Effect of First Premolar Extraction on Facial Vertical Dimension in Hyperdivergent Cases

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ABSTRACT

Background: The purpose of this study was to compare changes in the vertical dimension in patients after the extraction of maxillary and mandibular first premolars. **Methods:** The pretreatment and posttreatment records of 30 patients of age range 18-25 years who had skeletal class II with Hyperdivergent facial pattern and have undergone first premolar extraction in both the arches for orthodontic treatment under MBT prescription were taken. **Results:** There was significant increase seen in the maxillo-mandibular plane (MM angle), mandibular plane angle (MP angle), and Steiner's SN (Go-Gn) angle from pretreatment to posttreatment cephalometric records. **Conclusion:** Controlling the vertical dimension with the extraction of first premolars is not possible. It is important to prevent extrusion of molars to avoid further increase in vertical dimensions in vertical growers.

Keywords: Vertical dimension, Premolar extractions, Hyperdivergent, High angle.

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INTRODUCTION

The extraction of premolars as a practical form of orthodontic therapy has been accepted for many years, but there remains a controversy regarding the effect of premolar extraction on the facial vertical dimension. Some believe that premolar extraction allows the posterior teeth to move forward resulting in reducing the vertical dimension of occlusion. Also, many believe that premolar extraction to be an etiologic factor in causing temporomandibular joint (TMJ) disorders. It has been suggested that orthodontic forward movement of the posterior teeth after mandibular and maxillary premolar extraction leads to a reduction in vertical dimension.[1-3] The mandible is then allowed to overclose; as a result, it was thought that TMJ problems are likely to occur. There are no published results to support this theory. Cusimano et al,[4] analyzed the premolar extraction cases and found no over collapse of the vertical dimension; on the contrary, the vertical dimension was either maintained or slightly opened.

The purpose of this study was to evaluate changes in vertical dimensions in the patients with hyperdivergent facial form who have undergone maxillary and mandibular first premolar extractions for orthodontic treatment.

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MATERIALS & METHODS

Records of 30 patients treated with maxillary and mandibular first premolar extraction were obtained from department of Orthodontics and Dentofacial Orthopaedics, Government Dental College and Hospital Srinagar. All patients selected had a skeletal class II and hyperdivergent facial form. The assessment of the skeletal relationship was based on the patient's pretreatment SNA angle, SNB angle, and ANB angle. Facial divergence was determined on the basis of the maxillary-mandibular plane angle (MM angle) and the ratio of posterior facial height to the total anterior facial height (PTH/TAFH). All the patients were treated using MBT prescription.

The subjects were selected on the basis of the following criteria:

- Skeletal Class II malocclusion.
- Hyperdivergent facial form.
- Age range 15-25 years.
- The availability of full records, including pretreatment and posttreatment models, lateral cephalograms, and clearly documented orthodontic treatment mechanics.
- The treatment involved the extraction of the maxillary and mandibular first premolars.
- No headgear was used before or during the fixed appliance therapy.
- No functional appliance was used before or with the fixed appliance.

The pretreatment and posttreatment cephalometric tracings were done by same operator. Five linear and three angular cephalometric measurements were selected to evaluate vertical changes [Figure 1].

1. Maxillo-mandibular plane (MM angle) - Angle formed by the intersection of anterior nasal spine-posterior nasal spine and menton-pogonion lines.
2. Mandibular plane (MP angle) - Angle formed by the intersection of menton-gonion and orbital-Porion lines.
3. Sella Nasion to Gonion Gnathion (angle)
4. Total anterior facial height (TAFH) - The distance between nasion and menton.
5. Lower anterior facial height (LAFH) - The distance between anterior nasal spine and menton.
6. Posterior facial height (PFH) - The distance between sella and gonion.
7. LAFH/TAFH- Ratio of the distance between anterior nasal spine and menton to the distance between nasion and menton.
8. PFH/TAFH- Ratio of the distance between sella and gonion to the distance between nasion and menton.

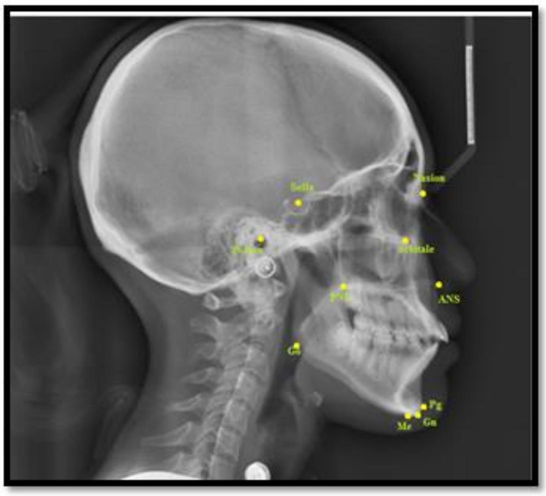

Figure 1: Lateral cephalogram showing various landmarks used in the study.

Statistical Method

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Statistical software SPSS (version 20.0) and Microsoft Excel were used to carry out the statistical analysis of data. Data were expressed as Mean±SD. Paired t-test was employed for comparing changes in various parameters before and after treatment. Graphically the data was presented by bar diagrams. A P-value of less than 0.05 was considered statistically significant. All P-values were two tailed.

RESULTS

The mean and standard deviation of various measurements at pretreatment and post treatment are shown in [Table 1].

The mean changes resulting from treatment show a significant increase in maxillo-mandibular angle (MM angle), Mandibular plane angle (MP angle) and SN (Go-Gn) angle which depict futher opening of the mandibular angle.

Table 1: Pre and post treatment comparison of various parameters

Parameter	Pre treatment		Post treatment		Mean Change	t-value	P-value
	Mean	SD	Mean	SD			
MM Angle 0	31.63	1.71	34.47	1.28	2.83	12.87	<0.001*
MP Angle 0	27.67	1.25	28.35	1.28	0.68	4.89	<0.001*
SN TO (Go-GN) 0	34.17	1.18	35.43	1.04	1.27	6.24	<0.001*
TAFH (mm)	110.07	2.38	110.53	3.26	0.47	1.45	0.158
LAFH (mm)	63.37	1.22	63.73	1.08	0.37	1.23	0.229
PFH (mm)	67.80	3.45	68.00	3.44	0.20	0.815	0.421
LAFH/TAFH	0.570	0.02	0.572	0.02	0.002	0.263	0.794
PFH/TAFH	0.610	0.03	0.609	0.03	-0.001	0.187	0.853

*Statistically Significant Difference; P-value by Paired t-test

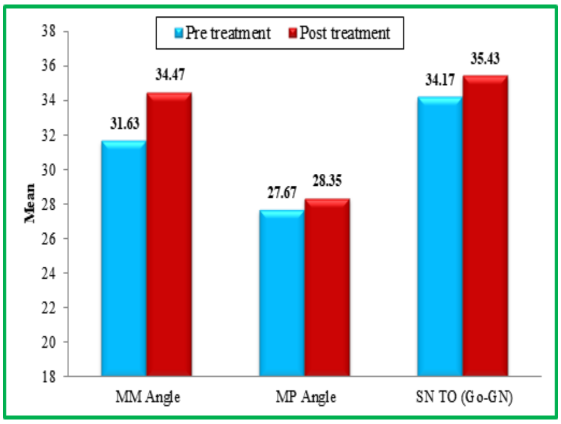

Figure 2: Changes seen from pretreatment to posttreatment in MM angle, MP and SN (G0-Gn).

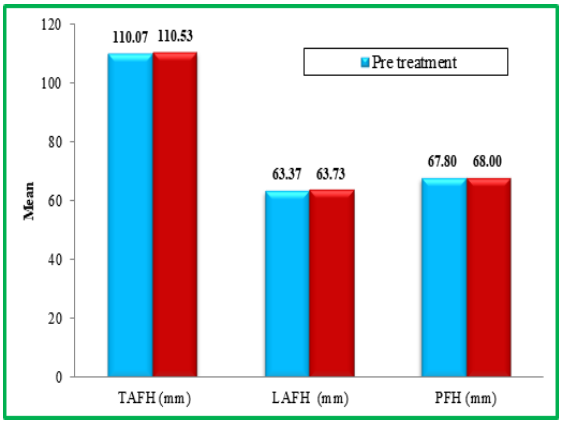

Figure 3: Changes seen from pretreatment to posttreatment in TAFH, LAFH and PFH.

There was also increase in the mean values of lower anterior facial height (LAFH), Total anterior facial height (TAFH) and Posterior facial height (PFH) after treatment but the increase was statistically insignificant. The change in ratios LAFH/TAFH and PFH/TAFH between pre and post treatment cephalograms was also found to be insignificant.

The results are graphically depicted using a bar diagram in [Figure 2-4].

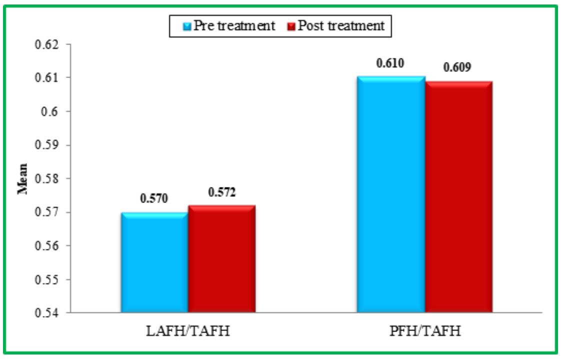

Figure 4: Changes seen from pretreatment to posttreatment in LAFH/TAFH and PFH/TAFH.

DISCUSSION

The aim of this study was to evaluate the effect of first premolar extraction on the facial vertical dimension in orthodontically treated Class II division 1 malocclusion with hyperdivergent facial pattern. Functional appliances and cervical headgear were considered to have an extrusive effect on the posterior teeth that could mask any possible vertical dimension loss resulting from premolar extraction.[5] Therefore, cases with functional appliances or headgears were excluded.

The vertical dimension of the occlusion is thought to be a critical etiologic factor in temporomandibular joint disorders. The results of this study showed that the changes in vertical dimension with respect to angular measurements showed a significant increase. On average, most of the changes in linear cephalometric measurements from before treatment to after treatment reflected an increase in the vertical dimension. Thus the results of this study did not support the theory that extraction of first premolars produces a loss in the vertical dimension of occlusion as suggested by several authors.[1-3] Retrospective sample studies and longitudinal sample studies have consistently failed to demonstrate a causative link between orthodontic treatment (including premolar extraction) and temporomandibular joint disorders.[6-14] In a study by Sivakumar and Valiathan,[15] linear vertical dimensions increased in both the extraction and the non-extraction groups and the changes were comparatively greater in the extraction group , this in accordance with the results of study which showed increase in the vertical dimension.

The results of this study showed that in Class II patients the extraction of maxillary and mandibular first premolars did not cause a loss in vertical dimension and is in accordance with the findings of Staggers.[16]

CONCLUSION

- First premolar extraction in Class II division 1 subjects was not associated with a significant reduction of the facial divergence measured by the MM angle and the MP angle.
- This study demonstrates that the attempt to help control (close) the vertical dimension with the extraction of first premolars is not possible.

  This study suggested that it is important to prevent extrusion of molars to avoid further increase in vertical dimensions in vertical growers.

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