IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Patient Vs Dentist Perception Upon Extraction Vs Non Extraction Cases Post Orthodontic Treatment

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Abstract:

Aim: This review article aims to evaluate the treatment outcomes and patient satisfaction after orthodontic treatment. Understanding these outcomes will help orthodontists better plan treatments for future patients.

Materials and Methods A systematic literature search was conducted using electronic databases, including PubMed, Google Scholar, and relevant orthodontic journals. Studies focusing on patient perceptions of extraction versus non-extraction cases following orthodontic treatment were included in this review.

Conclusion: According to the American Board of Orthodontics (ABO) and their Objective Grading System (OGS), also known as the ABO Grading System, the final occlusion of patients treated with extractions appeared more acceptable than those treated without extractions.

1. Introduction:

The debate regarding the use of extractions in orthodontics has persisted since the early 20th century. Angle (1907), who first classified malocclusion and defined normal occlusion, was influenced by the prevailing biological concept of the time, which emphasized the perfection of human beings. He believed that extraction for orthodontic purposes was unnecessary, as it was thought that individuals could naturally achieve perfect teeth. Consequently, extractions were uncommon during the early 20th century.

In contrast, Tweed (1940) observed that the occlusion of several patients who had initially been treated without extractions became significantly more stable after the removal of four first premolars. This led to a rise in extraction cases, reaching nearly 70% of orthodontic patients by the 1960s. Afterward, the rate of extractions began to decline steadily, although it stabilized or slightly increased by the early 1990s.

In the study on inter-clinician agreement, Baumrind et al. found that 34% of cases showed disagreement over whether extraction or non-extraction treatment was more appropriate. Finalizing the preferred treatment modality (extraction vs. non-extraction) requires careful consideration of various factors,

including facial esthetics, the width, and perimeter of the dental arches, the stability of occlusion, and their effects on the dentofacial complex. Recently, several studies (citation needed) have evaluated these factors following extraction versus non-extraction treatments.

The American Board of Orthodontics (ABO) developed the Objective Grading System (OGS), also known as the ABO Grading System, in 1998 to more objectively evaluate treatment outcomes using a grading system based on casts and panoramic radiographs. The system's validity and reliability were established through field testing, and it is now used to assess orthodontic records. By applying the OGS, orthodontists can evaluate whether they are achieving "Board-quality" results in their practices, independently of the initial malocclusion and using final casts and panoramic radiographs.

Patient perceptions of orthodontic treatment, particularly regarding its impact on quality of life and satisfaction, have been a focus of recent research. For example, AlQurani et al. (citation needed) found that orthodontic treatment in adolescents improved self-confidence, self-esteem, social interactions, and social acceptance, in addition to enhancing health-related behaviors, dental health, and psychosocial well-being. These findings underscore the positive effects of orthodontic treatment on adolescents' quality of life.

The objective of the present study is to review the literature on patient perceptions regarding extraction versus non-extraction cases after orthodontic treatment, using tools such as the Visual Analogue Scale (VAS) and evaluating patient satisfaction.

2. Review of Literature on Patient Perception Upon Extraction Vs Non Extraction Cases Post Orthodontic Treatment

Paula Cotrin et al[1] aimed to assess patient satisfaction, long-term occlusal changes, and treatment outcomes following 37 years of non-extraction and extraction procedures. The six keys to normal occlusion were used as the optimum finishing parameters for orthodontic treatment. To consistently define and analyze the degree of malocclusion, evaluate the effectiveness of various treatment modalities, and determine whether orthodontic treatments relapse, objective criteria must be applied. Recently, efforts have been made to evaluate treatments more objectively so that dental professionals worldwide can communicate about orthodontic results in a unified manner.

Two popular indices for assessing treatment outcomes and stability in this context are the Peer Assessment Rating (PAR) index and the American Board of Orthodontics (ABO) Objective Grading System (OGS). The PAR index was created to assess orthodontic treatment outcomes by weighting several components to represent their relative relevance, thus increasing the validity of the index. It assesses overjet, overbite, midline discrepancies, dental impaction, and the relationships between the buccal segments. The higher the reduction in the PAR score after treatment, the better the orthodontic outcome. More recently, the ABO developed the OGS as an occlusal index to evaluate post-treatment dental casts to determine the sufficiency of completed orthodontic results.

The assessment of the final occlusion is based on eight distinct occlusal components: alignment, interproximal contacts, root angulation, occlusal connections, occlusal contacts, overjet, and marginal ridges. The measurements are made using a metal gauge that is sold by the ABO.

Although tooth extraction procedures have become less common in recent years, there is still an ongoing debate regarding the differences in treatment outcomes and long-term effects between patients who receive extractions and those who do not. Patients treated with and without extractions exhibit varying and sometimes unpredictable long-term post-treatment effects. The orthodontic literature remains lacking in information regarding patient satisfaction over time and long-term occlusal changes resulting from non-extraction and extraction procedures.

AlQurani et al. [2] discovered that orthodontic treatment improves self-confidence, self-esteem, social interactions, and social acceptance, in addition to health-related behavioral changes, dental health, and psychosocial benefits. These findings support the notion that orthodontic treatment enhances adolescents' quality of life. However, studies assessing patient satisfaction with orthodontic treatment after more than 35 years of retention are scarce. The goal of the present study was to assess long-term patient satisfaction and

occlusal changes in patients treated with and without extractions, using the Peer Assessment Rating (PAR) and OGS indices.

Felicia Miranda et al. [1,2] highlighted the increasing focus on evaluating occlusal aging, prompted by the rise in life expectancy. Maturational changes have been previously studied in untreated populations with normal occlusion. A longitudinal study of normal occlusion maturation from 9 to 20 years demonstrated declines in arch length and intercanine width. Overjet, overbite, and incisor irregularities were found to increase between the early permanent dentition and 20 years of age.

A study on the long-term stability of the dental arch form in normal occlusion patients aged 13 to 31 years indicated a more rounded mandibular arch. There was a decrease in maxillary and mandibular intercanine widths and arch lengths.In a study of Brazilians with normal occlusion, a decrease in arch perimeter and an increase in incisor crowding and overbite were observed from ages 21 to 28 years. Similarly, in a cross-sectional study in Sweden, occlusal alterations were evaluated from ages 5 to 31 years. The intercanine width in both arches decreased from ages 16 to 31 years. A Finnish study of participants with normal occlusion, aged 7 to 32 years, found a decrease in intercanine distance, maxillary intermolar breadth, overjet, and overbite after 15 years. Research suggests that between the ages of 25 and 46, there is a decline in maxillary and mandibular intercanine widths, a decrease in maxillary arch length, and an increase in mandibular incisor crowding. There was a consistent decrease in maxillary and mandibular intercanine distances between ages 13 and 45 years (Miranda et al.)

Essam A. Al Yami et al.[3] conducted a study in the Netherlands with 1,016 patients. Dental casts were evaluated for long-term treatment outcomes using the Peer Assessment Rating (PAR) score. The PAR index was assessed at various stages: pre-treatment (n = 1,016), immediately post-treatment (n = 783), post-retention (n = 942), 2 years post-retention (n = 781), 5 years post-retention (n = 821), and 10 years post-retention (n = 564). The mean absolute change and percentage of change per year (relapse) for the post-retention stages were calculated. An analysis of variance was used to assess the mean change in PAR between instances with and without a set retainer at the post-retention stage, up to 10 years later. Drop-out analysis revealed that more Class II Division 2 cases were lost to follow-up compared to other Angle classes. The findings showed that 67% of the acquired orthodontic treatment outcomes were retained 10 years later. The PAR index indicated that approximately half of all relapses occurred within the first two years after retention.

After 5 years of retention, all occlusal features gradually relapsed but remained stable, with the exception of the lower anterior contact point displacement, which increased rapidly and exceeded the baseline score.

The inclusion of a permanent retainer improved the PAR score. Fixed retention reduced relapse rates by 3.6 PAR points at 5 years and 4.6 points at 10 years. The findings from these studies allow practitioners to inform their patients about the limitations of orthodontic treatment to better manage expectations. After ten years of retention, 67% of the orthodontic treatment outcome was still maintained. Approximately 50% of total relapse occurs within the first two years following retention. All occlusal characteristics gradually relapsed, but after five years of retention, they remained stable, except for the lower anterior contact point displacement, which increased steadily and nearly surpassed the baseline score. These findings enable medical professionals to advise patients about the limitations of treatment prior to beginning therapy, helping them to set more realistic expectations.

Nahla AlQurani et al.[2] identified three primary categories commonly used to describe orthodontic treatment outcomes: functional, psychological, and cosmetic. Despite this, little research has been done to examine treatment outcomes from the patients' perspective in a qualitative manner. A deeper understanding of these outcomes is essential to manage expectations and improve treatment satisfaction. In their prospective qualitative study, semi-structured in-depth interviews were conducted with 20 adolescent patients (ages 13–18) and their parents to explore how they felt about the results of their treatment. The interviews were digitally recorded, transcribed verbatim, and analyzed using a framework-based content thematic approach. The data from these patient interviews revealed three primary benefits of treatment: psychosocial impacts, dental health, and health-related behavioral modifications. Both patients and orthodontists should be aware of these findings, especially during the informed consent phase, to manage expectations effectively. The majority of participants reported health-related behavioral changes, pointing to both immediate

improvements in oral health and long-term benefits in dental attitudes. Patients also noted improvements in social interactions, acceptability by others, self-esteem, and confidence, highlighting the significant quality-of-life benefits of orthodontic treatment.

N. Farhadian, A.F. Miresmaeili, and M.K. Soltani reviewed the ongoing debate over extraction vs. non-extraction treatments, a topic that has been discussed since the early days of orthodontics. The Objective Grading System (OGS), developed by the American Board of Orthodontics (ABO), is a new tool used to assess orthodontic treatment outcomes. In this study, the OGS was used to assess and compare the final occlusion of patients following extraction and non-extraction therapy. Sixty six-matched patients, aged 15 to 25, were selected and divided into two equal groups: thirty patients underwent non-extraction treatment, while thirty patients underwent the extraction of four premolars. All patients had Class I malocclusion prior to treatment. In a private clinic, they received care using the typical edgewise technique. Eight occlusion characteristics were tested three times each using an ABO measuring gauge. Levene's test and the Student's t-test (with a 95% significance level) were used to compare the overall OGS scores between the two groups and assess the reproducibility of the measures using the Phi correlation coefficient.The results showed that the non-extraction group had significantly lower mean OGS scores (-6.58 ± 8.63) compared to the extraction group (-28.65 ± 6.67, $p < 0.004$). Acceptable occlusion was noted in 43.4% of the non-extraction cases and 73.4% of the extraction cases. In conclusion, the ABO grading system showed that patients who underwent extraction treatments had a more satisfactory final occlusion compared to those treated without extractions.[1,3]

After treatment, Fox and Chadwick (citation needed) observed a 72% decrease in PAR in 100 cases (from 29.5 to 8.3). One year after retention, this decrease had reverted to 57% (12.8, n = 51). Jones and Otuyemi (citation needed) assessed 50 Class II/1 malocclusions and found an 82% reduction in PAR. However, only 60% and 38% of the cases, respectively, were able to maintain the post-treatment results at one and ten years after retention. Late lower anterior crowding appeared to be the main cause of this degradation. A "quantitative and qualitative assessment of post-treatment changes using a sufficiently large sample for statistical analysis, consisting of cases out of retention for at least 10 years," as highlighted by Kahl-Nieke et al. (citation needed), is necessary. This study utilized a large treated sample of more than 1000 cases at the University of Nijmegen. The objective of this study was to assess long-term post-treatment outcomes using the PAR index up to ten years after retention.

O'Brien et al.[1,4] concluded that while various aspects of malocclusion were not significant predictors of perceived treatment difficulty, treatment difficulty and malocclusion severity were separate but connected variables. Although the ABO examiners have a specific objective in mind—to evaluate final treatment details based on criteria for case categories—the evaluation of pre-treatment study models can be integrated into the analysis. The study's goal was to assess treatment outcomes in a university graduate orthodontic clinic, rather than validate the ABO grading system. The Ideal Tooth Relationship Index (ITRI), created by Haeger et al. (citation needed) and later used by Tahir et al. (citation needed) to assess a sample of cases from ABO diplomats, is most comparable to the OGS of the ABO. Both assessments are based on the number of optimal tooth relationships and are quite strict. While the ITRI evaluates each relationship as either present or missing, the OGS considers the severity of each relationship.

Little, Wallen, and Riedel [1,5] tracked 65 subjects over a ten-year retention period after treating them with four first-premolar extractions. Their findings showed that, although crowding increased, arch length and width generally decreased. Furthermore, fewer than 30% of cases showed stability in the mandibular anterior position. The authors concluded that factors such as the degree of initial crowding, age, gender, Angle classification, and retention duration were not helpful indicators for predicting whether mandibular incisor alignment would remain stable.

Both Brodie and Cole, who examined orthodontic patients undergoing both non-extraction and extraction treatments, reached the same conclusion: teeth that have undergone orthodontic treatment tend to revert to their pre-treatment axial inclination. Weinberg and Sadowsky identified mandibular incisor protrusion as a risk factor for relapse. However, Freitas et al. found that crowding relapse is not influenced by the tilt or linear protrusion of the last mandibular incisor. Schulaf et al. concluded that post-retention crowding of mandibular incisors was unrelated to the anteroposterior position of the mandibular incisors relative to

various cephalometric values. Other researchers identified the most common cause of mandibular incisor instability as intercanine width expansion during therapy.

Reports suggest that maintaining the mandibular intercanine width is key to achieving stable outcomes. However, research has also shown that stability of the mandibular incisor position during treatment is not guaranteed by simply maintaining the pre-treatment intercanine distance. A reduction in arch length during the post-retention phase may lead to incisor crowding. Kahl-Nieke et al. and Årtun et al. found that an increase in arch length is associated with crowding relapse.In a university sample, Cook et al. reported an average overall OGS score of 25.1, with individual variability reaching up to nearly 24.[1,6]

Yang-Powers et al. demonstrated that post-treatment total OGS scores could exceed 36, with an average as high as 45.5. Since orthodontists aim to achieve the best possible occlusal results, it is crucial to understand the degree of variability among treated patients, the most variable occlusal components, and the factors influencing post-treatment variability.

The Peer Assessment Rating (PAR) index, introduced by Richmond et al. in 1992, primarily measures the improvement in malocclusion between the initial and final conditions, though it does not precisely quantify tooth positioning or occlusal outcomes. Later, Daniels and Richmond (2000) introduced the Index of Complexity, Outcome, and Need (ICON), which evaluates the need for treatment, treatment complexity, improvement, and final results. The primary advantage of the ICON is its simplicity—requiring no additional equipment—and its ability to provide more objective data. However, a key limitation of this index is that the majority of its assessment is based on aesthetics. The ABO Objective Grading System (ABO-OGS), as recommended by the American Board of Orthodontics (ABO), is a more comprehensive method for evaluating treatment outcomes. [7]

Premolar extraction is associated with increased crowding, more severe buccal segment occlusion, a larger overjet, and a greater midline deviation. The long-term consequences of extraction versus non-extraction therapies were investigated by Paquette et al. (2015), who found that the post-treatment improvements in both groups were nearly identical. Janson et al. (2011) compared the occlusal success rates of orthodontic treatment outcomes for two maxillary premolar extractions versus four premolar extractions. They found that patients who underwent two maxillary premolar extractions displayed stronger dental alignment and more developmental progress than those who underwent four premolar extractions. In their study, the occlusal success rate for treating malocclusions with four premolar extractions was lower than for treatment with two maxillary premolar extractions. Xu et al. also compared extraction versus non-extraction orthodontic treatment and found no statistically significant differences between the groups in terms of tooth alignment, midline symmetry, overbite, overjet, or posterior occlusion.

Wes Fleming et al. used the ABO Objective Grading System (OGS) to examine post-treatment occlusal variability in participants who did not undergo extractions. Using post-treatment study models, the OGS scores for six criteria (excluding interproximal contacts and root angulations) were determined. Their findings revealed a partial mean overall OGS score of 24.9. Occlusal contact, after alignment, was the factor that contributed the most to the overall score.

Farhadian et al. utilized the ABO OGS to compare the outcomes of four-premolar extraction treatments versus non-extraction treatments. They demonstrated that variations in overjet, buccolingual inclination, and marginal ridges differed between the two groups. However, no significant differences were observed for other parameters, such as root angulation, alignment, occlusal contact, occlusal relationship, and interproximal contact. While there were no significant differences between the groups in terms of alignment, buccolingual inclination, overjet, or interproximal contact, significant variations were noted in terms of occlusal contact, occlusal relationship, and root angulation.[8]

Driscoll-Gilliland et al. assessed the association between skeletal changes and mandibular incisor crowding by comparing the dental and skeletal changes in treated patients versus an untreated group. Due to different observation periods between the groups, the changes were annualized. The variations in irregularity between the two groups did not differ. These findings contradicted those of Sinclair and Little, who reported a higher

rate of relapse in the treated group due to late mandibular crowding. However, Driscoll-Gilliland et al. found no difference in mandibular irregularity changes between the treated and untreated groups. [9]

Changes in overjet following therapy were found to be unrelated to the nature of the initial malocclusion. These results align with the findings of Rose and El-Mangoury. Bresonis and Grewe, Hechter, and Little et al. indicated that Class II, Division 1 cases had a higher relapse rate in overjet following treatment compared to other malocclusion types, although their findings were somewhat contradictory.[10]

3. Conclusion:

1. Treatment resulted in improvements in the PAR index, and both the PAR and OGS indexes significantly increased, demonstrating long-term occlusal treatment modifications in both the extraction and non-extraction groups.

2. While marginal ridges, occlusal, and interproximal contacts improved over time, alignment, buccolingual inclination, and occlusal connection deteriorated over time.

3. The OGS Index revealed more occlusal treatment modifications in the nonextraction group than in the extraction group, but patient satisfaction was comparable in both.

4. Compared to the nonextraction group, patients in the extraction group felt that their alignment had changed more over time.

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