ORIGINAL ARTICLE

ESTHETIC IMPACT OF TOOTH EXTRACTION IN PAKISTANI PATIENTS

Sohaib Hassan, Attiya Shaikh, Mubassar Fida

Section of Dentistry, Department of Surgery, Aga Khan University Hospital, Karachi, Pakistan

Background: The norms of Pakistani female patients differ from other Asian patients, this difference should be considered during diagnosis and treatment planning and they should be treated with different protocols in terms of tooth extraction and non-extraction treatments. The present study will provide clinical guidelines to assist in the decision-making process for borderline patients when considering extraction or non-extraction in the orthodontic treatment plan. **Methods:** Panels of 40 dentists and 40 laypersons evaluated randomly presented pre-treatment and post-treatment soft-tissue profiles of 30 extraction and 30 non-extraction female patients. Borderline patients were selected based on their initial diagnostic records. Two panels were asked to compare the pre-treatment and post-treatment soft tissue profile tracings and to quantify their perceptions of the aesthetic impact of treatment change using a visual analogue scale (VAS). **Results:** The mean VAS scores of dentists and laypersons for extraction treatment strategy were +23.03±27.89 and +19.41±26.79 mm (p=0.182) respectively. For non-extraction treatment strategy, mean VAS scores of dentists and laypersons were +12.51±26.56 and +14.55±21.22 mm (p=0.448) respectively. The mean change in lower lip protrusion after extraction treatment was 2.15±3.38 mm (p=0.002) and after non-extraction treatment was 0.83±2.75 mm (p=0.109). **Conclusions:** No significant difference was found between dentists and laypersons in their perception of aesthetic impact of a treatment strategy. There was significant change in lower lip protrusion only after the extraction treatment strategy.

Keywords: Aesthetic impact, treatment strategies, borderline patients, Pakistan

J Ayub Med Coll Abbottabad 2014;26(3):263–8

INTRODUCTION

More than 100 years ago, Edward Angle believed the statement that "there should be full complement of teeth and each tooth shall be made to occupy its normal position".[1] In 1930s, during Tweed's era, extraction of premolars was preferred for orthodontic treatment keeping in mind the long term stability.[2] In late 1990s, soft tissue paradigm emerged because it is the soft tissue which largely determines the limitations of orthodontic treatment from the perspective of function, stability and esthetics.[3] In orthodontics certain factors have been devised which play role in the decision to extract or not to extract the teeth. Most important of those factors are over jet, arch length discrepancy, incisors proclination and lips protrusion.[4] The debate of extraction versus non-extraction treatment has been controversial because of the potential side effects of both treatment strategies. The predictable consequences of extraction treatment could be narrowed smiles with dark corners and dished in profiles.[5–7] Similarly, one can raise the question regarding the long term stability of non-extraction treatment outcomes.[8,9] This controversy draws an even larger picture when managing the borderline patients.

Recent literature emphasizes more on a rational individualized treatment plan bearing in mind all above mentioned deciding factors.[10] For every treatment plan, enhancement of facial aesthetics is the prime consideration. The incongruence lies in the perception of lateral facial aesthetics which is a more subjective phenomenon than a quantitative one corresponding to the aphorism, "Beauty is in the eye of beholder". Several studies have quoted the variable pattern for the perception of the aesthetic effects of extraction and non-extraction orthodontic treatments in recent years.[5,6,11–21] Moreover, dentist/orthodontist and layperson may differ in their perception of lateral facial aesthetics because of a large disparity in decision analysis of extraction among the clinicians.[4,22–25] Subsequently, the perception of layperson regarding lateral facial aesthetics needs to be evaluated especially in borderline subjects to complement the decisions of practitioners.

When aesthetic impact of treatment was investigated on 60 African American orthodontic patients (30 extraction, 30 non-extraction) in which five groups of observers were asked to evaluate and quantify the strength of their profile preference.[19] The results of this study suggested that the impact of treatment on facial profile should be evaluated by the patients themselves, laypersons as well as orthodontists. Bowman and Johnston[20] conducted a similar study on 120 Caucasian patients (70 extraction, 50 non-extraction) and asked two panels

of observers (42 dentists, 58 laypersons) to assess and quantify the strength of their profile preference. The outcome of this study bestowed clinically significant information regarding lower lip protrusion to consider during formulation of treatment plan. A parallel study[21] was carried out on 100 Korean patients (50 extraction, 50 non-extraction) in which they requested 50 dentists and 50 laypersons to appraise the impact of orthodontic treatment on lateral facial aesthetics. The conclusion of this study demonstrated significantly different viewpoints of observers concerning lower lip protrusion as compared to the Korean norms.

All these studies explain that the assessment of lateral facial aesthetics by the evaluators may well differ according to the individual preference, era, social environment and racial characteristics. Recently, aesthetic impact of premolar extraction and non-extraction treatment has been explored for Korean patients[21] but the norms of Korean population are different from subjects of Pakistani sample, although both have an Asian origin.[26–28] The purpose of this study was to examine the changes in lateral aesthetics after extraction and non-extraction treatment of Pakistanis with evaluations by dentists and laypersons and to provide clinical guidelines to assist in the decision-making process for borderline patients when considering extraction or non-extraction in the orthodontic treatment plan.

MATERIAL AND METHODS

This cross sectional descriptive study was carried out with a sample of 30 premolar extraction and 30 non-extraction adult Pakistani female patients selected from the files of a University Hospital in Karachi, Pakistan. Only Class-I and Class-II patients treated with straight wire appliance, having pre-treatment ANB angle between 1^o $–5^o$ were selected. The extraction sample consisted of all 1^{st} premolar extraction in both arches. The non-extraction sample consisted of those patients whose duration of treatment was more than 12 months. The exclusion criteria of study were patients with Class-III malocclusion, single arch extractions, having prior history of orthodontic treatment or craniofacial anomalies. Demographic summary of patients is briefed in table-1.

To collect 30 extraction and 30 non-extraction subjects meeting the selection criteria, 1400 patients were surveyed. Out of 1400, only those 100 (45 extraction, 55 non-extraction) patients were recruited into the study which satisfied the above mentioned selection criteria. To establish borderline subjects, certain factors were described which play important role in the decision of treatment strategy.[4] The factors were over jet, upper and lower incisor inclinations, crowding in lower arch and lower lip protrusion. Means and standard deviations of such factors were obtained from these 100 patients. Then out of 100 patients, only those 60 (30 extraction, 30 non-extraction) subjects were employed into the study whose means and standard deviations were matching (Table-2).

To evaluate the impact of treatment strategy on the facial profile, tracings of soft tissue profiles were obtained from pre and post treatment lateral cephalograms. Line drawings of pre and post treatment soft tissue profiles were allocated in a random order (pre/post; post/pre) for evaluation by 2 groups of Pakistani evaluators: 40 dentists and 40 laypersons. Among the 40 dentists 17 were male and 23 female with an average age of 30.82 and 27.65 years respectively. While in the lay person group 19 were male and 21 female with an average age of 32.21 and 28.45 years respectively.

Out of 40 dentists, 4 were specialists (an oral surgeon, a pedodontist, a prosthodontist and an orthodontist) and 36 were residents of orthodontics, operative dentistry and oral surgery from the same hospital of Karachi and another institute in Multan. The panel of 40 laypersons consisted of all staff from the dental department.

The line drawings of all 60 profiles were presented to each observer in pairs. Each observer was then requested to differentiate that which profile was esthetically pleasing from its pair.The observers indicated the intensity of their profile preference by placing a mark on visual analogue scale (VAS).[29] The VAS consisted of a 100-mm line labeled “the same” on the left and “very much better” on the right. The intensity of profile preference was determined by measuring the distance between the mark and the left end of the line using digital Vernier calliper. The measurement was given a positive sign on preference of post treatment profile. The measurement was given a negative sign on preference of pre-treatment profile. Hence, the aesthetic change was calculated on 200 points scale ranging from -100 (very much worse) through zero (the same) to +100 (very much better) (Figure-1).

After the evaluations of 60 profiles by 80 evaluators, 4800 observations were obtained. To simplify the data for analysis, the VAS score from each of 2 panels of evaluators were averaged to produce a single dentist’s score and a single layperson’s score for each of 60 patients. These 120 means formulated the central data on which statistical analysis were applied. Descriptive statistics (means and standard deviations) were determined for both treatment strategies as well as both groups of evaluators. Paired *t*-test was applied

to test the difference between the determinants of treatment strategy for both extraction and non-extraction groups. Paired *t*-test was also applied to test the main effects of extraction and non-extraction treatment strategies and also the interaction effects between both treatment strategies and panels of evaluators. The lower lip to the Ricketts' E-line was measured with pre-treatment and post-treatment lateral cephalometric analysis. Means and standard deviations were computed for the extraction and non-extraction patients and paired t test was applied to test the difference of lower lip protrusion in both treatment strategies. All aforesaid statistical analyses were performed using SPSS-19.

The linear regression analysis was used to investigate aesthetic interaction between treatment strategy and initial lower lip protrusion for both panels of evaluators. For this purpose, VAS scores and lower lip to E-line were plotted on y-axis and x-axis, respectively. The regression analysis was performed with STATA-10.0. Level of significance was kept less than or equal to 0.05.

RESULTS

Mean and standard deviations of VAS scores of 2 categories (extraction and non-extraction treatment strategies and panels of dentists and laypersons) are summarized in table-3. Both treatment strategies (extraction, non-extraction) showed positive mean VAS scores. The mean VAS scores for extraction treatment were higher than non-extraction treatment for the dentists (23.0 vs 12.5, respectively) (p=0.14) and the laypersons (19.4 vs 14.5, respectively) (p=0.43) but the difference was not statistically significant. In addition, there was no statistically significant difference between the dentists and laypersons for any of treatment strategies. According to cephalometric analysis lower lip protrusion to E-line was reduced from +1.80±2.39 mm before treatment to -0.35±2.19 mm after treatment in the extraction group (p=0.002). In non-extraction group lower lip protrusion to E-line was reduced from +1.20±2.49 mm before treatment to +0.36±1.59 mm after treatment which is not statistically significant (p=0.10). The change in lower lip protrusion to E-line was 2.15±3.38 mm and 0.83±2.75 mm in extraction and non-extraction groups, respectively (Table-4).

The results of correlation analysis showed a statistically insignificant relationship between lower lip protrusion and VAS scores as evaluated by both dentists and laypersons in extraction group (p= 0.59 vs p = 0.59, respectively) and non-extraction group (p=0.19 vs p= 0.17, respectively)(Figure-2).

Table-1: Demographic summary of patients in this study

Group	n	Angle Classification		Age	
		I	II	Average (y)	Range (y)
Extraction	30	12	18	23.43	20.0–30.0
Non-extraction	30	20	10	24.49	20.0–29.0

Table-2: Means and standard deviations of factors which significantly contribute in the decision of treatment strategy

Factors	Extraction (Mean ± SD) (n = 30)	Non-Extraction (Mean ± SD) (n = 30)	Difference*
Over jet	5.43±2.09	4.07±2.30	0.09
Crowding in lower arch	0.68±3.36	0.93±3.98	0.15
Upper incisor inclination	110.71±5.61	108.86±7.01	0.26
Lower incisor inclination	30.38±6.37	28. 97±6.63	0.19
Lower lip protrusion	1.80±2.39	1.20±2.49	0.34

n=60, Paired *t*-test,*$p \leq 0.05$

Table-3: Comparison of mean VAS scores of evaluators and treatment strategies (mm)

Category	Dentists (n=40)	Laypersons (n=40)	Difference*
	Mean±SD	Mean±SD	
Extraction (n=30)	+23.03±27.89	+19.41±26.79	0.182
Non-Extraction (n=30)	+12.51±26.56	+14.55±21.22	0.448
Difference*	p=0.140	p=0.439	

n=60, Paired *t*-test,*$p \leq 0.05$

Table-4: Change of lower lip protrusion to E-line according to extraction and non-extraction (mm)

Treatment strategy	n	Before treatment	After treatment	Change	Difference*
		Mean±SD	Mean±SD	Mean±SD	
Extraction	30	1.80±2.39	-0.35±2.19	2.15±3.38	0.002
Non-extraction	30	1.20±2.49	0.36±1.59	0.83±2.75	0.109

Paired *t*-test,*$p \leq 0.05$

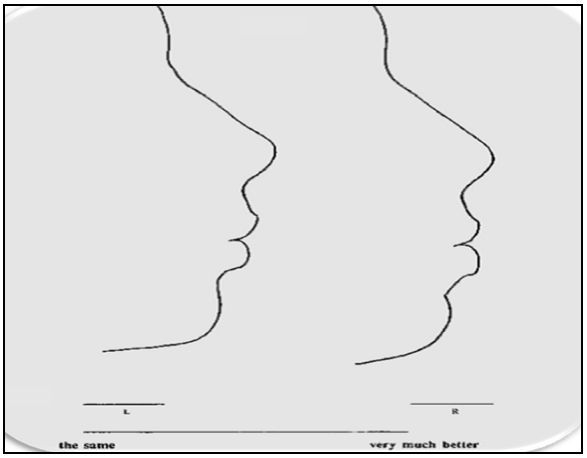

Figure-1: Example of pre-treatment and post-treatment profile tracings, presented in random order (pre/post; post/pre) for evaluation by panels of observers

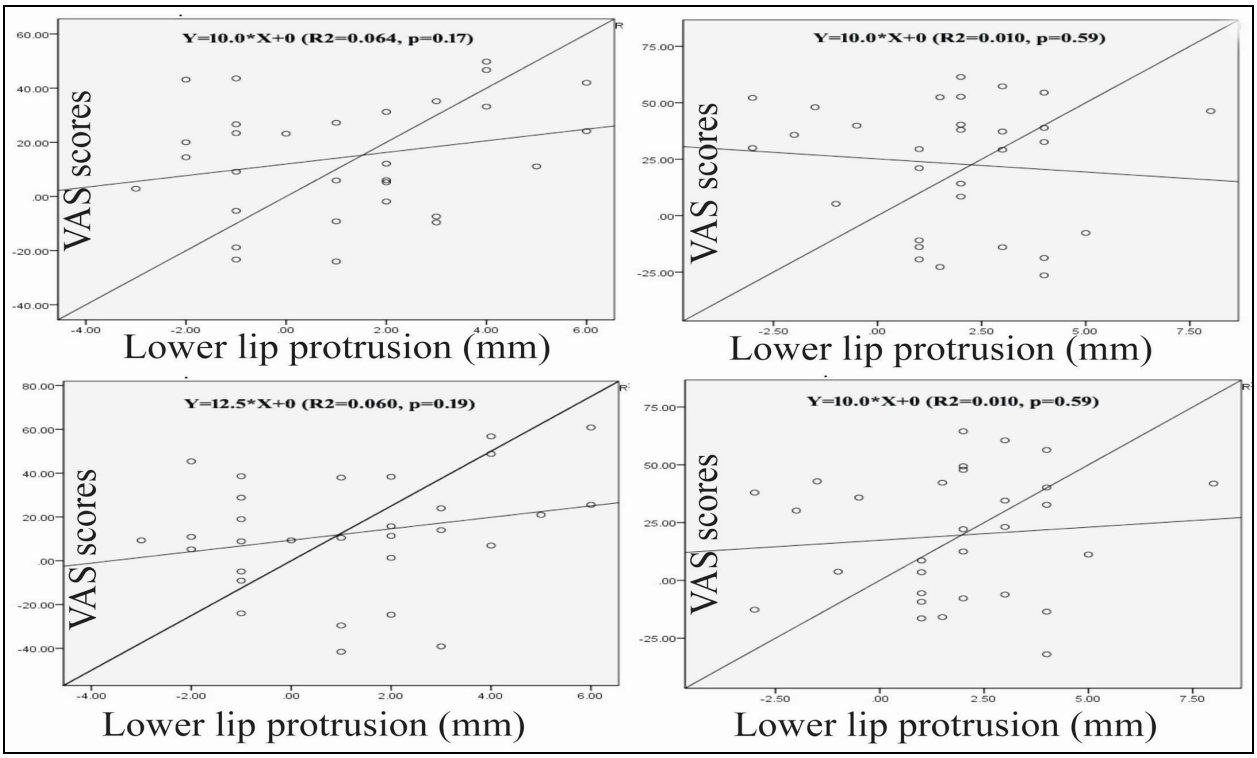

Figure-2: Correlation between mean VAS scores and initial lower lip protrusion to E-line: A, extraction treatment evaluated by dentists; B, non-extraction treatment evaluated by dentists; C, extraction treatment evaluated by laypersons; D, non-extraction treatment evaluated by laypersons

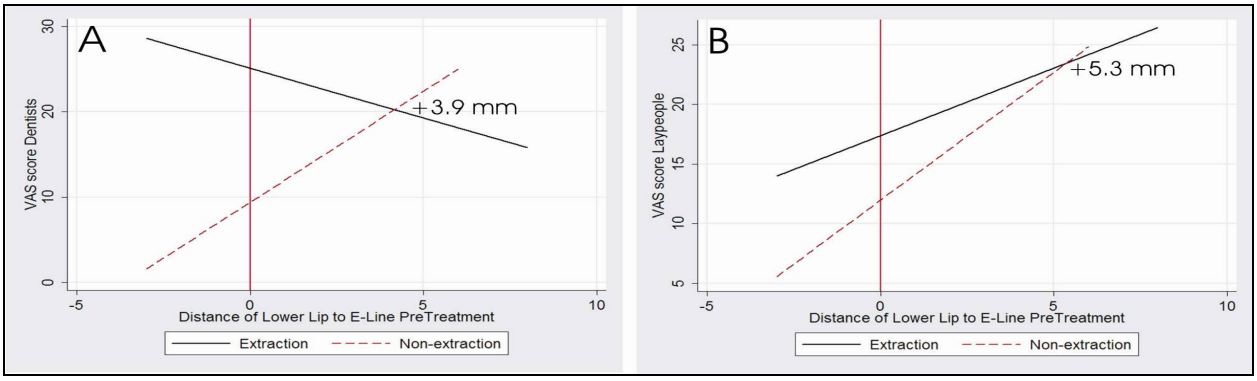

Figure-3: Mean VAS scores expressed as linear functions of initial lower lip protrusion (mm). A, Evaluations by dentists; B, evaluations by laypersons

DISCUSSION

This study was an attempt to clarify the controversy of extraction or non-extraction treatment and to discover the aesthetic impact of either treatment strategy on Pakistani female patients.

The reason for the recruitment of only female subjects was the reduced number of male subjects as per selection criteria of this study. Overall, more female patients come to our centre for orthodontic treatment because they are more conscious and aware of their malocclusion and appearance. So, to avoid the gender bias, only female patients were employed, hence, its implication will target only female Pakistani patients.

To establish borderline cases, previous studies[5–6, 17,19] have applied discriminant analysis. In this study, we have employed different method for establishment of borderline subjects. A total of 100 patients were selected from 1400 patients who satisfied the inclusion criteria of the study. Means and standard deviations of treatment deciding factors (Table-2) were obtained from these 100 patients (45 extractions, 55 non-extractions). Paired *t*-test was applied to these parameters to find out level of difference between them. Out of 100 patients, only those 60 patients (30 extractions, 30 non-extractions) were recruited for which paired t-test showed no significant difference between parameters. Using this method, extraction and

non-extraction group were matched to establish a borderline sample.

In this study, mean crowding in lower arch for extraction group is 0.68 mm which indicates that there might be lip protrusion which majorly contributes to the decision of extraction treatment strategy. The mean distance of lower lip to E-line in extraction group is 1.80 mm which is ahead of average range of this parameter but not to the extent to compensate for the absence of crowding in extraction group. One possibility could be the large nasal tip projection of Pakistani sample leading to reduced values of lower lip to E-line distance. This can be curtailed by considering multiple parameters with regard to lower lip protrusion.

To rule out the confounder of incremental growth, adult patients were recruited into the study. A recent similar study[21] has been conducted on Asian patients to provide a guideline for the decision of treatment strategy on the basis of lower lip protrusion to E-line distance. Since there would be a deviation in the norms of Pakistani subjects from Korean subjects, the need for this study was established.[26]

To compare the racial differences in a more appropriate way, we have also taken into account Class I and II patients who are parallel to those of previously reported studies. Certain studies[30–32] have reported analogous results for aesthetic evaluations by orthodontist as well as laypersons whereas others[22,25,33] have found differences between the evaluators. For this reason, laypersons were used as evaluators in addition to professionals. To minimize the manifestation of knowledge based backgrounds of professionals, pre-treatment and post-treatment profiles were used together in evaluation of facial aesthetics. Line drawings of soft tissue profiles were used that eliminate the confounding factors (lighting, hair style, make up and complexion) that may be present in photographs.

All mean VAS scores showed positive values 23.0 mm for the dentists and 19.4 mm for the laypersons for extraction treatment; the corresponding mean VAS scores were 12.5 mm and 14.5 mm for non-extraction treatment. This indicates that our subjects were generally well treated with respect to lateral facial aesthetics, regardless of extraction and non-extraction treatment. It was realized that a good decision of either extraction or non-extraction treatment had been made for borderline subjects. The mean VAS scores for extraction treatment were slightly higher than non-extraction group indicating greater aesthetic improvement in extraction group although the difference was not statistically significant.

When facial aesthetics between extraction and non-extraction groups was compared, we found statistically insignificant difference between treatments and panels of evaluators. Our results are in general agreement to the results of another study[21] which did not report statistically significant difference between mean VAS scores of dentists and laypersons for both extraction and non-extraction treatments. The results of our study seem inconsistent with the results of other studies[19,20] which showed significant difference between VAS scores of dentists and laypersons. Our study supports the suggestion of researchers[21] that the overall opinion about facial profiles between dentists and laypersons are similar for people of Asian origin.

To estimate the impact of initial lower lip protrusion on aesthetic improvement, correlation analysis was applied. It showed that there was no statistically significant correlation between initial lower lip protrusion and mean VAS scores for both extraction and non-extraction treatment strategies. We acknowledge that this poor correlation reflects that facial profile improvement is not significantly related to initial lower lip protrusion.

The regression analysis was used to determine the degree of lip protrusion at which the retraction that commonly follows premolar extraction would be seen by panels as beneficial to facial aesthetics. The intersection of extraction and non-extraction regression lines determined the bend point at which the panel would favour reduction in protrusion. When African American subjects[19] were analysed, the intersection was at +2 mm for Caucasian panelists and +4 mm for African American panellists. A study[20] in which Caucasian subjects were recruited, the intersection was at -3.9 mm for dentists and -3.3 mm for laypersons. In another study[21] which employed Korean subjects, the intersection was at -1.1 mm for dentists and -3.7 mm for lay persons. According to the results of our study for Pakistani subjects, the intersection was at +3.4 mm for the dentists and +5.3 mm for the laypersons. This provides evidence that the dentists and laypersons saw extraction treatment as a superior treatment when the lower lip was more protrusive than 3.9 mm and 5.3 mm, respectively, from the Ricketts' E-line.

The controversy of extraction and non-extraction treatments has its own implication on people living all around the world. Certain reported studies[19–21] have been attempting to clarify this controversy on their own population. If the norms of Pakistanis are different from Koreans[26,27] then it would not be justified to apply them on all the subjects even though they both are of Asian origin. If the results of our study are compared with those studies, it is justified that Pakistani female patients should be treated with different protocols in contrast to those of Caucasians and Koreans patients in terms of extraction or non-extraction. Up till now, there was no data available on profile preference related to treatment strategies, which can serve as a protocol to consider during the tremendously vital process of diagnosis and treatment planning. In this study, panels preferred relatively protrusive lip position compared

with the norms of Pakistani adults with normal occlusion.[27,28] This implies that the norms used as standard in clinical diagnosis might be different from actual preference. This difference should be taken into account during the diagnosis and treatment planning sessions. The clinical implication of this study seems to recommend that extraction therapy of Class-I and Class-II borderline adult Pakistani female patients resulted in better lip profile aesthetics as perceived by dentists and laypersons.

CONCLUSIONS

There were no significant differences between dentists and laypersons in their perceptions of aesthetic impact. There was no significant difference in facial profile improvement for patient treated with extraction and non-extraction treatment strategies. There was a weak correlation between facial profile improvement and initial lower lip protrusion both in extraction and non-extraction patients. The degree of lip protrusion at which the retraction that commonly follows premolar extraction would be needed, the intersection was about 3.9 mm and 5.3 mm for dentists and laypersons, respectively, from the Ricketts' E-line.

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Address for Correspondence:

Dr. Attiya Shaikh, Program Coordinator, Orthodontics Residency Program, Aga Khan University Hospital, Stadium Road, Karachi 74800, Pakistan. **Cell:** +92-307-2224463, **Email:** attiya.shaikh@aku.edu