

## Original Article

# Extraction Versus Non-Extraction: A Retrospective Study

### ABSTRACT

**Introduction and Objectives:** The extraction versus nonextraction 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 posttreatment 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 nonextraction cases in borderline cases by ABO-OGS system.

**Materials and Methods:** Forty 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: twenty patients were treated by extraction of all first premolars and twenty patients with a nonextraction treatment protocol. MBT 0.022” slot prescription was used for all forty 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’s *t*-test.

**Results:** The mean OGS scores were significantly less negative in the extraction group ( $22.0 \pm 2.29$ ) as compared to the nonextraction group ( $26.80 \pm 5.18$ ,  $P < 0.005$ ).

**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 nonextraction patients.

**Keywords:** American Board of Orthodontics Objective Grading System, Extraction versus Non-extraction, Orthodontic Treatment Outcome

### INTRODUCTION

The extraction versus nonextraction controversy is the oldest as well as the most enduring controversy and still remains a topic of debate in the field of orthodontics. The debate was between Angle’s school of thought and its followers such as Martin Dewey and Calvin Case, who believed in extraction therapy. In 1952, eventually, the battle was won by Charles Tweed, a student of Angle, who presented few case reports of patients who were treated initially using Angle’s treatment philosophies, i.e., nonextraction and were later retreated with all first premolar extractions. The Tweed philosophy was born, and extractions were finally accepted into orthodontics due to the great work of Tweed which provided scientific evidence toward the need for extraction in treatment.<sup>[1]</sup>

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.<sup>[2]</sup> Various aspects such as occlusal stability, facial appearance, dental arch characteristics, and their effects on the dentofacial complex need to be considered to decide the preferred treatment option for the borderline case.<sup>[3]</sup>

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An evaluation of orthodontic treatment outcome helps to set certain treatment goals, establish orthodontic treatment standards, and achieve a measurable finish for completed patients.<sup>[4,5]</sup> 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, and functional problems.<sup>[6]</sup>

Several quantitative indices have been explained in the literature for the evaluation of orthodontic treatment need or treatment outcome. Of these indices, the peer assessment rating index has been widely used for evaluating the severity of malocclusion and the effects of treatment in resolving them. It quantitatively evaluates postorthodontic treatment outcome using posttreatment casts.<sup>[7]</sup>

“The American Board of Orthodontics” (ABO-1998) introduced an index called the objective grading system (OGS) which evaluates posttreatment dental casts and panoramic radiographs. It assesses the final occlusion in first, second, and third orders according to eight different occlusal and radiographic components. The aim of the present study was to evaluate the treatment outcome of extraction and nonextraction cases in borderline cases by ABO-OGS system.<sup>[8,9]</sup>

## MATERIALS AND METHODS

In this retrospective study, the parent sample consisted of the records of 137 patients presented at the Department of Orthodontics and Dentofacial Orthopaedics, JSS Dental College and Hospital, JSS University, Mysore. The inclusion criteria for the parent sample were male or female patients with an Angle’s Class I dental and skeletal malocclusion, a full complement of teeth excluding the third molars, no previous orthodontic treatment, no clefts or dentofacial deformities, and no orthognathic surgery treatment plans.

Of the parent sample, 55 were treated with extraction of all first premolars and 82 received nonextraction treatment. All patients were treated with preadjusted 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 cephalograms were taken in natural head position and were traced manually.

Of the parent sample of 137 patients, 40 patients were selected as borderline cases. First, a stepwise discriminant analysis was performed in the parent sample to identify the borderline sample. The variables used in the discriminant analysis were 25 cephalometric measurements and 6 model

measurements. Attempt was made to consider all skeletal, dental, and soft-tissue variables that could have influenced the decision regarding treatment protocol [Table 1].

The discriminant analysis resulted in significant discriminating variables in descending order of importance: mandibular crowding, upper incisor to NA, overjet, maxillary crowding, and nasolabial angle [Table 2]. Each patient concluded with a standardized discriminant score (Z score) according to which he or she was classified to the predicted extraction or nonextraction group. The optimal cutoff point of the sample was set. In a discriminant analysis, as patients’ discriminant scores move away from zero to positive values, they are predicted to be nonextraction patients, and as they reach negative values, they are predicted to be extraction patients.

The subsample of borderline cases was determined around the cutoff point. Finally, twenty extraction and twenty nonextraction patients whose scores fell closest to the critical cutoff point were identified as the borderline subsample.

**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 maxillary length	
EFF mandibular 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: postface height ratio	
Lower incisor to APO line	
Nasolabial angle	

Evaluations of the treatment outcomes were made according to the ABO-OGS criteria: alignment, marginal ridges, buccolingual inclination, occlusal relationships, occlusal contacts, overjet, interproximal contacts, and root angulation. The measurements were obtained using the special gauge as instructed by the ABO [Figure 1].

In all cases, each parameter was measured two times and then the mean negative scores for each parameter and total OGS scores were calculated. To examine the intergroup differences between the scores of the eight ABO-OGS variables as well as between the total ABO-OGS scores, descriptive statistics and *t*-tests for independent samples were performed.

## RESULTS

The extraction borderline sample consisted of 20 patients; 11 were females and 9 were males with a mean age of  $15.2 \pm 4.2$  years. The nonextraction borderline sample consisted of 20 patients; 12 were females and 8 were males with a mean age of  $14.6 \pm 2.7$  years.

The results of statistical test calculated for the ABO-OGS variables are shown in Table 3. The maximum negative score in nonextraction and extraction groups was achieved for buccolingual inclinations,  $-7.73 \pm 1.44$  and  $-6.4 \pm 1.29$ , respectively [Table 3]. The minimum negative score was assessed for the interproximal contact variable for both groups,  $-0.86 \pm 0.63$  for nonextraction group and  $-0.86 \pm 0.51$  for extraction group [Table 3].

The results demonstrated a significantly higher negative score in the mean values of alignment and overjet in the nonextraction group. The mean OGS scores were significantly less negative in the extraction group ( $-22.0 \pm 2.29$ ) as compared to the nonextraction group ( $-26.80 \pm 5.18$ ,  $P < 0.005$ ) [Table 3 and Figure 2].

## DISCUSSION

The battle was really begun in 1911 in what has become to be known as “The Extraction Debate of 1911.” At the 1911 meeting of the National Dental Association, Calvin Case presented an article entitled “The Question of Extraction in Orthodontia.” In the article, Calvin Case strongly criticizes the creationist belief of the Angle school and their disregard

of heredity as a cause of malocclusion and their belief that all causes of malocclusion were local and replacing teeth in their intended positions would lead to a harmonious face. To substantiate the case further, he presented a patient whose dental protrusion would have worsened if nonextraction treatment had been done, thus emphasizing that all cases cannot be treated nonextraction to achieve a harmonious face. In 1952, eventually, the battle was won by Charles Tweed, a student of Angle, who presented few case reports of patients who were treated initially using Angle’s treatment philosophies, i.e., nonextraction and were later retreated with all first premolar extractions. The tweed

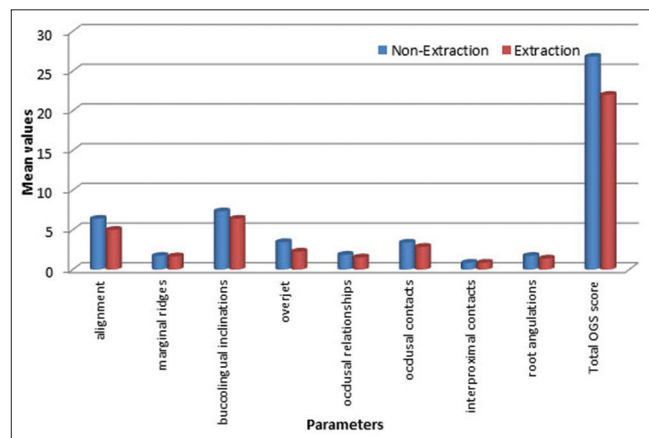
**Table 2: Stepwise discriminant analysis**

Step	Variable	Significance
1	Mandibular crowding	<0.001
2	Upper incisor-NA	<0.001
3	Overjet	<0.001
4	Maxillary crowding	<0.001
5	Nasolabial angle	<0.001

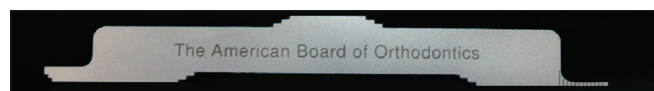
**Table 3: Statistics for the American Board of Orthodontics-objective grading system variables and total American Board of Orthodontics-objective grading system scores**

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

OGS: Objective grading system, SD: Standard deviation



**Figure 2: Scores of the American Board of Orthodontics-objective grading system variables**



**Figure 1: American Board of Orthodontics measuring gauge**

philosophy was born, and extractions were finally accepted into orthodontics due to the great work of Tweed which provided scientific evidence toward the need for extraction in treatment.

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 nonextraction treatment protocol, treated with the standard edgewise technique (MBT 0.022" slot).

The results demonstrated a significantly higher negative score in the mean values of alignment and overjet in the nonextraction group compared to extraction group. The high negative score for these variables in the nonextraction group demonstrates a lack of available space for a perfect tooth placement.

The minimum negative scores were achieved in the interproximal contact variable in both groups. This may be due to the easier recognition and correction of spaces during treatment. Yang-Powers *et al.* found the similar results.<sup>[10]</sup> In the present study, the combination of alignment, overjet, and buccolingual inclination caused a significant difference between the two groups in the total OGS score.<sup>[11,12]</sup>

The mean total OGS score in nonextraction patients was significantly more negative than the extraction group. This result was not in accordance with the study done by Anthopoulou *et al.* They found that, for a patient with a Class I malocclusion, extraction and nonextraction treatment can achieve the same quality of results as assessed by the ABO-OGS.<sup>[13]</sup>

Furthermore, 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 and dentofacial complex characteristics), it seems that the occlusal parameters of adult patients treated according to extraction strategy are better than nonextraction 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 nonextraction patients
- The results demonstrated a significant difference in the mean values of alignment and overjet in the nonextraction group compared to extraction group.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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