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ORIGINAL ARTICLE

A Cephalometric Evaluation of Soft Tissue Following Maxillary Incisors Retraction

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ABSTRACT

Background: Class 2 Division 1 is the most prevalent type of malocclusion affecting about 32% of Pakistani population. With upper maxillary premolar extraction is one of most frequent treatment choice.
Aim: To evaluate the effects of these extractions on soft tissue show variable results depending upon the sex, ethnicity, maxillary arch crowding and pretreatment structure of lips.
Methods: In this study pretreatment cephalograms of 106 Class 2 div 1 patients were taken whose treatment plan include extraction of maxillary 1st premolar. Then the second and final cephalograms were taken when retraction of incisors was completed. Mean changes in the position of upper and lower lip were measured with respect to Ricketts E-line before and after completion of retraction of maxillary incisors.
Results: After the extraction of premolars there is a significant (P value=0.000) reduction in the lip protrusion of -2.033mm±1.148mm and -1.695mm±1.628mm in both upper and lower lip respectively.
Conclusion: Extraction of maxillary premolars cause significant reduction of lip prominence and achieve facial esthetic balance.
Keywords: Class 2 div 1, lip position, Premolar Extraction

INTRODUCTION

Class 2 Division 1 is the most prevalent type of malocclusion affecting about 32% of Pakistani population.[1] Different treatment options are available for the correction of class 2 patients with include maxillary premolar extractions, distalization of maxillary dentition and orthognathic surgeys.[3]Bilateral maxillary first premolar extraction is the second most preferred (20.2%) treatment protocol followed by all first premolar extractions (42.9%)[2]. The class 1 canine and calss2 molar relationship achieved after the extractions of maxillary premolar is shown to be very stable[4]. These extractions are indicated if arch length discrepancy is of 10mm or more[5]. But there are a few disadvantages associated to premolar extractions which includes profile flattening, Increased frequency of TMJ disorders[6] increased chances of relapse[5] and undesirable changes in lower facial height[7].

With different treatment modalities available for class 2 treatment in mild cases the choice of treatment usually depends on compliance, growth potential and Arch length discrepancy (ALD) in maxillary and mandibular arches. Non extraction treatments usually require Good compliance and growth potential in order to be successful. Which is not the case with extractions. In cases of Class 2 div 1 with mild ALD most Class 2 Cases can be treated satisfactorily[2,4,8].

With the advent of soft tissue paradigm the emphasis on the effects of different treatment modalities on the soft tissues has grown considerably.[9] many studies have been done to evaluate the soft tissue changes after maxillary premolar extractions. These studies show variable results depending upon the sex, ethnicity, maxillary arch crowding and pretreatment structure of lips. Generally previous studies have shown soft tissue profile flattening was not a major concern when comparing the lips to the Esthetic Plane.[10] Freitas BV and colleagues showed that facial profile flattening which is the major concern of extraction was not observed and there was no major difference between extraction and non-extraction profiles.[11]On the other hand Jamilian A observed decrease in lip protrusion in all premolars extraction cases with class I bimaxillary dentoalveolar protrusion[12].

It has been established form scienti fic research that cephalometric norms and response of soft tissues to different treatment modalities vary according to the ethnic background of patents,[13] to provide optimal orthodontic treatment we need to have the predictable results to minimize adverse changes. At present no study has been done to evaluate soft tissue changes after maxillary premolar extractions in population of Pakistan.

The aim of this study is to measure the soft tissues changes in class 2 div 1 patients after maxillary first premolar extractions.

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MATERIALS AND METHODS

For the purpose of this study after IRB permission 106 patients were selected after permission from IRB. In order to exclude skeletal class 2 cases only cases with ANB less than 5 were included, other inclusion criteria were normal vertical angle and pretreatment crowding of less than 4mm were selected. Standardization of initial and final cephalograms was done by keeping the Frankfurt horizontal plane parallel to true horizontal. Patients were guided to bite in centric occlusion while keeping their lips relaxed during the accusation of lateral cephalogram.

All of these patients having Class 2 div 1 malocclusion were treated with extraction of maxillary 1st premolars. Retraction of anterior teeth was done in 2 steps with TPA placed on molar bands. Lateral cephalogram were taken at two stages. The initial lateral cephalometric radiographs of were taken prior to the start of treatment (T0). All of the cases were finished in class 2 molar and class1 canine relationship with good overjet and overbite. The end-treatment radiographs were taken after the completion of retraction (T1).

After that registration points were placed on the cephalograms, the tracing of both pre- and post-treatment radiographs were done 0.5micron thick acetate tracing sheets using a sharp 4H pencil on a radiograph illuminator in a dark room by experienced examiner. All of the tracings were done by same person to reduce intra examiner error. The linear measurements were made to the nearest 0.5mm with the help of scale and protractor. The distance between E line and upper lip (UL) and E line, lower lip (LL) were measured & recorded in the form (Fig. 1).

The data obtained by manual tracing was entered in the IBM SPSS, Version 20. The variables were analyzed by using independent sample t-tests to detect differences at the start and end of treatment. A significance level of $p < .05$ was set.

RESULTS

In this study 106 patients were selected having class 2 div 1 malocclusion and undergoing upper first premolar extraction

treatment. Patients having age 15 years and older were selected to exclude growth related changes. The average age of patients was 20.50±4.77 years (Figure 3). There were 49 (46.7%) male and 56(53.3%) female patients (Figure 2). Pretreatment value shows that both upper lips and lower lips were +2.1143mm±2.166mm and +1.724mm±1.8488mm ahead of e-line which should lie behind e-line to achieve facial balance. After the extraction of premolars there is a significant (P value=0.000) reduction in the lip protrusion of -2.033mm±1.148mm and -1.695mm±1.628mm in both upper and lower lip respectively. (Table I) (Figure 4)

Both male and female groups show that there is significant reduction in lip protrusion after extraction but inter group comparison shows that the reduction is similar (Table II), for upper lip in males reduction was -1.929mm±1.118mm and for female -2.125mm±1.176 and the difference was insignificant (P value= 0.384). Similarly for lower lip reduction in protrusion found out to be -1.653mm±1.006mm and -1.732mm±1.467mm for male and female respectively which shows insignificant difference (P value=0.752).

Similarly to check the effect of age on the reduction of the projection patients were divided into two groups. Group A consisted of patients 18 years or less while Group B consisted of patients 19 and above. Upper lip retraction was -2.020mm±1.120mm for Group A and -2.043mm±1.181mm for Group B. which shows insignificant (P value=0.919) difference. Similarly for lower lip reduction for Group A is -1.948mm±1.230mm and for Group B it was -1.482±1.271 which again shows insignificant difference (P value=0.061), which shows that after completion of growth; age doesn't affect the behavior of soft tissue after extraction (Table III).

Table I: Difference between the upper lip to e-line and lower lip to e-line after extraction

Variables	n	Mean	Std dev.	P value
ULpost- ULpre	60	-2.033	1.148	0.000*
LLpost- LLpre	60	-1.695	1.628	0.000*

p≤0.05, paired t test

Figure 1. Distance of E Line from UL and LL

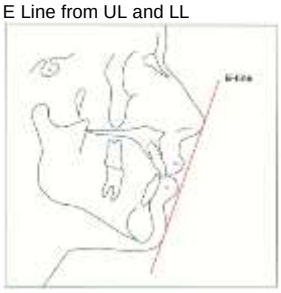


Figure 2: Gender Distribution Chart

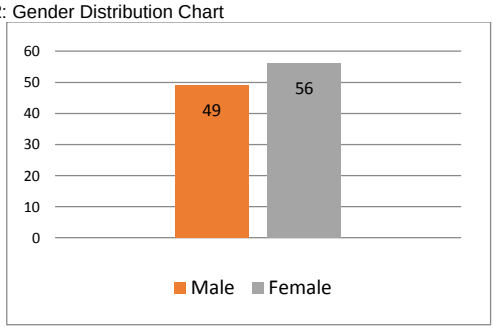


Table II: Difference betweem the upper lip to e-line and lower lip to e-line after extraction between gender

Variables	Gender	N	Mean	Std. dev.	P value
ULpost-ULpre	Male	49	-1.929	1.118	0.384
	Female	56	-2.125	1.176	
LLpost-LLpre	Male	49	-1.653	1.006	0.752
	Female	56	-1.732	1.467	

p≤0.05, independent sample - t test

Table III: Difference between the upper lip to e-line and lower lip to e-line after extraction between two age groups

Variables	Age	N	Mean	Std. dev.	P value
ULpost-ULpre	Group A	48	-2.020	1.120	0.919
	Group B	57	-2.043	1.181	
LLpost-LLpre	Group A	48	-1.948	1.230	0.061
	Group B	57	-1.482	1.271	

p≤0.05, independent sample - t test

Figure 3: Age Group Distribution Chart

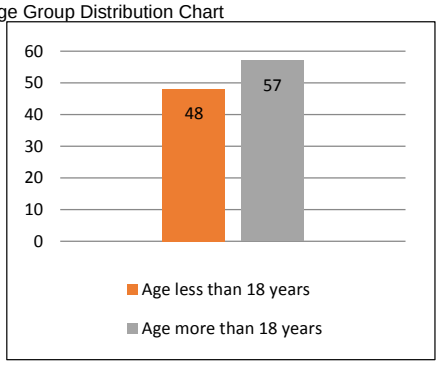
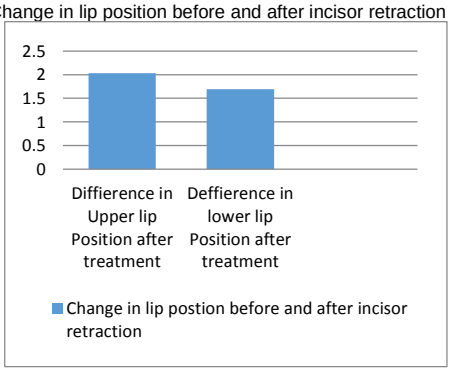


Figure 4: Change in lip position before and after incisor retraction



DISCUSSION

By evaluating the results of this research we can evaluate and establish the extent of alterations caused by maxillary premolar extraction. Maxillary 1st premolars extraction cause significant retrusion of the upper and lower lip. This is in accordance to the results presented in the literature that maxillary premolar extraction cause not only reduction in the prominence of the upper lip but also significant reduction in the prominence of lower lip which is also shown by Scott Conley and Jernigan, who attributed this reduction of lower lip prominence to the presence of an everted lower lip, because of an increased overjet and a Class II incisor relation, the lower lip may get trapped in between upper and lower incisors which may cause it to protrude outwards. With the resolution of the overjet after the treatment lower lip will move to it normal position and decrease in prominence.[14]

Akyalcin and Hazar found out on average -1.1mm reduction of prominence of upper lip as compared to non-extraction treatment which showed reduction of only 0.5mm. Similarly lower lip showed on average 2mm reduction with extraction treatment as compared to 0.8mm reduction with non-extraction treatment.[15] Janson et al. found out that in extraction group upper lip distance from E-line increased by 2.10mm as compared to non-extraction group which showed the only change of 0.84mm whereas lower lip showed retrusion of 2.04mm as compared to E-line in extraction as compared to 0.56mm showed by non-extraction group.[4] Kinzinger G, Frye L and Diedrich P Found out that the distance between upper lip and E-line increase by 0.75mm± 2.87mmas opposed to Functional orthopedic group which showed increase 0.88mm ± 2.38mm and orthognathic surgery group which showed

increase of 3.84mm ± 1.76mm similarly lower lip also increased by 0.75mm± 2.87mm as opposed to Functional orthopedic and orthognathic surgery group which showed increase of -0.16mm ± 2.22mm and –1.54mm ± 1.99mm respectively.[16]

Seben MP et al evaluated the effect of maxillary premolar extraction on the perioral soft tissues .they found out significant changes in soft tissue profile after the retraction of maxillary incisors retraction. Upper lip distance from e line is decreased by 2.28 mm (p value <0.05) and lower lip distance decreased by 0.85mm (p value<0.05). They concluded that with upper pre molars extraction there is flattening of profile along with significant retrusion of upper lip.[10]Similarly Amirabadi GE et al reported significant reduction in lip prominence after maxillary premolars extraction. They compared the effect of crowding have on the decrease in lip projection. In the least crowded i.e. less than 4mm crowding they reported up to 1.99mm±1.40mm reduction in upper lip prominence and 1.84mm±2.43mm reduction in lower lip prominence with respect to E-line.46. The results are in accordance with our study which shows reduction in the lip protrusion of -2.033mm±1.148mm and -1.695mm±1.628mm in both upper and lower lip respectively.[17]All of above studies correlates with our study that showed significant retrusion of lips after extraction.

In our study we found out that for upper lip in males reduction was -1.93mm and for female -2.13mm and the difference was insignificant (P value= 0.384). Similarly for lower lip reduction in protrusion found out to be -1.65mm and -1.73mm for male and female respectively and there is no significant difference between the amount of retraction of upper lip between males and females. These findings are supported by the study done by Diels RM who found out that that extraction of premolars cause 1.5mm retraction of upper lips in males and 1.74mm retraction in females. For lower lip they calculated the mean retraction of about -2.7mm for males and -2.53mm for females and there is no significant difference between the amounts of retraction between both sexes.[18] Basciftci performed a study to evaluate the influence of extraction treatment on Holdaway soft tissue measurement. The results of this study rejected the generalizations regarding the negative effects of extraction on the profile. Similar to our study the changes in soft-tissue measurements were not affected by sex of the patient values, and no statistically significant differences were recorded between the two sexes.[19]

Nanada studied the effect of growth on the soft tissues of the children. They studied the effect of growth on the cephalograms of the children which were taken between 7-18 years of age. They obseved males grew in a more sagittal direction which results in male profile being more prognathic and females showed more vertical growth direction making their profile more convex..[20] we also look the effect of age on the amount of retraction of lips and found out that there was no significant difference between both the groups. Because we took the minimum age of 15 years and maximum growth of soft tissue is completed by then after that the most significant variable which determine the position of lips is the new incisor position. This result is also in accordance of the study done by Maetevorakul and Viteporn who found out that age and sex does effect the vertical position of the lips but the post-treatment position of the lips are mostly influenced by the position of the incisors.[21]

Other factors which could affect the amount of lip changes in orthodontic treatment are lip thickness and inter labial gap which can vary between different ethnicities.[13] Broke II JD correlated the ethnicity with its effect on the amount of lip retraction after the extraction treatment and he concluded that there were significant difference between different ethnicities but these difference can be explained by effect of different lip morphologies between black and white papulation[22].

Our study indicates the extractions of maxillary premolars are one of the most reliable treatment plan to decrease the lip projection in class 2 div 1 patients.

CONCLUSION

There is significant reduction in the lip projection after the maxillary premolar extraction. After the completion of soft tissue growth, Effect of Age on the amount of lip retraction is insignificant. There is no effect of gender on amount of lip retraction in class 2 div 1 patients.

Conflict of interest: Nil

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