of Dentistry at Selçuk University.

The sample consists of the 31 patients who have Class II malocclusion with ANB angle greater than 4°. The average age is 15,95 and the age range is between 12 and 25 (Table 1). 13 patients (3 male, 10 female) with an average age of 15.06 are treated with extraction of four premolars while other 18 patients (10 males, 8 females) with an average age of 16.85 are treated without extraction.

Criteria for selection of subjects:

1. There is no absence of permanent teeth except the third permanent molar,
2. There is not any important restoration carried out and morphological anomaly,
3. There is no craniofacial or congenital anomaly,
4. There is no temporamandibular joint disorder,
5. The patient histories do not include any orthodontic treatment.

Sagittal measurement used in this study were shown in Figure 1.

1. SNA (°): The angle formed by the planes Sella-Nasion and Nasion-Point A.

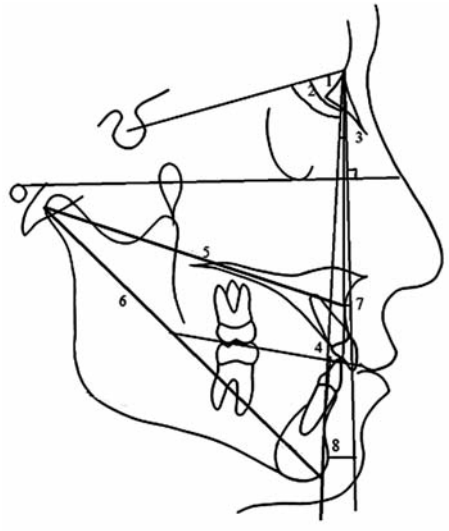

Fig. 1. Sagittal Measurement.

2. SNB (°): The angle formed by the planes Sella-Nasion and Nasion-Point B.
3. ANB (°): The angle formed by the planes Nasion-Point A and Nasion-Point B.
4. Wits appraisal (mm) Perpendicular distance from AO (perpendicular point from point A to the occlusal plane) to BO (perpendicular point from point B to the occlusal plane).
5. Condylion-A (mm): Measured from Condylion to A point.
6. Condylion-Gnathion (mm): Measured from Condylion to Gnathion.
7. A-N perp (mm) Perpendicular distance from A to the N perp line to FH plane.
8. Pog-N perp (mm) Perpendicular distance from B to the N perp line to FH plane.

Figure 2 shows vertical measurements.

1. FMA (°): Angle between the FH and mandibular planes.
2. SN-GoGn (°): Angle between the SN plane and Go-Gn line.
3. Occlusal plane to SN (°): Angle between the SN and occlusal planes.
4. Palatal Plane-SN (°): The angle formed by the Palatal plane (ANS-PNS plane) and Sella -Nasion plane.
5. Palatal Plane-MP (°): The angle formed by the madibular plane and palatal plane.

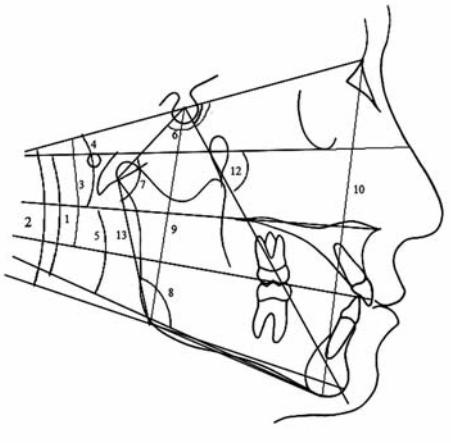

Fig. 2. Vertical measurements.

6. Saddle angle (NSAr) (°): Angle constructed by the SN plane and the S Ar line.
7. Articular angle (SArGo) (°): Angle constructed by the S-Ar and Ar-Go lines.
8. Gonial angle (ArGoMe) (°): Angle constructed by the Gn-Go and Go-Ar lines.
9. Posterior facial height (S-Go) (mm): Length from S to Go.
10. Anterior facial height (N-Me) (mm): Length from N to Me.

Table 2

Pre-treatment and post-treatment mean values and standard deviations of measurements for the extraction group and the results of statistical comparisons

Variables	Extraction group				p
	Pretreatment		Posttreatment		
	Mean	SD	Mean	SD	
Sagittal measurements					
SNA (°)	83.892	3.807	80.715	3.571	0.000***
SNB (°)	78.215	3.335	76.792	3.192	0.001**
ANB (°)	5.754	1.696	3.831	2.620	0.004**
Wits appraisal (mm)	1.769	3.836	0.323	2.836	0.168 NS
Co-A (mm)	89.208	4.180	83.846	4.043	0.007**
Co-Gn (mm)	117.900	7.467	117.977	5.316	0.07 NS
A-N⊥FHP (mm)	-0.154	4.748	-0.669	5.863	0.729 NS
Pog-N⊥FHP (mm)	-8.985	9.021	-6.977	9.022	0.564 NS
Vertical measurements					
FMA (°)	30.969	5.438	28.138	5.888	0.057 NS
SN-GoGn (°)	36.069	6.461	34.585	7.095	0.010*
SN-Occlusal P (°)	17.715	5.369	18.623	4.409	0.43 NS
SN-PP (°)	7.085	3.730	7.862	4.023	0.282 NS
PP-MP (°)	25.538	8.078	23.954	5.165	0.027*
NSAr (°)	122.269	4.625	123.662	5.337	0.302 NS
SArGo (°)	149.877	5.325	148.862	6.759	0.692 NS
ArGoMe (°)	124.854	4.598	124.269	8.658	0.773 NS
S-Go (mm)	79.985	9.361	75.069	5.853	0.004**
N-Me (mm)	124.762	10.846	109.692	30.140	0.073 NS
S-Go: N-Me (%)	64.115	5.033	63.938	5.142	0.671 NS
POr-GnS (°)	68.054	4.637	65.269	6.496	0.027*
Ar-Go (mm)	46.077	7.076	43.754	5.219	0.155 NS

S.D: Standard Deviation, N.S: Non significant, * – P < 0.05; ** – P < 0.01; *** – P < 0.001.

Table 3

Pre-treatment and post- treatments mean values and standard deviations of measurements for the nonextraction group and the results of statistical comparisons

Variables	Nonextraction group				P
	Pretreatment		Posttreatment		
	Mean	SD	Mean	SD	
Sagittal measurements					
SNA (°)	83.611	4.605	80.233	4.685	0.000***
SNB (°)	78.117	4.231	76.106	4.395	0.033*
ANB (°)	5.478	1.128	4.172	2.621	0.027*
Wits appraisal (mm)	2.339	2.908	0.778	3.012	0.026*
Co-A (mm)	88.689	5.336	86.117	7.225	0.204 NS
Co-Gn (mm)	113.578	8.015	111.711	9.000	0.478 NS
A-N⊥FHP (mm)	1.072	2.953	-0.517	4.983	0.077 NS
Pog- N⊥FHP (mm)	-7.317	5.410	-7.794	7.547	0.639 NS
Vertical measurements					
FMA (°)	27.383	5.149	27.622	5.395	0.807 NS
SN-GoGn (°)	33.167	5.691	34.428	7.182	0.405 NS
SN-Occlusal P (°)	17.878	6.752	20.478	5.008	0.087 NS
SN-PP (°)	6.617	5.526	8.717	4.871	0.020*
PP-MP (°)	28.178	5.783	27.311	5.607	0.417 NS
NSAr (°)	123.667	6.528	124.411	7.266	0.562 NS
SArGo (°)	147.878	7.408	149.472	9.216	0.290 NS
ArGoMe (°)	123.894	6.817	121.217	8.083	0.117 NS
S-Go (mm)	75.817	6.525	71.267	11.279	0.220 NS
N-Me (mm)	117.667	10.782	113.100	18.529	0.372 NS
S-Go: N-Me (%)	64.617	4.057	63.356	4.954	0.257 NS
POr-GnS (°)	68.406	4.288	65.928	15.359	0.468 NS
Ar-Go (mm)	42.972	4.231	43.417	5.290	0.758 NS

S.D: Standard Deviation, N.S: Non significant, * – P < 0.05; ** – P < 0.01; *** – P < 0.001.

11. Jarabak proportion (SGo/NMe)(%): Proportion Facial height ratio Posterior facial height/anterior facial height.
12. Y-axis to FH (°) Angle between the FH plane and Y-axis (S-Gn).
13. Ramus height (Go-Ar) (mm): Length from Ar to Go.

Statistical Analysis of Data

In the statistical analysis, matched t-test is used. All the data are analyzed with SPSS ver.15 with an accepted significance level of P < 0,05.

Results

Treatment Changes (Extraction Group)

In an extraction group after the treatment it is obvious that there was a significant difference in SNA angle (P < 0.001), SNB angle (P < 0.01), ANB angle (P < 0.01), Co-A measure (P < 0.01). SN-GoGn angle (P < 0.05), SN-PP angle (P < 0.05), POr-GnS angle (P < 0.05) and post-face height (S-Go) (P < 0.01). However, in other parameters, there was not any statistically significant difference [Table 2].

Treatment Changes (Nonextraction Group)

In the end of the treatment without extraction, it is found that there are significant statistical differences in SNA angle (P < 0.001), SNB angle (P < 0.05), ANB angle (P < 0.05), Wits appraisal (P < 0.05), SN-PP angle (P < 0.05). However, in other parameters, there was not any statistically significant difference [Table 3].

Discussion

At the end of our study, after the completion of the treatment of the skeletal Class II malocclusion first four premolar extractions and nonextraction treatment groups were compared among themselves.

It is determined that although there is a statistically significant increase in the SN-PP angle in the nonextraction group in the vertical direction, this increase is not clinically important. There is no statistically significant change in the dimension the other vertical inflection group.

There is a reduction in the vertical dimension of SN-Go Gn angle, MP-PP angle and Y angle in the extraction group. Reduction in posterior facial height was determined. There is no statistically significant change in other vertical dimension

The findings of our study corresponds with the studies' which states that extraction space is closed with the the mesial movement of the molars decrease the vertical and the madibular angle [1, 9, 2, 10, 6, 11]. This study is accordance whit the proposes that tooth extraction whit mesial movement of the molars decreases the vertical facial dimension [2, 10].

Some researchers reported that mesial movement of the molars without extrusion causes mandibular anterior rotation. In cases whit hyperdivergent facial type exraction orthodontic treatment has been proposed despite there is not a certain lack of space [3, 6]. Pearson [2] showed the mesial movement of the posterior teeth as the cause of decrease in the SN/MP angle. Our study support with studies reporting a reduction in the vertical direction size [3, 9, 2, 10, 6, 11].

Küçükkeleş et. al.(1997) reports that in the four first premolar extracted patients with the Class II division 1 malocclusion, the extraction has not changed the vertical dimension [16]. In the result of his study Class I and Class II extraction and nonextraction group, Chua et. al. [12] has stated that the tooth extraction will not be effective alone in the vertical dimension change. Some researchers cited that extracting first premolars and mesial movement of the molars don't occur counterclockwise rotation of the mandible, and extrusion of the mesial movement of molar prevent the decrease in the vertical dimension [4]. Our study is not consistent with the studies reporting no change in the extraction group in the vertical dimension [12, 4, 16, 17].

Dougherty [14] reported the increase in mandibular plane angle due to mechanicals [14]. Cusimano et. al. [13] noted that along with the growth and development there is an increase in the vertical dimension with the cause of extrusion during the mesial movement of molar [13]. Sarac and Cura [17] determined an increase in jarabak ratio , TAFH and PFH, in the Class II division 1, in the extraction group. The similar changes occurred in the non- extraction group as well. They stated that extraction will not be effective alone in increase in the vertical dimension, but together with other treatment mechanics. Kumari and Fida [15] have evaluated the vertical facial and dental arch dimensional changes in the four premolar extractions and nonextraction orthodontic treatments. Increase in the vertical face dimension was observed in both groups [15]. Başçiftçi et. al. [18] reported the vertical dimension is increased; mandibula is moved counter-clock wise and downward, in subjets had growth potential. The result of our study do not support the studies reporting an increase in the vertical dimension [13, 14, 15, 17].

In extraction group, reduction in Co-A distance was found statistically significant. Although there is decline in Co-A and Co-Gn distance of nonextraction group, this decline is statistically insig nificant. This reduction shows that the backward movement of maxilla can be performed with extraction treatment. Başçiftçi et. al [18] stated that in class II nonextraction group increase of Co-Gn distance was occurred as a result of growth and development. In both groups SNA, SNB and ANB angles decreased. They reported that while SNA and ANB angles was decreased in extraction group; in nonextraction group SNA and ANB angles decreased, but SNB angle increased [18]. Gkantidis [19] reported that ANB angle decreased in both groups.

Wits appraisal showed reduction in nonextraction group and was found statistically significant. Wits appraisal was affected by the backward movement of A point. Although the Wits appraisal decreased in extraction group, it was statistically insignificant.

Conclusion

In our study, comparison of skeletal Class II firs four premolar extraction and nonextraction treatment groups vertical dimension before and after treatment, reduction of vertical face dimensions was determined in the extraction group. Maxillary mid-face size is reduced in the extraction group. Progress toward normal has been recorded in the bony base and relations with each other of extraction and nonextraction groups. Progress toward normal has been recorded in the maxilla and mandible to cranial base and intermaxilary relations of extraction and nonextraction groups.

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