RESEARCH ARTICLE

EVALUATION OF ORTHODONTIC TREATMENT OUTCOME IN EXTRACTION AND NON-EXTRACTION PROTOCOLS WITH ABO OBJECTIVE GRADING SYSTEM

*Mrudul Vaidya, Jyothikiran, H, Raghunath, N. and Pratham Pai

Department of Orthodontics and Dentofacial Orthopaedics, JSS Dental College & Hospital (Constitute College) Jagadguru Sri Shivarathreeshwara University, Mysuru, India

ARTICLE INFO	**ABSTRACT**

Introduction & Objectives: The extraction versus non-extraction controversy is the oldest as well as the most enduring controversy and still remains a topic of debate in the field of orthodontics. The "American Board of Orthodontics" (ABO-1998) introduced an index called the Objective Grading System (OGS) which evaluates post treatment dental casts and panoramic radiographs. It assesses the final occlusion in first, second and third orders according to eight different occlusal components. The aim of the present study was to evaluate the treatment outcome of extraction and non-extraction cases in borderline cases by ABO-OGS system.

Methodology: 40 borderline orthodontic patients with Angle's Class I malocclusion with an age group of 13-20 years were selected and equally divided into two groups: 20 patients were treated by extraction of all first premolars and 20 patients with a non-extraction treatment protocol. MBT 0.022" slot prescription was used for all 40 patients. With the aid of an ABO measuring gauge and panoramic radiographs, the total OGS scores between the two groups were calculated and compared using Student t-test.

Results: The mean OGS scores were significantly less negative in the extraction group (-22.0± 2.29) as compared to the non–extraction group (-26.80 ± 5.18, p < 0.005).

Conclusion: According to this study, in the borderline cases, the final occlusion and radiographical characteristics were more acceptable in the patients treated with extraction than the non-extraction patients.

INTRODUCTION

The extraction versus non-extraction controversy is the oldest as well as the most enduring controversy, and still remains a topic of debate in the field of orthodontics. It all started between Angle's school of non-extraction philosophy and its followers like Martin Dewey and Calvin Case who believed in the need of a tooth extraction in orthodontics. In 1952, eventually the battle was won by another student of Angle-Charles Tweed, who presented few case reports of patients who were treated initially with non-extraction treatment protocol and were later retreated with all first premolar extractions. Due to the great work of Charles Tweed in this direction which provided scientific evidences towards the need of extraction in orthodontic treatment, the Tweed philosophy and extractions were finally accepted in the field of orthodontics (Proffit William and Fields Henry, 2000).

In clear cut cases it is easy for an orthodontist to decide the appropriate treatment protocol than in the borderline cases. It is of prime importance to decide which treatment protocol provides better treatment outcomes (Baumrind *et al.*, 1996). Various aspects such as occlusal stability, facial appearance, dental arch characteristics and their effects on the dentofacial complex need to be considered in order to decide the preferred treatment option for the borderline case (Gianelly, 2003; Ismail *et al.*, 2002; Bishara *et al.*, 1997). An evaluation of orthodontic treatment outcome helps to set certain treatment goals, establish orthodontic treatment standards and achieve a measurable finish for completed patients (Vaden and Kokich, 2000). However, quantitative evaluation of patient records is known to be extremely difficult because of the various factors affecting the treatment outcome such as occlusal, skeletal, dental & functional problems. Several quantitative indices have been explained in the literature for the evaluation of orthodontic treatment need or treatment outcome. To evaluate the post-orthodontic treatment outcome quantitatively, the Peer Assessment Rating (PAR) index has been used frequently (Richmond *et al.*, 1992). "The American Board of Orthodontics" (ABO-1998) introduced an index called the

*Corresponding author: **Mrudul Vaidya,**
Department of Orthodontics and DentofacialOrthopaedics, JSS Dental College & Hospital (Constitute College) Jagadguru Sri Shivarathreeshwara University, Mysuru, India

Objective Grading System (OGS) which evaluates post treatment dental casts and panoramic radiographs. It assesses the final occlusion in first, second and third orders according to 8 different occlusal and radiographic components. The aim of the present study was to evaluate the treatment outcome of extraction and non-extraction cases in borderline cases by ABO-OGS system (James, 2000).

MATERIALS AND METHODS

In this retrospective study, the parent sample consisted of the records of 137 patients presented at the Department of Orthodontics and DentofacialOrthopaedics, JSS Dental College and Hospital, JSS University, Mysuru. The inclusion criteria for the parent sample were: Male or female patients with a Angle's Class I dental and skeletal malocclusion, a full set of teeth mesial to the third molars, no history of orthodontic treatment, no orofacial clefts and no orthognathic surgery treatment plans. Of the parent sample, 55 were treated with extraction of all first premolars, and 82 received non-extraction treatment. All patients were treated with edgewise appliance with MBT 0.022" slot prescription. The records used in the study were plaster dental casts, panoramic radiographs and digital lateral cephalograms with 100% scale. All lateral cephalogramswere traced manually. Of the parent sample of 137 patients, 40 patients were selected as borderline cases. First, a stepwise discriminant analysis was carried out in the parent sample to discover the borderline subsample. 25 cephalometric variables and 6 model measurements were used in the discriminant analysis. All the skeletal, dental and soft-tissue variables that could have influenced the orthodontist's decision regarding treatment protocol were taken into consideration in the discriminant analysis (Table 1).

Table 1. Variables used in discriminant analysis

Cephalometric variable	Model measurements
Sna	Overbite
Snb	Overjet
Anb	Maxillary crowding
Wits appraisal	Mandibular crowding
N perp. Pt. A	Maxillary midline deviation
N perp. Pog	Mandibular midline deviation
Angle of inclination	
Go-gn to sn	
Eff. Max. Length	
Eff. Mandi. Length	
Y- axis	
Facial axis	
Upper incisor – na (linear measurement)	
Upper incisor – na (angular measurement)	
Upper incisor – sn	
Upper incisor to maxillary plane angle	
Lower incisor to mandibular plane angle	
Lower incisor to nb (linear measurement)	
Lower incisor to nb (angular measurement)	
Interincisal angle	
Maxillary- mandibular planes angle	
Lower anterior facial height	
Ant:post face height ratio	
Lower incisor to apo line	
Nasolabial angle	

The discriminant analysis resulted in significant discriminating variables in descending order of importance: Mandibular crowding, upper incisor to NA, overjet, maxillary crowding, and Naso-labial angle (Table 2). The patients were classified to the predicted extraction or non-extraction group based on the standardized discriminant score assigned to each patient. The

optimal cutoff point of the sample was set. As the patients' discriminant scores moved away from zero to positive values, they were predicted to be non-extraction patients and as they moved towards negative values, they were predicted to be extraction patients. The subsample (borderline class I patients) was identified around the cutoff point. Finally, 20 extraction and 20 non-extraction patients whose scores fell nearest to the cutoff point were identified as the class I borderline subsample. Treatment outcomes were evaluated according to the 8 ABO-OGS variables: alignment, marginal ridges, occlusal relationships, buccolingual inclination, overjet, occlusal contacts, interproximal contacts, and root angulation. ABO Measuring Gauge introduced by ABO was used for all the measurements (Fig.1).

Table 2. Stepwise discriminant analysis

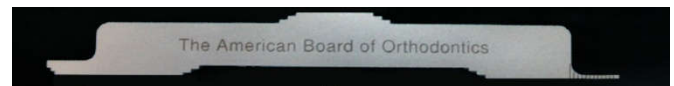| Step	Variable	Significance
1	Mandibular crowding	<0.001
2	Upper incisor – na	<0.001
3	Overjet	<0.001
4	Maxillary crowding	<0.001
5	Naso labial angle	<0.001

Fig. 1. ABO Measuring Gauge

In all cases, each ABO-OGS parameter was measured two times and the mean score for each parameter was taken for calculation. The data were analyzed using descriptive statistics and 't' tests for independent samples.

RESULTS

The extraction borderline sample consisted of 20 patients; 11 were female and 9 were male with a mean age of 15.2 ±4.2 years. The non-extraction borderline sample consisted of 20 patients; 12 were female and 8 were male with a mean age of 14.6 ± 2.7 years. The results of statistical test calculated for the ABO-OGS variables are shown in Table 3. The maximum negative score for the non-extraction and extraction group was -7.73± 1.44 and-6.4 ± 1.29 respectively, for the bucco-lingual inclination variable for both groups. The minimum negative score for the non-extraction and extraction group was -0.86 ±0.63 and -0.86 ±0.51 respectively, for the interproximal contact variable for both groups (Table 3).

Table 3. Statistics for the ABO-OGS variables and total ABO-OGS scores

Variables	Non extraction Group		Extraction Group		p-Value (<0.005)
	Mean	SD	Mean	SD	
Alignment	-6.4	0.63	-5.0	0.92	0.001
Marginal Ridges	-1.73	0.59	-1.66	0.72	0.785
Buccolingual inclinations	-7.33	1.44	-6.4	1.29	0.074
Overjet	-3.46	0.83	-2.26	0.59	0.003
Occlusal relationships	-1.86	0.63	-1.53	0.51	0.128
Occlusal contacts	-3.4	1.24	-2.86	0.83	0.178
Interproximal contacts	-0.86	0.63	-0.86	0.51	1.000
Root angulations	-1.73	0.70	-1.40	0.50	0.148
Total OGS score	-26.8	5.18	-22.0	2.29	0.003

The mean values of alignment and overjetshowed significantly higher negative scores in the non-extraction group.The total

OGS score was significantly less negative in the extraction group (-22.0 ± 2.29) as compared to the non–extraction group (-26.80 ± 5.18, p < 0.005) (Table 3) (Fig 2).

accordance with the study done by Chrysi *et al*. They found that for a patient with a Class I malocclusion, extraction and non-extraction treatment can achieve the same quality of results
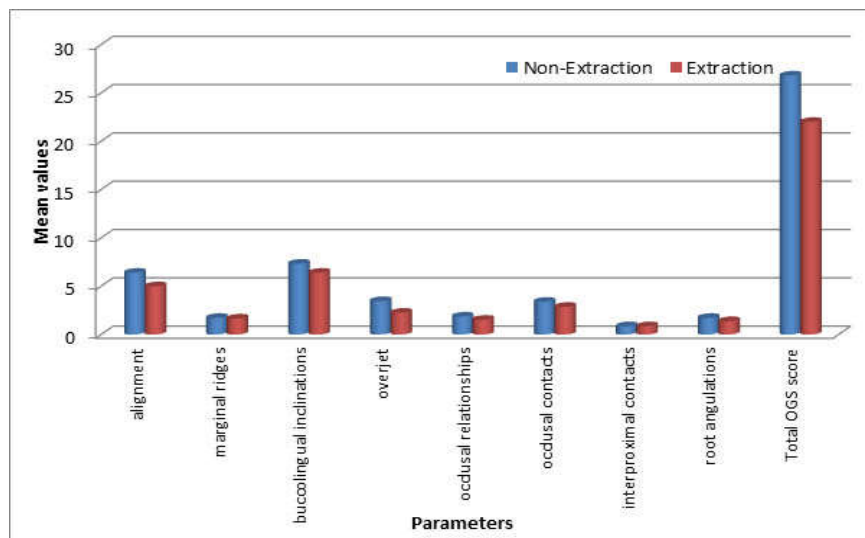

Fig. 2. Scores of the ABO-OGS Variables

DISCUSSION

Apparently, what is known as "The Extraction Debate of 1911" was the main reason for this never ending controversy between extraction and non-extraction treatment protocol. In the year 1911, Calvin Case presented an article entitled "The Question of Extraction in Orthodontia" at the meeting of the National Dental Association, in which he strongly disagrees with the Angle's school of thought of Non-extraction treatment protocol for all the cases. He strongly criticizes their ignorance of heredity as a potential etiological factor of malocclusion and even the belief that all causes of malocclusion are local and positioning teeth in their intended positions would bring about a harmonious orofacial system was not supported by him. He strongly emphasized on the point that all the orthodontic patients cannot be treated with the non-extraction treatment protocol to achieve an ideal result and harmonious face. In 1952, eventually the battle was won by another student of Angle- Charles Tweed, who presented few case reports of patients who were treated initially with non-extraction treatment protocol and were later retreated with all first premolar extractions. Due to the great work of Charles Tweed in this direction which provided scientific evidences towards the need of extraction in orthodontic treatment, the Tweed philosophy and extractions were finally accepted in the field of orthodontics. The main aim of the present study was to evaluate the treatment outcome in patients with Angle's Class I malocclusion with borderline characteristics treated by premolar extraction versus non-extraction treatment protocol, treated with the edgewise technique (MBT 0.022" slot). Significantly higher negative scores in the mean values of alignment and overjet in the non-extraction group was observed. A lack of available space for a precise tooth positioning in the non-extraction patients could be the reason for this. The interproximal contact variable showed the minimum negative scores in both groups. This result was in accordance with the study done by Yang-Powers *et al*. (2002) In our study, the combination of alignment, overjet and buccolingual inclination led to significant difference between the two groups in the Total OGS score. The total OGS score was significantly less negative in the extraction group as compared to the non-extraction group.This result was not in

as assessed by the ABO-OGS (Chrysi Anthopoulou *et al*., 2014). Also, it was noted that the majority of extraction cases had an acceptable occlusion, which may be explained by the more available space for precise positioning of teeth after extraction. Irrespective of the other parameters that could affect the clinician's decision regarding treatment protocol (facial appearance, dentofacial complex characteristics), it seems that the occlusal parameters of adult patients treated according to extraction strategy are better than non-extraction patients parameters when evaluated through ABO-OGS.

Conclusion

*   According to this study, in the borderline cases the final occlusion and radiographical characteristics were more acceptable in the patients treated with extraction than the non-extraction patients.
*   The results demonstrated a significant difference in the mean values of Alignment and Overjet in the non-extraction group compared to extraction group.

REFERENCES

Baumrind S, Korn EL, Boyd RL. And Maxwell R. 1996. The decision to extraction: part 1. Interclinician agreement. *Am J OrthodDentofacialOrthop*., 109(3):297-309.

Bishara SE, Cummins DM. and Zaher AR. 1997. Treatment and posttreatment changes in patients with class 2 division 1 malocclusion after extraction and non-extraction treatment. *Am J OrthodDentofacialOrthop*., 111(1):18- 27.

ChrysiAnthopoulou, DimitriosKonstantonis and Margarita Makou, 2014. Treatment outcomes after extraction and non-extraction treatment evaluated with the American Board of Orthodontics objective grading system. *Am J OrthodDentofacialOrthop*., 146:717-23.

Gianelly, AA. 2003. Arch width after extraction &non-extraction treatment. *Am J Orthod Dentofacial Orthop*., 123(1):25-8.

Ismail SF, Moss JP. and Hennessy R. 2002. Three dimensional assessment of the effects of extraction and non-extraction orthodontic treatment on the face. *Am J Orthod Dentofacial Orthop*., 121(3):244-56.

James, RD. 2000. Objective cast & panoramic radiograph grading system. *Am J Orthod Dentofacial Orthop.*, 117(5): 530-2.

Proffit William R. and Fields Henry, W. 2000. Contemporary orthodontics. St. Louis: Mosby-year book, Pages 249-51.

Richmond, S., W.C. Shaw, K.D.O'Brien, I.B. Buchanan, R. Jones, C.D. Stephens, C.T. Roberts and M.Andrews, 1992. The development of the PAR index (Peer Assessment Rating): reliability and validity. *Eu J Orthod.*, 14:125-139.

Vaden JL. and Kokich, VG. 2000. American Board of Orthodontics: past, present and future. *Am J Orthod Dentofacial Orthop.*, 117(5):530-2.

Yang-Powers LC, Sadowsky C, Rosenstein S. and BeGole EA. 2002. Treatment outcome in a graduate orthodontic clinic using the American Board of Orthodontics grading system. *Am J Orthod Dentofacial Orthop.*, 122(5):451-5.

****