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"EVALUATION AND COMPARISON OF VERTICAL CHANGES IN NON GROWING CLASS I SUBJECTS TREATED WITH ALL FIRST PREMOLARS EXTRACTION AND NON EXTRACTION USING PRE ADJUSTED EDGEWISE APPLIANCE – A CEPHALOMETRIC STUDY"

Dental Science

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ABSTRACT

OBJECTIVES:- To evaluate and compare the vertical changes in non-growing class I subjects treated with all first premolars extraction and non-extraction using pre adjusted edgewise appliance.

METHOD:- The pretreatment and post treatment lateral cephalograms of 28 patients out of which 14 patients were treated by all first premolars extraction and 14 with no extraction pre adjusted edgewise appliance therapy were used. Intragroup and intergroup comparison was done by using paired t-test and unpaired t-test respectively.

RESULTS:- Both the treatment modalities caused an increase in lower anterior facial height along with an increase in mandibular plane angle due to general extrusive nature of the mechanotherapy. However, this backward rotation of the mandible was found to be more in non extraction group.

CONCLUSION:- Thus, the wedge hypothesis suggesting decrease in vertical dimension following all first premolars extraction stands invalid.

KEYWORDS

Class I, vertical dimension, all first premolars extraction, non-extraction

Introduction

Treatment of malocclusions has been a great challenge to the orthodontists for years which include Angle's class I, II and III. Among these, Angle's class I forms the largest single group (50-55%) exhibiting normal skeletal and molar relationship but certain dental irregularities.[1] Treatment modality of these dental irregularities such as spacing, rotation, crowding etc may include no extraction or extraction of all first premolars.

Orthodontic extractions continue to be a controversial topic in dentistry today. Beginning with the great extraction debate between Angle and Calvin Case and continuing through Johnston's comparison of extraction and non-extraction outcomes in borderline cases.

The primary reasons of extraction of permanent teeth are to correct the discrepancy between tooth size and arch length, to reduce bimaxillary protrusion and lack of contact between anterior teeth.

Yet few others believe that the dentoalveolar apparatus is assumed to take the form of an occlusal wedge so that the bite is opened when molars or premolars are extruded or distalized, or it is closed when molars are moved forward after extraction of the premolars allowing the mandible to over close and the muscles of mastication becoming foreshortened thus resulting in decrease in the vertical dimension.[2-4]

This rationale for extraction is referred to as 'wedge hypotheses.[5,6] Unlike other dental treatments, orthodontic mechanotherapy is performed in an environment of biological complexities and complexities associated with the treatment per se. Hence any differences of opinion regarding the above claim are not surprising.[7]

One of the important ignored factors in previous studies is the effect of growth on vertical dimension of face. As the mandible develops it is displaced downward and forward because of primary and secondary displacement. Therefore, facial height increases as a result of facial growth. Hence, to be able to purely evaluate the vertical changes due to premolar extraction and non-extraction one must exclude the above mentioned factor.

Thus the purpose of this study is to investigate the validity of the mentioned claim by evaluating and comparing the vertical changes in non-growing class I subjects treated with all first premolars extraction and non-extraction using pre adjusted edgewise appliance.

Materials and methods

Pretreatment and post treatment lateral cephalograms of patients were collected from the record section of the Department of Orthodontics and Dentofacial Orthopedics.

The study was carried out on 28 patients who were divided into 2 groups:

The growth status of all patients was evaluated using cervical vertebrae maturation index by Hassel and Farman on lateral cephalograms. Lateral cephalograms were taken at following two points of time:

Pre-treatment- T1
Post treatment-T2

Group I: 14 non growing patients treated with all first premolars extraction using pre adjusted edgewise appliance.

Group II: 14 non growing patients treated with non-extraction using pre adjusted edgewise appliance.

Inclusion criteria:

a. Skeletal and dental class I (ANB= 0-4^0).
b. Non growing individuals determined by cervical vertebrae maturation index.
c. Maxillary and mandibular pre adjusted edgewise appliance as part of orthodontic treatment.
d. Presence of all teeth upto first permanent molars.
e. Moderate anchorage in both the arches
f. Average growth pattern
h. Treated with all first premolars extraction or non-extraction

The cephalometric parameters measured include:

Skeletal linear parameters
Nasion to menton, Anterior nasal spine to menton, Sella to constructed gonion, Nasion to anterior nasal spine

Dental linear parameters
MxM – PP (Maxillary first molar-Palatal plane), MdM – MP (Mandibular first molar to mandibular plane)

Skeletal angular parameters
MP-TH (Mandibular molar to True horizontal)

Soft tissue linear parameters
Glabella to soft tissue menton, Glabella to subnasale, Subnasale to soft tissue menton For within group comparison of skeletal, dental and soft tissue parameters before and after treatment, Student's paired t test was used. Between groups comparison was done using Student's unpaired t test.

Results (table1-6)

Variable		T1	T2	T1-T2	p
N – Me	Mean	121.93	122.57	-0.64	0.002*
	SD	4.57	4.70	0.63	
ANS-Me	Mean	69.79	70.43	-0.64	0.002*
	SD	4.46	4.73	0.63	
S – Go	Mean	82.00	82.00	0	
	SD	7.13	7.13	0	
N-ANS	Mean	52.14	52.14	0	
	SD	2.25	2.25	0	
MxM-PP	Mean	24.86	24.93	-0.07	0.33,NS
	SD	1.51	1.38	0.27	
MdM-MP	Mean	32.36	33.5	-1.14	0.003*
	SD	2.56	2.68	1.17	
G'-Me'	Mean	142.86	143.43	-0.57	0.01*
	SD	3.66	3.94	0.51	
G'-Sn	Mean	68.00	68.00	0	
	SD	2.57	2.57	0	
Sn-Me'	Mean	74.86	75.43	-0.57	0.001**
	SD	4.44	4.75	0.51	

Paired t test

Table 1: Intragroup comparison of linear parameters – Group I

Variable		T1	T2	T1-T2	p
MP-HP	Mean	25.43	25.93	-0.5	0.03 *
	SD	2.85	2.84	0.52	

Paired t test

Table 2: Intragroup comparison of angular parameter – Group I

Variable		T1	T2	T1-T2	p
N – Me	Mean	121.86	123.36	-1.5	0.001**
	SD	7.51	7.23	1.22	
ANS-Me	Mean	67.14	68.64	-1.5	0.001 **
	SD	5.92	5.85	1.22	
S – Go	Mean	82.79	82.79	0.0	
	SD	7.53	7.53	0.0	
N-ANS	Mean	54.71	54.71	0.0	
	SD	3.15	3.15	0.0	
MxM-PP	Mean	23.43	24.71	-1.29	0.00**
	SD	2.56	2.70	0.73	
MdM-MP	Mean	33.00	33.57	-0.57	0.006 *
	SD	3.06	3.03	0.65	
G'-Me'	Mean	143.79	145.29	-1.5	0.00**
	SD	9.09	8.69	1.16	
G'-Sn	Mean	70.36	70.36	0.0	
	SD	4.57	4.57	0.0	
Sn-Me'	Mean	73.43	74.93	-1.5	0.00 **
	SD	6.86	6.57	1.16	

Table 3: Intragroup comparison of linear parameters – Group II

Variable		T1	T2	T1-T2	p
MP-HP	Mean	22.86	23.79	-0.93	0.00 **
	SD	1.66	1.93	0.62	

Table 4: Intragroup comparison of angular parameter – Group II

Variable		T1 - T2	Extraction v/s Non extraction		
		Extraction	Non extraction	t	p
N – Me	Mean	-0.64	-1.5	-2.33	0.02*
	SD	0.63	1.22		
ANS-Me	Mean	-0.64	-1.5	-2.33	0.02*
	SD	0.63	1.22		
S – Go	Mean	0.0	0.0		
	SD	0.0	0.0		
N-ANS	Mean	0.0	0.0		
	SD	0.0	0,0		
MxM – PP	Mean	-0.07	-1.29	-5.87	0.00* *
	SD	0.27	0.73		
MdM – MP	Mean	-1.14	-0.57	1.60	0.12NS
	SD	1.17	0.65		
G'-Me'	Mean	-0.57	-1.5	-2.74	0.01 *
	SD	0.51	1.16		
G'-Sn	Mean	0.0	0.0		
	SD	0.0	0.0		
Sn-Me'	Mean	-0.57	-1.5	-2.74	0.01 *
	SD	0.51	1.16		

Table 5: Intergroup comparison of linear parameters

Unpaired t test

Variable		T1 - T2		Extraction v/s Non extraction	
		Extraction	Non extraction	t	p
MP-HP	Mean	-0.5	-0.93	-1.99	0.05*
	SD	0.52	0.62		

Table 6: Intergroup comparison of angular parameter

Unpaired t test
* $p < 0.05$, S (Significant)
** $p < 0.001$, HS (Highly significant)
$p > 0.05$, NS (Not significant)

T1: Pre-treatment
T2: Post-treatment

T1 – T2: Difference in pre-treatment and post-treatment measurements
Statistical analysis of the cephalometric data revealed an increase in the vertical dimension from before to after fixed orthodontic treatment for both the groups.

Statistically significant increase was found in N-Me, ANS-Me, MdM-MP, G'-Me', Sn-Me', Sn-Me' and MP-HP in the Extraction group and in N-Me, ANS-Me, MxM-PP, MdM-MP, G'-Me', Sn-Me' and MP-HP in the non-extraction group.

In the intergroup comparison, non-extraction fixed mechanotherapy was found to be more extrusive in nature with statistically significant difference in the increase of N-Me, ANS-Me, MxM-PP, MdM-MP, Sn-Me' and MP-HP from before to after treatment.

Discussion
The present study was done to evaluate and compare the vertical changes in non growing class I subjects treated with all first premolars extraction and non extraction using pre adjusted edgewise appliance.

Effect on skeletal and soft tissue linear parameters:
A statistically significant increase in anterior facial height and lower anterior facial height was noted in both the groups from pre to post treatment.

Similar results were obtained in studies done by Staggers[8], S.F.H. Ismail et al.[9], Meena Kumari et al[10], Ilken Kocardeli [11] and Klapper et al.[12]. This can be attributed to the orthodontic mechanics which are extrusive in nature and appear to maintain or even increase the vertical dimension.

However, studies done by Nikolaos et al.[13] and Chia-Hung et al.[14] showed no significant increase in total and lower anterior facial height .They have concluded that facial height is more under the control of genetics than environmental factors like treatment mechanics and that

the extrusive effect of class II elastics is negated by protraction of molars into the wedge.

The intergroup comparison showed that the increase in lower anterior facial height contributing to the increase in total anterior facial height was more in the non-extraction group.

Similar result was obtained in a study done by Chua et al.[15] which can be attributed to lack of mesialisation of lower molars and also distalization of upper molars.

However, study done by Arunachal Sivakumar et al.[7] showed more increase in lower anterior facial height in the extraction group. This can be attributed to the fact that the use of class II elastics in extraction group to close down the extraction space had more extrusive effect than mesialisation which was absent in non extraction group. It is also said that the extrusive effect of treatment which leads to increased lower anterior facial height is more pronounced with a longer duration of treatment in the extraction group.

On the other hand, authors like Staggers[8], Meena Kumari et al.[10], S.F.H. Ismail et al[9], Klappers et al.[12], and Ilken Kocardeli[11] in their studies showed no significant difference in the increase in lower anterior facial height between the extraction and non extraction groups. This can be attributed to the minimum use of class II elastics required as patients selected were having class I molar relation.

No change in posterior facial height and middle facial height was noted in both the groups pre to post treatment as the patients selected were non growing as determined by Hassel and Farman's cervical vertebrae maturity indicator index.

Similar results were obtained by Staggers[8] and Meena Kumari et al.[10] where they have observed a decrease in facial height ratio that is N-ANS/ANS-Me and Jarabak ratio that is Se-Go/N-Me pre to post treatment as the denominator increased and numerator remained constant.

Effect on linear dental parameters:

An increase in MxM-PP that is the linear perpendicular distance from mesiobuccal cusp tip of maxillary first molar to palatal plane from pre to post treatment in both the groups has been noted signifying extrusion of the maxillary molars.

The intergroup comparison shows that the extrusion of upper molars was more in non extraction group compared to extraction group. This can be attributed to minimum need of distalization of upper molars required using a sliding jig to overcorrect the molar relation in non extraction group. Although the extrusion of upper molars was statistically insignificant in the extraction group, it can be attributed to the Spee in the upper archwire and the general extrusive nature of mechanotherapy.

An increase in MdM-MP that is linear perpendicular distance from the mesiobuccal cusp tip of mandibular first molar to the mandibular plane signifying extrusion of lower molars from pre to post treatment in both the groups has also been noted.

Intergroup comparison shows that extrusion of lower molars is more in extraction group which can be attributed to the need of use of class II elastics in the extraction group though minimal.

Similar results have been shown in studies done by Kazem[16], Meena Kumari et al.[10] and Staggers[8] signifying that fixed mechanotherapy is extrusive in general causing both upper and lower molars to extrude. While Klapper et al.[12] showed that upper molars were more liable to be extruded because of relatively spongy bone in the maxilla .This extrusion of upper molars was seen more in the non extraction group corresponding to a greater degree of maxillary molar distal movement. However, Sarisoy et al.[17] in their study showed more probability of extrusion of lower molars due to the use of class II elastics.

On the other hand, Sivakumar and Valiathan[7] in their study have shown no significant extrusion of molars.

Effect on skeletal angular parameter:

An increase in MP-HP angle was noted in both the groups pre to post treatment.

Similar results were obtained by Ilken[11], Klappers et al.[12] and Staggers[8] who attributed it to the extrusive mechanotherapy leading to backward rotation of the mandible.

However, authors like Kazem[16], Sivakumar et al.[7] and Samir E Bishara et al.[18] noted no increase in mandibular plane angle. This was supported by assuming that the extrusion of molars takes place along the occlusal plane maintaining the growth pattern of the patient and that the growth pattern of a person is more under genetic control than environmental factors like fixed mechanotherapy. Sivakumar et al.[7] also mentioned that the mesial movement of the maxillary and mandibular posterior teeth was coincidental with the extrusion to such an extent that it increased the vertical dimension, although the mandibular plane angle remained unchanged during treatment.

The intergroup comparison showed that the increase in mandibular plane angle to the true horizontal was more in non-extraction group pre to post treatment compared to the extraction group. This could be attributed to the wedge hypothesis that is less chances of mesialization of lower molars due to absence of available extraction space. Moreover, there are increased chances of distalization of upper molars accompanied by extrusion due to the use of sliding jig. This extrusion of upper molars is also facilitated by relatively spongy bone of the maxilla.

Similar results were obtained by Klapper et al.[12] who mentioned that there were indications of greater degree of facial axis angle opening also denoting backward rotation of the mandible with greater degrees of maxillary molar distal movement in non-extraction group.

Whereas, authors like Ilken[11] and Staggers[8] showed that the difference in the amount of mandibular plane angle opening in both the groups pre to post treatment was not statistically significant owing to same amount of extrusion of the teeth.

Conclusion

1. There is an increase in vertical dimension of the lower face following both all first premolars extraction and even non extraction in class I non growing patients treated with pre adjusted edgewise appliance.
2. The increase in the vertical dimension is more in the non-extraction group compared to the extraction group.
3. The wedge hypothesis suggesting decrease in vertical dimension following all first premolars extraction stands invalid
4. Fixed mechanotherapy is extrusive in general leading to increased vertical dimension of the lower face.

REFERENCES

1. Proffit WR, Fields HW, Sarver DM. Contemporary orthodontics. 4th ed. St. Louis: Mosby Elsevier; 2007. p.10-13.
2. Isaacson JR, Isaacson RJ, Spiedel TM, Worms FW. Extreme variation in vertical facial growth and associated variation in skeletal and dental relations. Angle Orthod 1971;41:219-29.
3. Frankel R, Frankel C. Functional aspects of molar extraction in skeletal open bite. In: Graber LW, editor. Orthodontics: state of the art, essence of the science. St Louis: Mosby 1986.p. 184-99.
4. Aras A. Vertical changes following orthodontic extraction treatment in skeletal open bite subjects. Eur J Orthod 1991;100:141-155.
5. Pearson LE. Vertical control in treatment of patients having backward rotational growth tendencies. Angle Orthod 1978;48:132-140.
6. Roth RH. Gnathological concepts and orthodontic treatment goals. In: Jarabak JR, Fizzel J, editors. Technique and treatment with light wire edgewise appliances. Second edition. St. Louis: Mosby; 1972.
7. 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;133:869-75.
8. Staggers JA. Vertical changes following first premolar extractions. Am J Orthod Dentofacial Orthop 1994;105:19-24.
9. Ismail SFH, Moss JP, Hennessy R. Three-dimensional assessment of the effects of extraction and nonextraction orthodontic treatment on the face. Am J Orthod Dentofacial Orthop 2002;121:244-56.
10. Kumari M, Fida M. Vertical facial and dental arch dimensional changes in extraction vs. non-extraction orthodontic treatment. Journal of the College of Physicians and Surgeons Pakistan 2010;20:17-21.
11. Kocadereli I. The effect of first premolar extraction on vertical dimension. Am J Orthod Dentofacial Orthop. 1999;116:41-5.
12. Klapper L, Navarro SF, Bowman D, Pawlowski B. The influence of extraction and nonextraction orthodontic treatment on brachyfacial and dolichofacial growth patterns .Am J Orthod Dentofacial Orthop 1992;101:425-30.
13. Gkantidis N, Halazonetis DJ, Alexandropoulos E, Haralabakis NB. Treatment strategies for patients with hyperdivergent Class II Division 1 malocclusion: Is vertical dimension affected. Am J Orthod Dentofacial Orthop 2011;140:346-55.
14. Lin CH, Short LL, Banting DW. The effects of non-extraction orthodontic treatment on the vertical dimension: a comparison of a dolichofacial and a mesofacial group. Aus Orthod J 2012;28:37-43.
15. Chua AL, Lim JYS, Lubit EC. The effects of extraction versus nonextraction orthodontic treatment on the growth of the lower anterior face height. Am J Orthod Dentofacial Orthop 1993;104:361-8.

16. Al-Nimri KS. Vertical Changes in Class II division 1 Malocclusion after Premolar Extractions Treatment. Angle Orthod 2006;76:52-8.
17. Sarisoy LT, Darendeliler N. The influence of extraction orthodontic treatment on craniofacial structures: Evaluation according to two different factors. Am J Orthod Dentofacial Orthop 1999;115:508-14.
18. Bishara SE, Cummins DM, Jakobsen JR, Zaher AR. Dentofacial and soft tissue changes in Class II, Division 1 cases treated with and without extractions. Am J Orthod Dentofacial Orthop 1995;107:28-37.