Effect of Extraction Versus Non-extraction Orthodontic Treatment on Anterior Facial Height in Class II division 1 Malocclusion

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Abstract Background: Extraction of all 1st premolars in the orthodontic treatment of Class II div 1 malocclusion has been associated with a decrease in vertical dimension of occlusion thus predisposing the patient to TMJ disorders. **Objectives**: To evaluate the vertical changes occurring in patients having class II div 1 malocclusion, treated orthodontically with 1st premolar extractions & compare these changes with those occurring in patients treated orthodontically without extractions. **Method**: Pre-treatment & Post-treatment Lateral Cephalogram radiograph of 11 patients having CL-II div1 malocclusion treated without extraction and 16 patients treated with the extraction of all 1st premolars were analyzed and compared to observe the changes in the anterior facial height**. Result**: the orthodontic treatment of Cl-II div 1 malocclusion cases treated with a non-extraction approach leads to a statistically significant increase in the anterior facial height due to the downward & backward rotation of the mandible. The cases treated with the extraction of all 1st premolars also show the statically significant increase in the anterior facial height but this increase was less than that observed for the non-extraction group. **Conclusion**: this study does not support the theory that the first premolar extractions reduce the vertical dimension of occlusion and predispose the extraction patients to TMJ disorders. [Sharma A NJIRM 2014; 5(1) : 100-105]

Key Words: Extraction Versus non-extraction treatment, Anterior Facial Height changes, Cl-II div1 malocclussion.

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Introduction: A In executing the treatment plan in orthodontic patients to extract or not is still debatable. Researchers have showed that the reduction in the number of teeth affects the balance of the face. it is necessary for an orthodontist to be able to predict the changes that will result from the dental extractions. Along with the effect of vertical growth as it relates to antero-posterior growth. These two factors namely vertical and antero-posterior growth determines the final position of pogonion, which is responsible for retrognathic and prognathic facial types. The proportion of facial height to facial depth determines the facial type and also directly influences the vertical overbite and function. The interplay of anterior vertical facial growth increments and posterior vertical growth increments, together with antero-posterior growth, is responsible for normal occlusion as well as malocclusions. Controlling the vertical growth of the face, it would solve many orthodontic problems. The controversial point is the role of extraction in the cause or cure of temporo-mandibular Joint disorders has been extensively debated in the dental literature. One of the etiological factor in TMJ disorders is 1st Premolars extractions[1,2,3,4,5]. Reason being that the extraction of premolars permits the posterior teeth to move forward resulting in a decrease in the vertical dimension of occlusion, which lead to over closure of mandible resulting in foreshortening of muscles of mastication. Contrary it has been stated that 1st premolars extractions lead to the over-retraction of the anterior teeth, particularly in the maxilla [2,4], Which Displace the mandible and the condyles posteriorly, therby predisposing to TMJ disorders.

However the etiology of TMJ dysfunction is multifactorial, yet changing the vertical dimension with extraction of 1st premolars for orthodontic treatment has often been considered as one of the prime aetiological factor in causing TMJ dysfunction.

Material and Methods : The sample size for the study consisted of 27 post pubertal patients which were divided into two groups:

Group I: (Non –Extraction method) 11 patients including 4 males and 7 females.

Group II: (Extraction method) 16 patients with the extractions of all 1st premolars including 4 males & 12 females.

Criteria for the selection of the cases were:

1. Successful completion of treatment with begg technique.
2. Well defined pre and post treatment lateral cephalograms with standardized radiographic technique
3. All the patients included in the sample had a CL-II Div1 malocclusion.

The pre and post treatment lateral cephalograms were traced manually and various angular and linear measurements were recorded to assess the pre and post treatment changes.

Various angular and linear measurements used in this study were:

Angular Measurements: (Fig.1)

1. GoGn to SN angle : It is the angle formed between the sella-nasion plane and the mandibular plane (Steiner's : Go-Gn). The normal value is 32degrees.
2. Frankfort- Mandibular plane angle (FMA): It is the angle formed between the Frankfort horizontal plane and the Mandibular plane (Tweeds: Go-Me). The mean reading for this angle is 25 degrees.
3. Y-axis angle (S-Gn to FH): It is the antero-inferior angle formed at the intersection of the line joining the points sella and gnathion with the Frankfort horizontal plane. Normal value is 59.4 degrees.
4. Facial Axis Angle (Ba-N to Ptm-Gn): It is the posterio- inferior angle formed at the intersection of the line joining the points Basion and Nasion with the line joining the points pterygomaxillary and gnathion . The normal value is 90 degrees
5. Sum of the Saddle, Articulare and Gonial angles: sum of posterior angles. The sum of these three angles is 396 degrees
6. Gonial angle (Ar-Go to Go-Me): the nomal value is 130 degrees.

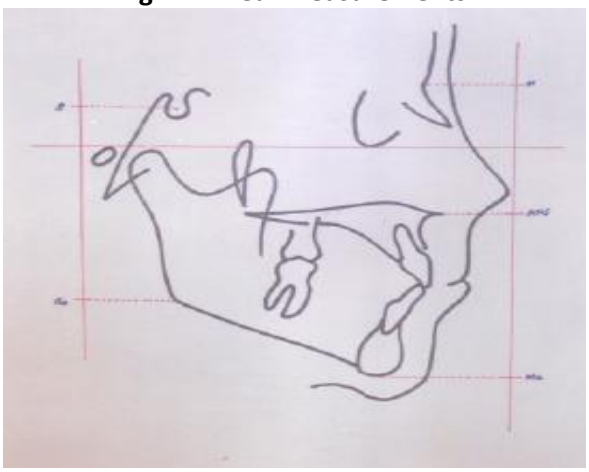
Linear Measurements: (Fig.2)

1. Upper facial height to lower facial height ratio (N-ANS: ANS-Me): The points nasion, anterior nasal spine and menton are projected onto the Frankfort horizontal perpendicular and measured. The mean value for the upper facial height to lower facial height ratio is 0.7

Fig. 1: Angular measurements

1. GoGn to SN angle
2. Frankfort- Mandibular plane angle (FMA)
3. Y-axis angle (S-Gn to FH)
4. Facial Axis Angle (Ba-N to Ptm-Gn)
5. Saddle angle,
6. Articulare angle
7. Gonial angle

Fig. 2 : Linear measurements



1. Upper facial height (N- ANS)
2. lower facial height (ANS – Me)
3. Anterior facial height (N – Me)
4. Posterior facial height (S- Go)

2. Lower anterior facial height to total anterior facial height ratio (ANS-Me:N-Me): A ratio greater than 60% is seen in patients with a long lower face and is indicative of backward growth rotation while a lower ratio suggests a forward growth rotation.
3. Posterior facial height to anterior facial height ratio or Jaraback's ratio(S-Go:N-Me): The

posterior facial height is measured between the points Sella and Gonion by projecting these points on the Frankfort horizontal perpendicular. The normal range of this ratio is 62% to 65%.

The values obtained were statistically analyzed. The mean net changes and the standard deviations were calculated. The effect of the treatment was found out by the 'paired t-test'. Trends of inter-relationships between the anterior facial height and other variables were examined by correlation coefficient analysis which in turn was tested for significance by 'r' test to determine whether the correlations were appreciable. The above tests were done for both the non-extraction group as well as the 1st premolar extraction group.

Results and discussion: In orthodontic treatment with non-extraction approach it is observed that mandible gets downward and backward rotation therby lower anterior facial height of the patient increases. however the extraction approach results in upward and forward rotation of the mandible resulting in decrease in the lower anterior facial height therby predisposing the patient to TMJ disorders.[7,8]

Table 1: Statistical comparison of pre treatment and post treatment value of group I

Parameter	Pre Treatment	Post Treatment	Difference	T Value	Inference
ANGULAR MEASUREMENTS					
Go Gn – SN	25.91	28.00	2.09	5.33	P<0.001
FMA	19.73	22.45	2.73	5.20	P<0.001
Y- Axis	62.27	64.64	2.36	6.50	P<0.001
Facial Axis	90.73	88.55	-2.18	6.19	P<0.001
Gonial angle	117.35	120.45	2.73	10.00	P<0.001
Some of posterior angles	387.64	390.73	3.09	7.45	P<0.001
LINEAR MEASUREMENTS					
UFH	53.36	54.00	0.64	2.28	p<0.05
LFH	64.45	67.36	2.91	6.67	p<0.001
AFH	117.82	121.36	3.55	7.19	p<0.001
PFH	85.45	86.09	0.64	3.13	p<0.05
UFH/LFH Ratio	0.83	0.80	-0.03	3.60	p<0.01
LFH /AFH Ratio	54.66	55.46	0.80	3.61	p<0.01
PFH/AFH Ratio	72.51	70.91	-1.60	7.85	p<0.001

Table 2 : Statistical comparison of pre treatment and post treatment value of group II

Parameter	Pre Treatment	Post Treatment	Difference	T Value	Inference
ANGULAR MEASUREMENTS					
Go Gn – SN	31.50	31.81	0.31	0.81	NS
FMA	25.44	25.81	0.38	0.84	NS
Y- Axis	62.56	63.00	0.44	0.87	NS
Facial Axis	87.88	87.44	-0.44	0.90	NS
Gonial angle	126.19	126.81	0.36	1.15	NS
Some of posterior angles	394.44	395.25	0.81	1.62	NS
LINEAR MEASUREMENTS					
UFH	51.94	52.81	0.94	2.53	p<0.05
LFH	64.44	66.38	1.94	3.18	p<0.01
AFH	116.38	119.25	2.88	4.45	p<0.001
PFH	75.75	77.25	1.50	3.87	p<0.01
UFH/LFH Ratio	0.81	0.80	-0.01	0.95	NS
LFH /AFH Ratio	53.33	55.64	0.31	0.95	NS
PFH/AFH Ratio	65.11	64.79	-0.31	0.85	NS

However the above mentioned statement is also dependent on the morphogenetic pattern of the face. In this study thirteen dominant variables reflecting mandibular rotation showed a statistically highly significant change in the non-extraction group indicating a downward and backward rotation of the mandible. Whereas, these changes were insignificant for the first premolar extraction group. This slight clockwise rotation of the mandible as observed in the non-extraction group makes the mandibular plane more steeper resulting in the inferior positioning of the menton thereby increasing the lower anterior facial height as well as the total anterior facial height. These observations were similar to the findings obtained by the following studies[9,10,11,12,13,14, 15 16,17.]

Table 3 : Non – Extraction group correlation coefficient between AFH and various Linear and Angular measurements

PARAMETER	r value	t VALUE	INFERENCE
ANGULAR MEASUREMENTS			
Go Gn – SN	0.3977	1.3004	NS
FMA	0.4097	1.3474	NS
Y- Axis	0.3458	1.1056	NS
Facial Axis	0.6238	2.3944	p<0.05
Gonial angle	0.0430	0.1291	NS
Some of posterior angles	0.0202	0.0606	NS
LINEAR MEASUREMENTS			
UFH	0.4752	1.6202	NS
LFH	0.8268	4.4096	p<0.01
AFH	0.8330	4.5168	p<0.01
PFH	0.3161	0.9996	NS
UFH/LFH Ratio	0.3239	1.0271	NS
LFH /AFH Ratio	0.0811	0.2441	NS

The lower facial height and the anterior facial height showed a statistically significant change in the extraction as well as the nonextraction groups (Table 1 and 2).The lower facial height increased by an average of 2.91 mm in the non-extraction group while it increased by an average of 1.94 mm in the first premolar extraction group. Whereas, the anterior facial height showed an average increase of 3.55 mm in the non-extraction group and 2.88 mm in the first premolar extraction group.

Table 4:First Premolar extraction group correlation coefficient between AFH and various linear and angular measurements

Parameter	R Value	T Value	Inference
Angular Measurements			
Go Gn – SN	0.3637	1.4609	Ns
FMA	0.4455	1.8619	Ns
Y- Axis	0.4252	1.7578	Ns
Facial Axis	0.5338	2.3620	P<0.05
Gonial angle	0.3507	1.4012	Ns
Some of posterior angles	0.4073	1.6687	Ns
LINEAR MEASUREMENTS			
UFH	0.3816	1.5447	Ns
LFH	0.8268	5.4998	P<0.001
AFH	0.4172	1.7176	Ns
PFH	0.3708	1.4939	Ns
UFH/LFH Ratio	0.3772	1.5239	Ns
LFH /AFH Ratio	0.6020	2.8209	P<0.05

As already stated in the non-extraction group this increase could be attributed to a downward and backward rotation of the mandible occurring due to the extrusion of molars during the orthodontic treatment since the class II force mechanics used in the Begg's technique are extrusive in nature. This finding is in accordance with the views expressed by Prince [18], Chua [19], Stromboni [20], Drobocky [21], A.Mair [22] and Parker [16].

In the first premolar extraction group, though the lower facial height and the total anterior facial height showed a statistically significant increase during the treatment period but the various other angular measurements such as the FMA, GoGn to SN, Y-axis, facial axis, Sum of posterior angles did not show any statistically significant change indicating that the mandibular plane was maintained during the treatment period and it did not become steeper with treatment(Table 3 and 4).

In the present study the UFH/LFH ratio, LFH/AFH ratio and the PFH/AFH ratio showed a statistically significant change In the nonextraction group

indicating a clockwise rotation of the mandible. This change can be attributed to the extrusion of the molars due to the effect of the class-II elastics as well as the tip back bends of the arch wires. In the first premolar extraction group these ratios did not show any significant change. This observation could be attributed to the fact that in patients with class II malocclusion a portion of the extraction spaces is used to correct the molar relationship and the molars are protracted. Yet, this molar protraction does not necessarily produce a loss of vertical dimension, since the orthodontic mechanics are extrusive in nature and this extrusion appears to maintain or even increase the vertical dimension as shown by the work of Staggers [15,26,27].

Conclusion: This cephalometric study indicates that the orthodontic treatment of class II division 1 malocclusion cases treated either with a non-extraction approach or with the extraction of all first premolars, lead to a statistically significantly increase in the anterior facial height. However, this increase in the anterior facial height is less pronounced for the first premolar extraction group than that observed in the non-extraction group. This study does not support the theory that the 1st premolar extractions reduce the vertical dimension of occlusion, and thus predispose the extraction patients to TMJ disorders. On the contrary, orthodontic treatment, both extraction as well as non-extraction, resulted in a mean increase in the various linear and angular Cephalometric parameters that were considered.

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