

Lower anterior facial height changes following premolar extraction in class II division 1 malocclusion

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Abstract

Background:

There is a controversy regarding the extraction of premolars and the alteration of lower anterior facial height of the patient. "Wedging effect" has been put forward which suggests that mesialisation of the molars leads to decrease in the lower anterior facial height.

Aims and objectives:

The aim of this study is to find out the effects of premolar extraction and mesialisation of molars on the lower anterior facial height of the patient with class II division 1 malocclusion and hyperdivergent face.

Materials and Methods:

The study includes 30 patients (21 Males, 9 Females) of age group 19.4 ± 1.4 years with class II (End on) Division I malocclusion with hyperdivergent face ($MP = 37.4 \pm 2.4^0$). All cases were treated with extraction of upper first premolars and lower second premolars. En masse retraction of the anterior teeth was done with loop mechanics on 0.018 Roth brackets with end result on Class I molar relation. Pancherz method was used to determine the measurement of the total mesialisation of molars on the post treatment cephalogram. The alteration of the vertical relations of the molars after mesialisation was determined in relation to the Frankfort Horizontal plane.

Results:

It is found that the mesialisation of the upper and lower molars is highly significant ($p < 0.05$). However, there is no significant change in the lower anterior facial height of the patient. LAFH (ANS-Me) alteration between T1 and T2 is not significant ($p > 0.05$).

Conclusion:

Extraction of premolars and mesialisation of the molars leads to no change in the lower anterior facial height of the patient. "Wedging effect" as previously claimed does not seem to be valid.

Key words:

Class II Division 1, hyperdivergent face, lower anterior facial height, Pancherz method, premolar extraction, wedging effect.

Introduction:

Facial types may be classified in variety of ways but hyperdivergent and hypo divergent facial types as described by Schudy is one of the most common.¹ Shuddy,² Nanda and Sassouni³ had advocated extraction treatment for closing the bite in case of hyperdivergent face and non extraction was suggested for hypodivergent face. However, there

is a controversy regarding the effect of premolar extraction and the change in the lower anterior facial height (LAFH). Some authors consider that premolar extraction causes Temporal mandibular joint (TMJ) problems due to over closure of the mandible and over retracting the anteriors⁴ where as other authors disapprove with the relation of premolar extraction and

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TMJ problems of alteration of the vertical height of the face.⁵⁻¹¹

Generally the first premolar is extracted in case of anterior crowding or in case if there is excessive protrusion of the lips so that the space gained by the extraction space is utilized in relieving the crowding or retracting the anteriors. Similarly the lower second premolars are extracted in case the lower anteriors are not so crowded and also in order to mesialize the lower first molar for obtaining the class I molar relation in case of End on molar relation. According to the "Wedge effect" concept, if the second premolar is extracted, then the mesial movement of the molar will decrease the vertical height of the face which may be favorable for hyperdivergent face but there is also a chance of TMD problem.^{2,4,12} The purpose of this study was to find out the effect of upper first premolar and lower second premolar extraction on the lower anterior facial height in Class II (End on) Div 1 patients.

Materials and Methods:

In this study Class II molar relation (End on) was selected because mesialization of lower molar could be done and to evaluate if there is "wedging effect" resulting in decrease in lower anterior facial height of the face. Similarly, hyperdivergent cases were selected because decreasing the lower anterior facial height would be a greater concern.

The study samples consisted of 30 Class II (End on) Div I subjects (21 males, 9 females) treated in Orthodontic Unit, Dental Department, NAMS, Bir Hospital. The average group was 19.4 ± 1.4 years. The facial divergence was determined in relation to SN-MP and the average MP was ($MP 37.4 \pm 2.4^\circ$)

All the cases were diagnosed by one operator and reevaluated by the second operator. All the cases were handled and completed by the same operator using 0.018 Roth Brackets and closing loop mechanics. All the cases had undergone extraction of the upper first premolars and the lower second premolars. Factors that would influence molar extrusion such as extra-oral anchorage; interarch elastics etc were not used. The pre and post treatment lateral cephalograms were taken with the same radiographic unit (Rotagraph plus model MR05). Cephalometric radiographs were taken with teeth in maximum intercuspation and lips relaxed in Natural head position.

All the radiographs were traced with hand on acetate paper sheets. All the landmarks were identified, located and marked. All the measurements were obtained with the help of vernier caliper (Mitutoyo SER No.60325791 Japan) for linear measurements and protractor for angular measure-

ments which recorded up to 0.02 mm and 0.5 degrees respectively. All these tracing were done by the same operator in order to avoid inter-examiner variability.

For the purpose of measurement of pre and post treatment dental changes, Pancherz method was used (Figure 1). Occlusal plane (OL) and its perpendicular plane (OLp) through sella point were used as a reference grid on the initial cephalogram. OL was used as X-axis and OLp was used as a Y-axis. The cephalogram was superimposed on SN at S (figure 2). Maxillary and mandibular dental changes are obtained from the movement of the dental landmarks along OL plane to OLp, subtracting the movement of their related skeletal basis.

For determining the Pre and Post treatment vertical alteration of the molars, perpendicular distance from the Frankfort Horizontal plane (FHP) to the maxillary first molar and perpendicular distance from the Mandibular Plane (MP) to the mandibular first molars on their respective distal cusps were measured (Fig3) The data obtained were analyzed with paired t-test using SPSS version 17 (SPSS Inc, Chicago, Ill). The P values were calculated under the predetermined level of significance of 0.05 and confidence level of 95%. For the purpose of testing the intra-examiner error, 10 cephalometric radiographs were randomly selected and retraced after a month by the same operator. The tracing were analyzed by paired t-test and then with Dahlberg's formula for any significant difference between the two tracings. The test showed that the error varied between 0.41 to 0.91.mm

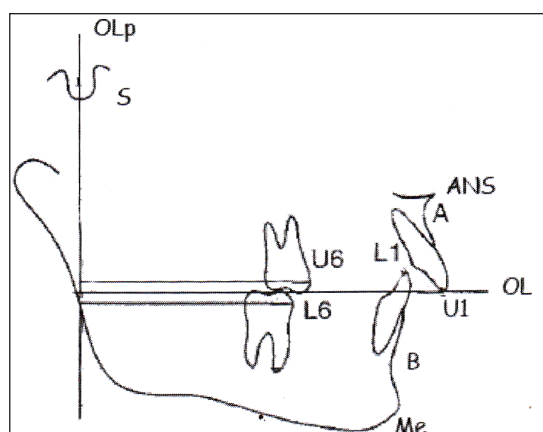


Figure 1: Hard tissue landmark in this study: Anterior Nasal Spine (ANS), Point A (A), Tip of the maxillary central incisor (U1), Tip of the mandibular central incisor (L1), Point B(B), Menton(Me), Maxillary first molar (U6), Mandibular first molar (L6), Sella(S), Occlusal plane (OL), Occlusal plane perpendicular passing through Sella (OLp).

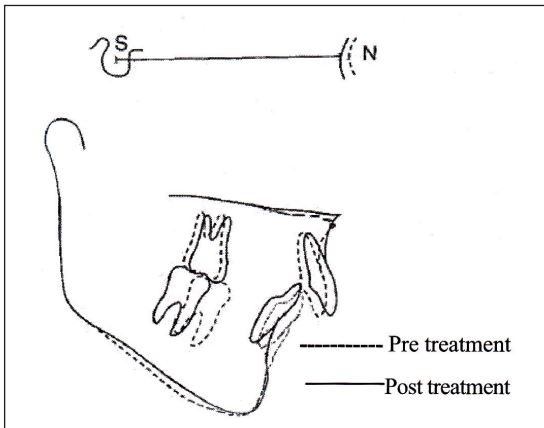


Figure 2: Pancher's superimposition method with reference to SN plane on point S. Sella (S), Nasion (N)

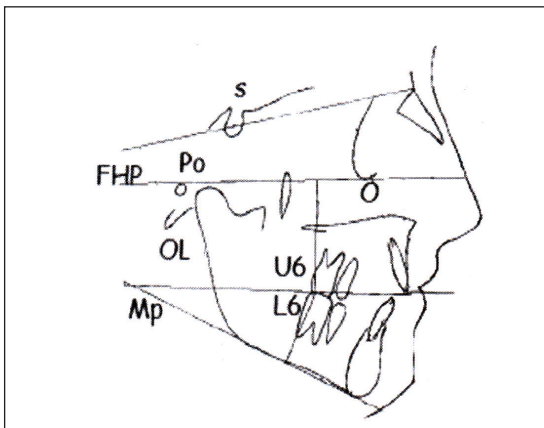


Figure 3: Porin(Po), Orbitale(O), Frankfort Horizontal plane (FHP), Mandibular plane(MP), The perpendicular distance of the maxillary first molar to Frankfort Horizontal plane(FHP-U6), The perpendicular distance of mandibular first molar to mandibular plane (MP-L6).

Results

The treatment changes have been shown in Table 1. Descriptive statistics of the cephalometric measurements of the subjects at T1 and T 2 have been compared. The extrusion of the molars between T1 and T 2 is seen. However, it is not significant ($P>0.05$). The mesialisation of the upper and lower molars is highly significant ($P<0.05$). However, there is no significant change in the LAFH (ANS-Me) alteration between T1 and T2 ($P>0.05$).

Table 1: Comparison between Pre-treatment and Post-treatment cephalometric measurements.

	Pre-treatment (T1)		Post-Treatment (T2)		P-Value	Significance ^a
	Mean	SD	Mean	SD		
FHP-U6	47.20	2.90	47.87	2.28	0.062	NS
MP-L6	27.00	2.18	27.22	2.21	0.254	NS
OLp-U6	53.12	6.35	54.98	6.27	0.000	*
OLp-L6	53.17	6.23	58.10	6.79	0.000	*
LAFH (ANS-Me)	65.87	4.99	65.36	4.80	0.083	NS

^aNS signifies Not significant, *P value<0.001

Discussion

There has been controversy regarding the relation between extraction and change in vertical dimension. Changes in lower anterior vertical height have been documented in literature. Garlington has claimed that there is a decrease in vertical height when enucleation of the premolars were done¹³ where as others claim that there is an increase in the lower anterior vertical height of the patients during extraction treatments of the premolars of the premolars.^{14,15} Chua et al¹⁶ examined the relation between extraction and non extraction treatment with the alteration of lower anterior facial height (LAFH) and found that non extraction significantly increases the LAFH where as extraction of premolars do not have an effect on it. Similarly, Cushimano et al¹⁷ found that there is no alteration in the LAFH by extraction of first bicuspid in hyperdivergent face.

In our study the alteration of the LAFH was compared between the T1 and T2 in relation to the concept that mesial movements of the molars will rotate the mandible in an anticlockwise direction leading to reduction of the LAFH thus creating a “wedging effect”. Precautions were taken not to extrude the buccal teeth during space closure by avoiding class II elastics and extra oral anchorages. Though these precautions were taken, post treatment results indicate that there was some amount of extrusion of both the upper and lower molars. However, it is not statistically significant. The reason of extrusion of molars may be due to the tip back bend given adjacent to molars during the space closing loop mechanics to increase moment for anchorage reinforcement during en mass retraction of the anteriors. In our study, Pancherz method was chosen in order to determine the alteration of sagittal relation of molars between pretreatment (T 1) and post treatment (T2). It was seen that mesialization of the molars is statistically significant when compared between T1 and post treatment T2. However, we found that the changes in the lower anterior vertical height of the patient are not significantly difference between T1 and T2. It is in contrary to Garlington et al¹³ who found

that there is decrease in lower anterior facial height due to forward rotation of the mandible but they also found that the total facial height of the patient were not altered. He claimed that it might be due to some compensatory changes in the vertical height of the maxillary region. Similarly our findings also contradicts to the study done by Shivakumar and Valiathan¹⁵ who mentioned that there is an increase in vertical height of the patients more in the premolar extraction cases than in the non extraction cases and it may be due to the extrusion effect during mesialization. However, they did not find any change in the mandibular plane angle.

In a study done by Taner-Sarisoy et al¹⁸ they concluded that extraction of premolars did not influence the LAFH because the extrusion of the molars and the growth of the patient may be compensated by the wedging effect by mesialization of the molars and thus maintain the LAFH. However, our study contradicts with this hypothesis as the age group of the patients in this study is beyond the growth potentials. So the effect of growth

influence on LAFH in our study can be neglected.

Our study agrees with other studies which have shown that there is no any significant alteration in the lower anterior vertical height of the patient after extraction of the premolars.¹⁹⁻²⁰ Since in our study, vertical alteration of molars was prevented and growth effects did not affect the LAFH, further studies are needed to determine the relation of LAFH with these factors.

Conclusion:

The extraction of the premolars did not affect the lower anterior facial height of the patient when extrusion of the molars was prevented. The concept of “wedging effect” i.e. mesialization of the molars leading to anti-clock wise rotation of the mandible and thus decrease in LAFH seems to be invalid in case of hyperdivergent face. However, the relation of the vertical alteration of the molars during mesialization and the effect of growth on LAFH needs to be further studied.

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