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Over-bite and Vertical Changes following First Premolar Extraction in High Angle Cases

GC Ramesh, MC Pradeep, G Arun Kumar, KS Girish, BS Suresh

ABSTRACT

Aims and objectives: Orthodontists generally agree that non-extraction treatment is associated with downward and backward rotation of the mandible and an increase in the lower anterior face height (LAFH). They also agree that extraction line of treatment is associated with upward and forward rotation of the mandible and decrease in the LAFH. The intent of this cephalometric investigation was to examine the wedge hypothesis, that the vertical dimension collapses after first bicuspid extraction. The present study was undertaken to evaluate the cephalometric overbite and vertical changes following first premolar extraction in high angle cases.

Materials and methods: Forty-five adult patients having high mandibular plane angle, i.e. Gogn – SN more than or equal to 32° having class I molar and canine relation were included. Pre- and post-treatment lateral cephalograms were measured and compared to analyze the cephalometric changes.

Results: There was no decrease in the overbite and vertical changes following first premolar extraction in high angle cases.

Clinical significance: The facial complex does increase in size with growth, but mandibular plane while moving inferiorly, remain essentially parallel to its pretreatment position due to residual growth and treatment mechanics.

Conclusion: The study concluded that, There was no decrease in the vertical facial dimension, overbite and mandibular plane angle. However, it should be interpreted with caution, given the small sample size.

Keywords: First premolar extraction, High angle, Wedge hypothesis, Lateral cephalograms.

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INTRODUCTION

The extraction of permanent teeth has been a controversial topic throughout orthodontic history, beginning with the great extraction debate between Angle and Calvin case[1] and continuing through Johnston's comparison of extraction and nonextraction outcomes in borderline cases.[2] The 'no extractions under any circumstances', Angle forces had been defeated by 'extractions when necessary', case forces on the strength of argument supported by the overwhelming preponderance of countervailing scientific and clinical evidence.[3]

Schudy[4-6] described facial types as 'hypodivergent and hyperdivergent' and recommended a nonextraction approach in treatment of hypodivergent facial types and an extraction in hyperdivergent facial types 'to close down the bite'. Although it is difficult to argue against extraction and nonextraction treatment, extraction of permanent teeth is still a valuable arrow in the orthodontists quiver of options.[1]

The primary reason for extraction of permanent teeth are to correct the discrepancy between tooth size and arch length to reduce bimaxillary protrusion. The first clinical concern, i.e. lack of contact between the anterior teeth or openbite, several authors have suggested that removing of permanent teeth from posterior buccal segment with subsequent protraction to close the spaces corrects the open bite by anticlockwise rotation of mandible. This rationale for extraction is referred to as 'wedge hypothesis'.[7]

Some disagreement exists concerning the effect of bicuspid extractions on the vertical dimension. It has been suggested that orthodontic forward movement of the posterior teeth after bicuspid extractions leads to a reduction in vertical dimension and overclosure of the musculature.[8] Several authors suggests that it requires special effort in addition to bicuspid extractions, to reduce the vertical dimension in high mandibular plane angle (MPA). Grasis Pearson showed a mean decrease of 3.9° in MPA following first bicuspid extraction with vertical chin cups used before and during orthodontic treatment.[9]

MATERIALS AND METHODS

The present retrospective study was designed to evaluate the overbite and vertical changes following first premolar extraction in high angle cases treated with preadjusted edgewise appliances (0.022 slot, MBT).

Sample Size

Forty-five adult patients were randomly selected from the pool of completed cases with pre and post-treatment records. All 45 cases were treated with consistent biomechanical principles, transpalatal arch were used for anchorage. Sample included 21 males, of age ranging from 17.3 to 21.6 years (average 18.9 years) and 24 females of age ranging from 17.1 to 20.6 years (average 18.6 years).

Inclusion Criteria

- Cases having high mandibular plane angle, that is GoGn-Sn greater than 32° (Steiner's analysis).
- Cases treated with PEA with all first bicuspids extractions.
- Cases having class I molar and canine relation bilaterally.

Exclusion Criteria

- Cases with class II and III molar relationship.
- Cases treated with surgical orthodontics.

Armamentarium used in the Study

- 0.3 mm pencil
- 0.3 mm lead acetate tracing sheets
- Set of protractors
- X-ray view box.

The analysis compares radiographs with fiducial horizontal and vertical reference lines, at the T_1 tracing. Horizontal drawn parallel to the FH and a perpendicular line was drawn to establish the vertical reference used. The T_2 tracing was superimposed on the T_1 tracing by using cranial base landmarks and both the horizontal and vertical fudicial lines were carried through the T_2 tracing. Six landmarks, anterior nasal spine (ANS), centre of rotation of the maxillary and mandibular central incisors (CRU1 and CRL1), incisal edges of the maxillary and mandibular central incisors (IEUI) and (IELI) and menton (Me) were identified on each cephalogram and projected on to the vertical reference line, keeping the landmark location parallel to the horizontal reference line.

1. *Maxillary skeletal change (MXSK)*: The distance between the intersection of the vertical horizontal reference lines to ANS.
2. *Bodily movement of the maxillary incisors (BU1):* The distance between ANS and CRU1.
3. *Tipping movement of the maxillary incisors (TU1):* The distance between CRU1 and IEU1.
4. *Tipping movement of the mandibular incisors (TL1):* The distance between CRLI and IEL1.
5. *Bodily movement of the mandibular incisors (BL1):* Distance between CRLI and Me.
6. *Mandibular skeletal change (MNSK):* The distance between ANS and Me projected onto the vertical reference line.

The net changes in these variables were used to compute changes in the dependent variables—'overbite' by using the following equation.[1]

$AOB = \Delta MNSK + \Delta BUI + \Delta TUI + \Delta BLI + \Delta TLI$

Where Δ—net change

Tracing 2 minus tracing 1 gives the post-treatment changes in overbite.

Following, angular and linear measurements were used to evaluate vertical dimensional changes.[10]

Angular Measurements (Fig. 1)

1. Go Gn to SN
2. Go Gn to FH
3. Go Gn to PP
4. Go Gn to occlusal plane
5. SN to PP
6. SN to FH
7. U1 to SN
8. L1 to Go Gn
9. IMPA
10. Y-axis

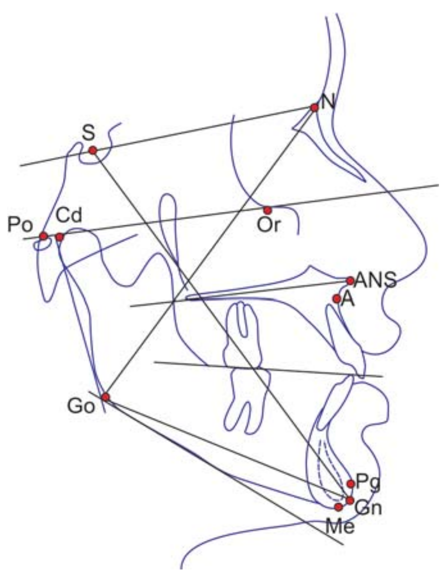

Fig. 1: Angular measurements

Linear Measurements (Fig. 2)

1. UAFH—N to ANS
2. Post FH—Se to Go
3. AFH—N to ANS
4. LAFH—ANS to Me
5. Anteroposterior face height ratio

$$= \frac{\text{Post-FH}}{\text{AFH}} \times 100 = \ldots\ldots\%$$

6. Sv—U6
7. Pog—L6
8. FH—U6
9. FH—L6

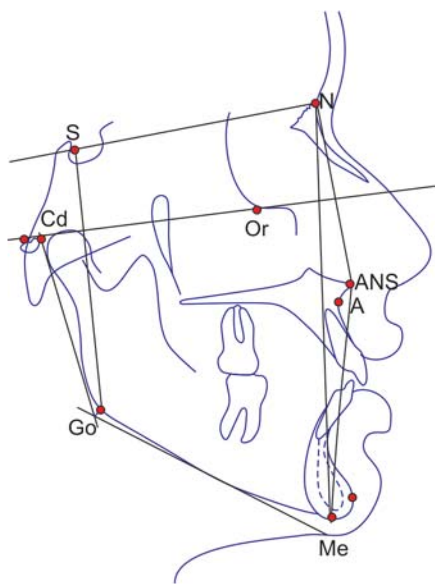

Fig. 2: Linear measurement

STATISTICAL ANALYSIS

Results are expressed as mean ± SD paired t-test was used to analyze post-treatment changes in cephalometric evaluation.

The results were also ascertained by nonparametric Wilcoxon's test, whenever the measurements were presumed to be non-normally distributed.

p-value of 0.05 or less was considered for statistical significance.

Formulae used for Analysis

$$\text{Mean, } \bar{x} = \frac{\Sigma xi}{n} \qquad i = 1, 2, \ldots n$$

$$\text{Standard deviation, SD} = \sqrt{\frac{\Sigma(xi - \bar{x})^2}{n-1}}$$

$$\text{Standard error, SE} = \frac{SD}{\sqrt{n}}$$

$$\text{Paired t-test, } t = \frac{\text{Mean of the differences}}{\text{Standard error of the differences}}$$

$$= \frac{\bar{d}}{SD/\sqrt{n}}$$

Wilcoxon's Signed Rank Test (Alternative to paired t-test)

Pre-post differences are found for each case and ranks are assigned to the differences. Sum of the negative and positive ranks are found separately.

Least of these two sums (Σ-ve α Σ+ve) is compared with table value for significance.

RESULTS

There was statistically significant change in the MPA (Gogn-SN) but the mean difference in the change –0.5 mm (Table 1) suggests that the change is clinically insignificant.

There was statistically significant change in the U1 to SN, L1 to Gogn, BUI and BLI (Tables 2 and 4) suggesting that, the extraction space was closed by retraction of the anteriors. The mean change in the U1 to SN and LI to Gogn is 10.8 and 7.9° respectively. The mean change in the BU1 and BL1 is –2.4 and 2.3 mm respectively.

There was significant change in the sella vertical to mesiobuccal cusp tip of maxillary first molar and pogonion vertical to mesiobuccal cusp tip of mandibular first molar (Table 4) suggests that there was mesial movement of the upper and lower molars. The average mesial movements of maxillary and mandibular molars is –2.3 and –2.2 respectively.

There was a statistically significant change in the FH plane to mesiobuccal cusp tip of maxillary first molar and FH plane to mesiobuccal cusp tip of mandibular first molar,

Table 1: Definitions of cephalometric landmarks

MXSK	The distance between the intersection of the vertical horizontal reference line to ANS
BU1	The distance between ANS and CRU1
TL1	The distance between CRU1 and IEU1
BL1	The distance between CRLI and IEL1
MNSK	Distance between CRLI and Me
MPA	It is the angle formed between Gogn-SN
UAFH	It is the linear distance from N to ANS
TAFH	It is the linear distance from N to Me
LAFH	It is the linear distance from ANS to Me
PFH	It is the linear distance from S to Go
Sv	Perpendicular to FH plane from sella
Pogv	Perpendicular to FH plane from pogonion
Gogn-FH	It is the angular measurement between Gogn-FH
Gogn-PP	It is the angular measurement between Gogn-PP
Go-OP	It is the angular measurement between Gogn-OP
SN-PP	It is the angular measurement between SN-PP
SN-OP	It is the angular measurement between SN-OP

Table 2: Pre- and post-treatment angular measurements

Parameters		*Pre*	*Post*	*Difference*	*t-value*	*p-value*
Gogn-SN	Mean	33.8	34.3	–0.5	2.3	0.03 (S)
	SD	1.2	1.3	1.0		
Gogn-FH	Mean	27.04	27.04	0.0	0.0	1.00 (NS)
	SD	2.0	1.1	2.4		
Gogn-PP	Mean	25.4	25.7	–0.3	–1.77	0.09 (NS)
	SD	1.6	1.1	0.8		
Gogn-OP	Mean	16.0	16.04	0.04	–1	0.92 (NS)
	SD	0.9	1.6	2.1		
SN-PP	Mean	10.0	10.3	–0.3	–1.16	0.26 (NS)
	SD	1.1	1.4	1.2		
SN-FH	Mean	9.8	9.8	0.0	0.0	1.00 (NS)
	SD	0.8	0.9	0.7		
UI-SN	Mean	116.8	105.9	10.8	29.08	<0.001 (HS)
	SD	2.3	1.2	1.9		
LI-Gogn	Mean	102.0	94.0	7.9	26.94	<0.001 (HS)
	SD	3.0	2.5	1.5		
U-Gonial	Mean	53.6	53.6	0.0	–0.44	0.66 (NS)
	SD	1.0	1.0	0.5		
L-Gonial	Mean	76.2	76.3	–0.04	–0.09	0.93 (NS)
	SD	1.9	2.0	2.3		
Y-ANS	Mean	67.2	67.4	–0.2	–1.04	0.31 (NS)
	SD	1.3	1.6	1.0		

S: Significant; NS: Nonsignificant

Table 3: Pre- and post-treatment values of linear measurements

Parameters		*Pre*	*Post*	*Difference*	*t-value*	*p-value*
N-Me	Mean	125.1	126	–0.12	0.37	0.72 (NS)
	SD	3.1	2.8	1.6		
N-ANS	Mean	52.0	52.1	–0.1	–0.62	0.54 (NS)
	SD	1.6	1.5	0.6		
ANS-Me	Mean	70.1	71.1	–0.04	–0.17	0.87 (NS)
	SD	3.6	3.3	1.2		
Se-Go	Mean	72.4	72.2	0.2	1.41	0.17 (NS)
	SD	3.3	3.3	0.7		
APF Ht ratio	Mean	59.64	59.71	0.02	0.2	0.84 (NS)
	SD	0.6	0.8	0.6		

NS: Nonsignificant

Table 4: Overbite and vertical changes of dentition

Parameters		*Pre*	*Post*	*Difference*	*t-value*	*p-value*
MXSIS	Mean	23.4	23.9	–0.5	–1.81	0.08 (NS)
	SD	1.7	1.6	1.3		
BU1	Mean	16.15	18.9	–2.4	–11.52	<0.001 (HS)
	SD	1.0	1.0	1.0		
TU1	Mean	19.4	20.6	–1.2	–5.79	<0.05 (S)
	SD	1.1	1.1	1.0		
BL1	Mean	25.7	23.4	2.3	7.77	<0.001 (HS)
	SD	1.7	1.1	1.5		
TL1	Mean	13.6	12.6	1.1	4.22	<0.05 (S)
	SD	1.2	1.1	1.3		
MNS1s	Mean	73.9	73.8	0.1	0.25	0.80 (NS)
	SD	1.2	1.2	1.6		
OB	Mean	150.5	150.2	0.2	0.79	0.44 (NS)
	SD	2.4	1.8	1.5		
Sv-U6	Mean	40.0	42.3	–2.3	–25.2	<0.05 (S)
	SD	0.9	0.9	0.5		
Pog-L6	Mean	–20.0	–17.8	–2.2	–19.58	<0.05 (S)
	SD	1.0	1.0	0.6		
FH-U6	Mean	46.4	48.6	–2.2	–24.39	<0.05 (S)
	SD	1.7	1.5	0.5		
FH-L6	Mean	47.5	46.3	1.2	4.77	<0.05 (S)
	SD	1.6	1.6	1.3		

$p \leq 0.05$ significant (S); $p \leq 0.001$ highly significant (HS); $p > 0.05$ nonsignificant (NS) suggesting that there was extrusion of molars in maxillary by –2.2 mm and in mandible by 1.2 mm.

There was a slight changes in the certain parameters shown in the Tables 2 to 4. Although there was a slight change, the difference in the changes were very less and statistically insignificant.

DISCUSSION

For evaluation of treatment results, it is important to consider facial types. Long-faced individuals exhibit long anterior face height, excessive backward rotation of the mandible and high MPA.[11,12] Similarly short anterior face height, excessive forward rotation of the mandible and low mandibular plane angle have been reported for short-faced individuals.[12,13]

Previously published literatures[8,14-16] showed that there is no significant changes in the vertical facial dimension following first premolar extraction treatment. The present study aimed to study the comparison of overbite and vertical facial changes following first premolar extraction in high angle cases.

Twenty-five adult patients having high mandibular plane angle, i.e. GoGn-SN greater than 32° were compared with pre- and post-treatment cephalometric results. Pre and post-treatment lateral cephalograms of all the adult 45 patients were taken, obtained with patient positioned in the natural head position.[17,18]

To evaluate the mandibular plane angle, Gogn-SN plane was used, as given by the Steiner's analysis.[19] N-Me and ANS-Me were used as landmarks to evaluate the AFH and LAFH respectively. As sella (Se) point is stable, vertical line drawn perpendicular to FH from sella was used to evaluate the mesial movement of maxillary first molar and Pog vertical was drawn from Pog perpendicular to FH in order to overcome the errors by mandibular rotation. Perpendicular line was drawn from FH to mesiobuccal cusps of the maxillary and mandibular first molars to determine the extrusion of molars after treatment.[20]

The absolute measurements of vertical face height, the ratio of AFH/PFH, MPA and incisor vertical heights did not show significant difference between the pre and post-treatment changes, following first premolar extraction in high angle cases. This suggests that the treatment approach following first premolar extraction in high angle cases does not affect the vertical proportions of the face.

Results in this study suggest that there were no statistically significant difference in the amount of change in the variables for TAFH and LAFH. This is because of the extrusion of molars which would compensate for the mesial migration of the molars, which would accounts for anchorage loss.

Kocadereli[16] and Straggers[14] showed that there was no statistically significant difference in vertical dimension changes between first premolar extraction and non-extraction groups. Chua et al[15] examined the effects of extraction and nonextraction on LAFH and reported a significant increase in the nonextraction group and no significant change in the extraction group. Cusimano, McLaughlin et al[8] found no difference in facial height of hyperdivergent patients with first premolar extraction treatment.

Kim et al[21] tested the occlusal wedge hypothesis by comparing the mesial molar movement and the changes in vertical dimension between first premolar and second premolar extraction groups and concluded that there was no decrease in facial vertical dimension regardless of maxillary and mandibular first or second premolar extraction.

The present study did not show the significant changes in AFH and PFH. This is due to extrusion of the molars leads to increase the downward and backward rotation of the mandible and maintain the vertical reduction of the facial height. Hayasaki et al[22] reported that the changes in the absolute magnitude of anterior and posterior facial heights between extraction and nonextraction treatments in both Class I and II malocclusion patients. Their results conclude that facial growth pattern in vertical and anteroposterior position of the maxillary and mandibular molars, in the absolute magnitude of anterior and posterior face heights, in the ratios of lower posterior face height/lower anterior face height, lower anterior face height/total anterior face height are similar between extraction and non extraction treatment, either in class I or II malocclusions.

Al-Nimi[23] compared the changes in facial vertical dimension in patients with class II division I malocclusion after extraction of either mandibular first premolar or second premolar and concluded that mandibular premolar extraction, whether first or second was not associated with mandibular over closure or reduction in facial vertical dimension.

The analysis of the variables at pretreatment and post-treatment in Table 3 suggests that there was some extrusion of maxillary and mandibular molars, which were statistically significant. This could have been consequent to the mechanotherapy.[8,14,19]

The maxillary and mandibular molars showed mesial movement in relation to 'S' vertical and pog vertical respectively, which were statistically significant (see Table 3). This movement may be consequent to mechanotherapy or residual growth. This finding is similar to the studies of Gardner et al,[24] West and McNamara[25] in late teens and Cusimano et al[8] In addition to this, the normal mesial displacement of the maxillary and mandibular molars, mesial movement in the extraction group might be allowed depending on the severity of the anterior discrepancies.[14,16]

Mandibular plane angle showed statistically significant increase from pretreatment to post-treatment (see Table 1). This is due to the extrusion of molars in both maxilla and mandible. This finding supports the study done by Cusimano, McLaughlin et al on effects of first premolar extraction on facial heights in high angle cases. Whereas a study[20] done by Arunachalam and Ashima Valiathan on cephalometric assessment of dentofacial vertical changes in class I subjects corroborates this finding. But the difference in the changes from pretreatment (–0.5) to post-treatment (1.0) is negligible. This statistical change may be due to small sample size.

There was a statistically highly significant change in the U1-SN, L1-GoGn (see Table 2) and BUI and BLI (see Table 3) suggests that the most of the extraction space was closed by upper and lower anterior retraction.

There was significant change in the tipping movement of upper and lower anteriors (TUI and TLI) (see Table 3) suggesting that there was bite closure by tipping movement of anteriors both in maxilla and mandible. There was no significant changes in the pre- and post-treatment comparison of maxillary and mandibular skeletal measurements (see Table 3) rather relative positions of the maxillary and mandibular incisors were affected by treatment. These results go in favor with the study done by Mark G Hans et al.[1]

There were slight changes in the certain parameters shown in the Tables 1 to 3. Although there was a slight change, the difference in the changes were very less and statistically insignificant. This could be probably due to limitations of the study which could be due to small sample size. Another limitation of the study is we could not analyze in depth the response differences of different patients. For example, in our study, nine patients showed vertical reduction, but statistical evaluation masked these findings. So, it is better to assess an in-depth evaluation of vertical dimension changes in each stage of treatment of the samples, and treatment results should be contemplated with concomitant evaluation of the biomechanics of the temporomandibular joint, since they do not function as simple hinges. So, further studies are required on the biological response to treatment effects as well as compensatory mechanisms, particularly affecting vertical dimensions.

CONCLUSION

The results of this study lead to the following conclusions:

1. There was no decrease in the vertical facial dimension.
2. There was no significant increase in the overbite.
3. There was no decrease in the mandibular plane angle.

This study indicates that occlusal movement of the posterior teeth tend to keep pace with the increase in anterior face height, thus maintaining the mandibular plane angle and nullifying the bite closing effect of posterior protraction. The facial complex does increase in size with growth, but GOGN-SN plane while moving inferiorly, remain essentially parallel to its pretreatment position, due to treatment mechanics.

REFERENCES

1. Hans MG, Groisser G, Oamon C, Amberman D, Nelson S, Palomo M. Cephalometric changes in overbite and vertical facial height after removal of four first molar or first premolars. Am J Orthod Dentofacial Orthop 2006;130(2):183-88.
2. Behrents RG, White RA. TMJ research. Responsibility and risk. Am J Orthod Dentofacial Orthop 1992;102(1):1-14.
3. Bernstein L, Edward H. Angle versus Calvin S. Case: Extraction vs nonextraction. Part I Historical Revisionism. Am J Orthod Dentofacial Orthop 1992;102(5):464-70.
4. Schudy FF. Vertical growth versus anteroposterior growth as related function and treatment. Angle Orthod 1964;34(2):75-93. Angle Orthod 1964;34(2):75-93.
5. Schudy FF. The rotation of the mandible resulting from growth; Its implication in orthodontic treatment. Angle Orthod 1965;35(1):36-50.
6. Schudy FF. The control of vertical overbite in clinical orthodontics. Angle Orthod 1968;38(1):19-39.
7. Issacson JR, Issacson RJ, Speidel TM, Worms FW. Extreme variations in vertical facial growth and associated variation in skeletal and dental relations. Angle Orthod 1971;41(3):219-29.
8. Cusimano C, McLaughlin RP, Zernik JH. Effects of first bicuspid extractions on facial height in high-angle cases. J Clin Orthod 1993;27(11):294-98.
9. Pearson LE. Angle Orthod 1973;43:194-200.
10. Sassouni, Nanda. Dentofacial vertical proportions. Am J Orthod 1964;50(11):801-23.
11. Nanda SK. Growth patterns in subjects with long and short faces. Am J Orthod Dentofacial Orthop 1990;98(5):247-58.
12. Opdebeeck H, Bell WH. The short face syndrome. Am J Orthod Dentofacial Orthop 1978;73(5):499-511.
13. Moorees CFA, Kean MR. Natural head position, a basic consideration in the interpretation of cephalometric radiographs. Am J Phy Anthropol 1958;16(3):213-34.
14. Straggers JA. Vertical changes following first premolar extractions. Am J Orthod Dentofacial Orthop 1994;105(1):19-24.
15. Chaw AL, Lim JYS, Lubit EC. The effects of extraction versus non-extraction orthodontic treatment on growth of the lower anterior face height. Am J Orthod Dentofacial Orthop 1993;104(4):361-68.
16. Kocadereli I. The effects of first premolar extraction on vertical dimension. Am J Orthod Dentofacial Orthop 1999;116(1): 41-45.
17. Cooke MS, Wei Stephen HY. The reproducibility of natural head posture: A methodological study. Am J Orthod Dentofacial Orthop 1988;93(4):280-88.
18. Steiners CC. Cephalometric changes in clinical practice. Am J Orthod 1959;29(1):8-29.

19. Garlington, Logan LR. Vertical changes in high mandibular plane cases following enucleation of second premolars. Angle Orthod 1990;60(3):263-67.
20. Sivakumar A, Valiathan A. Cephalometric assessment of dentofacial vertical changes in Class I subjects treated with and without extraction. Am J Orthod Dentofacial Orthop 2008;133(6):869-75.
21. Kim TK, Kim JT, Mah J, Yang WS, Back SH. First or second premolar extraction effects on facial vertical dimension. Angle Orthod 2005;75(2):177-182.
22. Hayasaki SM, Henriques JFC, Janson G, Creitas MRd. Influence of extraction and non-extraction orthodontic treatment in Japanese-Brazilians with Class I and Class II Division 1 malocclusion. Am J Orthod Dentofacial Orthop 2005;127(1): 30-36.
23. Al-Nimi KS. Vertical changes in class II division 1 malocclusion after premolar extractions. Angle Orthod 76(1):52-58.
24. Gardner RZ, Harris EH, Vanden JL. Postorthodontic dental changes. A long study. Am J Orthod Dentofacial Orthop 1998; 114(5):581-86.
25. West KS, McNamara JA. Changes in the craniofacial complex from adolescence to midadulthood: A cephalometric study. Am J Orthod Dentofacial Orthop 1999;115(5):521-32.

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