Original Article

Comparison of Extraction and Non-extraction Orthodontic Treatment using the Objective Grading System

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Abstract:

Statement of Problem: The extraction versus non-extraction debate is almost as old as the advent of orthodontic practice and up to now, this dilemma remains. Recently, the American Board of Orthodontics (ABO) has developed a method by the name of Objective Grading System (OGS) in order to evaluate the results of orthodontic treatment.

Aim: The aim of the present study was to evaluate and compare the patients' final occlusion after extraction and non-extraction therapy using the OGS.

Materials and Methods: Sixty sex-matched cases with an age range of 15-20 year old were selected and evenly divided into 2 groups as follows: 30 patients were treated by extraction of 4 premolars and 30 received a non-extraction treatment. All patients had class 1 malocclusion before treatment and were well treated with the standard edgewise system in a private clinic. With the aid of an ABO measuring gauge, 8 parameters of occlusion were measured 3 times, each. Reproducibility of the measurements were evaluated by use of the Phi correlation coefficient and the total OGS scores between the two groups were compared using Levene`s test and Student *t*- test with the significant level at 95%.

Results: The mean OSG scores were significantly more negative in the non–extraction group (-6.58 ± 8.63) as compared to the extraction group (-28.65 ± 6.67, $p < 0.004$). Acceptable occlusion was observed in 73.4% of the extraction and 43.4% of the non-extraction cases.

Conclusion: In this study according to the ABO grading system (OGS), the final occlusion of patients treated with extraction seemed more acceptable than non-extracted cases.

Keywords: Orthodontics; Occlusion; Crowding; Dental arch

Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran (2005; Vol: 2, No.3)

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Received: 20 January 2005
Accepted: 3 August 2005

INTRODUCTION

The extraction controversy still continues from the early 20th century. Angle (1907) was the pioneer to describe normal occlusion and classify malocclusion. He was influenced by the biologic concept of his time, emphasizing the perfectibility of man, therefore extraction of teeth for orthodontic purposes seemed inappropriate, because man was thought to be inherently capable of having a perfect dentition; thus extraction of teeth was rare in the early 20th century. In 1940, after re-treatment of a few cases that were previously treated without extraction, Tweed observed

their occlusion to be much more stable after removing four first premolars. This caused a peak in extraction cases, constituting about 70% of orthodontic patients in the 1960s. From that time to the early 1990s there was a continuing decline in extraction rates, which has stabilized or increased slightly, recently [1]. Baumrind et al [2] in their investigation on inter-clinician agreement found a disagreement exist in 34% of cases regarding extraction versus non-extraction treatment.

In order to reach a final decision on the preferred modality of treatment (extraction/non-extraction), several aspects such as stability of occlusion, characteristic of dental arches (widths, perimeters), and facial esthetics, must be considered and their effects on the dentofacial complex need to be clarified. Numerous investigations have recently compared these factors after both extraction and non-extraction treatment [3,4,5].

The ultimate goal for patient management is to achieve the highest quality of care. Quality of care has been defined in medicine as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes consistent with current professional knowledge" [6].

In an effort to make the evaluation of occlusion more objective, the American Board of Orthodontics (ABO) implemented an objective cast and panoramic radiograph grading system in 1998 for assessing the outcome of treatment; it was named the ABO Grading System or Objective Grading System (OGS) [7]. After several field tests, the validity and reliability of the system was proven and therefore it was used in the evaluation of orthodontic records. In this method practitioners are able to score their own final casts (regardless of the primary malocclusion) and panoramic radiographs in their private practice to determine if they are producing "Board quality" results. The OGS may also be an ideal scoring system for research purposes [8].

The aim of the present study was to evaluate and compare the patients' final occlusion after extraction and non-extraction treatment with the standard edgewise system, using the OGS.

MATERIALS AND METHODS

Based on a pilot study a total number of 60 patients consisting of 46 girls and 14 boys with an age range of 15 – 20 years were selected and evenly divided into two sex-matched groups. In first group, 30 patients treated with extraction of 4 premolars and in second group, 30 subjects, treated without extractions. Inclusion criteria were having a harmonic face (clinical symmetric face without significant vertical problems) and class I malocclusion before treatment. The only exclusion criterion was that none of them had a history of orthodontic treatment. All patients were well treated according to 6 keys of normal occlusion [9] in a private clinic with the standard edgewise system. The decision for extraction was based on the severity of crowding and lip-to-dentition relationships (lip incompetency). Final casts were obtained up to 3 months after removal of the retainer appliances.

The ABO Objective Grading System for scoring dental casts and panoramic radiographs contains eight criteria: alignment, marginal ridges, buccolingual inclination, occlusal relationships, occlusal contacts, overjet, interproximal contacts, and root angulation (Fig.1). Using an ABO measuring gauge, this system was implicated in the evaluation of the final casts and panoramic radiographs of each case. As stated by the ABO, a negative score was considered for each parameter, if there was any deviation from normal. Cases with an OGS score greater than -30 (total of 8 negative scores in each case) were considered not acceptable [10].

In all cases, each parameter was measured 3

Fig. 1: ABO measuring gauge to assess buccolingual inclination of upper first molar.

times and then the mean negative scores for each parameter and total OGS scores were calculated. The homogeneity of variances was analyzed using the Levene test followed by student *t*-test for statistical analysis and the mean values of the studied parameters as well as the mean of the OGS scores were compared between the two groups. Phi correlation coefficient was used for assessing the reproducibility of the measurements. The level of significance was set at 0.05.

RESULTS

The mean (standard deviation) age of the non-extraction and extraction groups were 17/6 (1/4) and 18/2 (1/8) (years/months) respectively. The duration of treatment with fixed edgewise appliances was 21 (7) months for the non-extraction and 25 (8) months for the extraction group. The retainer was used for 13 (2) and 14 (3) months by the non-extraction and extraction groups respectively.

The Phi correlation coefficient of all variables was high enough (0.994) to indicate a high reliability of the measurements.

Levene`s test showed that variances were differenct in Marginal ridges , Buccolingual inclination and Over jet between two groups, however, the other parameters (Alignment, Occlusal contact , Occlusal relationship, Interproximal contact, Root angulations, and ABO score) had no difference.

The maximum negative score in extraction and non-extraction groups was achieved for occlusal contacts, -6.23 (4.61) and -8.1 (4.85) respectively. The minimum negative score was assessed for the interproximal contact variable for both groups, -0.3 (0.53) for the extraction and -0.4 (0.8) for the non-extraction group. These results demonstrated a significantly higher negative score in the mean values of alignment in the non-extraction group ($p<0.05$). In addition the mean OGS score was significantly better ($p<0.004$) in the extraction, -28.65 (6.67), as compared to the non–extraction group, -36.58 (8.63), (Table I).

In the present study, 73.4% of extraction and

Table I: The results of Objective Grading System (OGS) in non-extraction and extraction groups.

Variables	Non - Extraction group			Extraction group			P-value
	Mean	SD	Range	Mean	SD	Range	
Alignment	-6.73	3.1	-3 — -16	-4.83	3.02	-1 — -13	0.019*
Marginal ridges	-1.17	1.34	0 — -4	-1.73	2.13	0 — -6	0.224
Buccolingual inclin.	-4.07	2.67	0 — -10	-4.23	1.67	-1 — -9	0.777
Overjet	-6.50	3.98	0 — -13	-4.07	2.56	0 — -10	0.099
Occlusal contacts	-8.10	4.85	-1 — -19	-6.23	4.61	0 — -16	0.132
Occlusal relationship	-3.53	3.07	0 — -11	-2.53	3.6	0 — -20	0.235
Interproximal contacts	-0.4	1	0 — -5	-0.3	0.53	0 — -2	0.632
Root angulation	-6.08	3.3	-2 — -14	-5.73	1.93	-3 — -10	0.738
ABO Score	-36.58	8.63	-4 — -52	-28.65	6.67	-10 —-35	0.004*

*significant difference between two groups ($p<0.05$).

43.4% of non-extrantion cases had an acceptable (less than -30) OGS score.

DISCUSSION

The main purpose of the present study was to evaluate the quality of treatment in patients with premolar extraction versus non-extraction patients, treated with the standard edgewise technique.

The results of the present study, revealed a significant difference in the alignment parameter between the extraction and non-extraction groups. The high negative score for this variable in the non-extraction group demonstrates a compromise in the available space for a perfect tooth positioning. The alignment score in the current study was near to the values reported by Yang-Powers et al which were -8.79 (5.13) for university treated subjects and -7.31 (4.34) for ABO presented samples [11]. In their study, about 63% of the cases were treated without extraction.

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 [11] have also reported similar results; they found minimum scores for interproximal contacts in both the university-treated and the ABO presented patients.

The maximum negative scores in both treated groups were seen in the occlusal contacts (Table I) which are comparable with the university group in the Yang-Powers study (-8.79) [11]. It is probably related to the difficulty in determining this discrepancy at the clinical level or more importantly due to incomplete settling of teeth after appliance (retainer) removal.

Overjet and occlusal contacts showed higher negative scores in the non-extraction group, but the differences were not significant. The combination of alignment, overjet and occlusal contacts caused significant difference between the two groups in the total OGS score.

Finally, the mean total OGS score in non-extraction patients was significantly more negative than the extraction group. Also, it was noted that the majority of extraction cases had an acceptable occlusion. It seems that the occlusal conditions in the extraction group is closer to ideal as compared to the non-extraction group, which may be explained by the more available space for precise positioning of teeth after extraction.

In equal situation, it seems that the occlusal parameters of adult patients treated according extraction strategy, are better than non-extraction patients' parameters.

COCLUSION

According to the result of this study, it can be concluded that:

1- Significant differences in treatment outcome by using OGS scores were found between the extraction and non-extraction groups treated with the standard edgewise system: extraction of four premolars resulted in a better occlusion. The teeth alignment and the total OGS scores also demonstrated a significant difference, which showed to be more acceptable in cases treated with extraction.

2- Based on the OGS, 43% of non-extracted and more than 70% of extracted cases had acceptable occlusions.

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مقایسه درمانهای ارتودنتیک Extraction و Non-Extraction با استفاده از روش درجه‌بندی عینی

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چکیده

بیان مسأله: بحث استفاده از درمان extraction با non-extraction قدمتی تقریباً به اندازه تاریخچه درمانهای ارتودنسی دارد و کماکان نیز به عنوان یک چالش مطرح است. بورد ارتودنسی آمریکا روشی را جهت ارزیابی نتیجه درمانهای ارتودنتیک ارائه داده است که روش درجه‌بندی عینی یا Objective Grading System (OGS) نام دارد.

هدف: مطالعه حاضر با هدف ارزیابی اکلوژن پس از درمان بیماران به صورت extraction و non-extraction با کمک روش درجه‌بندی عینی انجام شد.

روش تحقیق#تعداد ۶۰ بیمار در محدوده سنی ۱۵-۲۰ سال انتخاب و به دو گروه مساوی تقسیم شدند. بیماران دو گروه از نظر جنس همسان شده بودند. ۳۰ بیمار با کشیدن ۴ دندان پره‌مولر اول و بقیه بدون کشیدن دندان درمان شدند. همه بیماران مال اکلوژن کلاس I داشتند و همگی با سیستم استاندارد edgewise در یک مطب خصوصی درمان شدند. با استفاده از گیج استاندارد ABO، هشت شاخص اکلوژن هر کدام سه بار اندازه‌گیری شدند و ضریب تکرارپذیری Phi برای همه آنها محاسبه گردید و میزان عدد OGS نهایی برای دو گروه با استفاده از آزمونهای Leven's و t، نمونه‌های مستقل با در نظر گرفتن سطح معنی‌داری ۹۵٪ مقایسه شدند.

یافته‌ها: متوسط امتیازات OGS در گروه non-extraction (۸/۶۳±۶/۵۸-) به میزان معنی‌داری منفی‌تر از گروه extraction بود (۶/۶۷±۲۸/۶۵-)، (P=۰/۰۰۴). اکلوژن قابل قبول در ۷۳/۴٪ از بیماران با درمان extraction و ۴۳/۴٪ موارد non-extraction مشاهده شد.

نتیجه‌گیری: در مطالعه حاضر و با توجه به روش درجه‌بندی بورد آمریکا (OGS) نتیجه نهایی درمان بیماران به روش extraction مقبول‌تر از درمان non-extraction به دست آمد.

واژه‌های کلیدی: ارتودنسی؛ اکلوژن؛ کراودینگ؛ قوس دندانی

مجله دندانپزشکی دانشگاه علوم پزشکی و خدمات بهداشتی, درمانی تهران (دوره ۲, شماره ۳, سال ۱۳۸۴)