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COMPARISON OF ORTHODONTIC TREATMENT RESULTS WITH INVISALIGN AND FIXED APPLIANCE USING PEER ASSESSMENT RATING INDEX

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ABSTRACT

Malocclusion is defined as a condition that deviates from normal occlusion. Crowding is the most common malocclusion. Orthodontic treatment is a field of dentistry that plays an essential role in improving facial esthetics, function and stability of good treatment results. Orthodontic treatment offers several methods, such as conventional fixed orthodontic appliances and invisalign. The PAR index is an instrument used to measure deviations from ideal occlusion and to evaluate the results of orthodontic treatment quantitatively by comparing pre-and post-treatment dental models. **Purpose:** This study aims to compare the efficacy of orthodontic treatment results with invisalign and conventional fixed orthodontic appliances using the PAR Index. **Methods:** Analyzing databases such as Google Scholar, textbook, Elsevier, PubMed, and various national and international journal websites related to the title of this literature. The references have been selected based on relevant analysis and published in the last ten years, specifically from 2011 to 2021. Results: Based on the PAR index score, there were no significant differences in the efficacy of orthodontic treatment results with invisalign and conventional fixed orthodontic appliances. **Conclusion:** Both Invisalign and fixed appliances were able to improve the malocclusion. However, Invisalign may not be as effective as fixed appliances

INTRODUCTION

Malocclusion is a condition that can affect both children's and adolescents' oral-health-related quality of life (Bellot-Arcis C,c2013). It has is defined as a condition that deviates from normal occlusion or deviates from the normal relation of one tooth to another. Angle Class I malocclusion has a normal molar relationship, but there is crowding, misaligment of the teeth, crossbite, and orther aligment irregularities. Crowding of teeth is the most common malocclusion and is found a lot, especially crowding on the anterior region. Crowded teeth are defined as a discrepancy between tooth size and jaw size, thus causing the teeth' positions to overlap. These conditions can be treated with orthodontics (Riyanti E, 2018).

Orthodontic treatment aims to improve facial esthetics, function, and stability of treatment results (Bowman SJ, 1999). Orthodontic treatment offers several methods, e.g. invisalign and fixed orthodontic conventional appliances. A fixed orthodontic appliance is a appliance attached to the teeth by the dentist and can not be removed by the patient until treatment iscompleted (Natural MK.2012). The fixed orthodontic appliance has become an effective conventional orthodontic appliance for over one hundred years, but It's not aesthetically good and is less comfortable. Meanwhile, In recent years, there has been an increase in the number of patients who wants orthodontic treatment, which is more aesthetic and comfortable (Ke Y, 2019). One of the methods that can be used in addition to fixed orthodontic appliances is invisalign. Invisalign itself is a thin transparent plastic aligner, invisible and removable. Besides correcting malocclusion, invisalign prevents relapse after orthodontic treatment (L Valentina, 2018). Outcome of orthodontics treatment with invisalign and conventional fixed orthodontics can be different. One method of assessing the results of orthodontic treatment are Peer *Assessment Rating Index* (PAR index). A PAR index is an instrument in the form of a rulerused not only to measure deviations from ideal occlusion, but also to evaluate treatment outcomes in orthodontics quantitatively by comparing the orthodontic study model before and after orthodontic treatment. The PAR index score is measured from several components such as anterior alignment of the maxilla and mandible, right and left buccal occlusion, overjet, overbites, and midlines.

METHOD

Studies on the effectiveness of using the *Peer Assessment Rating Index* to evaluate the success of orthodontic treatment with invisalign and conventional orthodontic treatment in the correction of anterior *crowding* using the *Literature* approach *Review* (LR) that has an ISSN *(International Standard Serial Number)* published electronically through the internet. A literature search was conducted in December 2022. Literature was obtained from the database: PubMed, Google Scholar, Elsevier, Ebsco, *Textbooks* and various journal *websites* national and international, associated with this literature. The minimum number of planned articles is ten published in 10 years last from 2011 to 2021. Search articles using keywords treatment PAR index score: "Anterior *Crowding",* "Fixed Orthodontics", *"Invisalign,"* and *"Peer Assessment Rating Indexes".* "Boolean searching" method was used to find keywords: "Anterior Crowding OR Front Teeth Crowded AND Orthodontics Fixed OR Fixed Appliance AND Invisalign OR Transparent AND Peer Assessment Rating Index OR Index Rating Calculation Peer. References referred to are research, descriptive, and literature study.

RESULT AND DISCUSSION

Result

The results *of this literature review* about the effectiveness of orthodontics treatment using invisalign and fixed appliances conventional in anterior crowding correction using Peer Assessment Rating Index on treatment success obtained from two journals that have rated eligibility. Based on journal searches from multiple databases can be summarized in the table as follows:

Table 1. Comparison of Orthodontic Treatment Result with Invisalign and Fixed Appliance

Selected References	Research methods	Results
Lanteri et al. (2018)	A total of 200 patients were evaluated and the PAR index was used to see the effectiveness of Invisalign on occlusal treatment outcomes. The study group consisted of 100 subjects (30 men and 70 women), ages 14-56 years, with an average age of 28 (men) ± 10 (women) years, who were treated with Invisalign. The control group consisted of 100 patients (30 men and 70 women), aged 15-51 years, treated using straight-wire edgewise appliances with an initial malocclusion level of objection, based on dental crowding andPAR index scores.	- Between the two groups, there was no statistically significant difference concerning variables (age, sex, PAR index). - In the invisalign group, 63 subjects did not need refinement. At the end of treatment, 91 subjects achieved correction for the midline. The mean duration of treatment was 14 months (±7 months) for the invisalign repair group and 19 months (± 4 months) for the control (fixed conventional) group. - There were significant difference (P<0.05) between the mean for both groups' pre- and post-treatment PAR scores. - Good occlusal results were obtained, and there was no significant difference in the post-treatment scores of the invisalign and fixed conventional groups.
Gu J et al. (2017)	This retrospective case-control study sample was selected from approximately 1500 conventional orthodontic patients and 250 invisalign patients at Ohio State University College of Dentistry. 62 fixed appliance patients and 61 Invisalign patients met the criteria. To match the pre-treatment malocclusions between the two groups and eliminate early termination patients, 48 subjects from each group were selected.	- Between invisalign and conventional fixed orthodontic appliances, both can correct a malocclusion. - The duration of treatment of patients who were orthodontically treated using invisalign was shorter (13 months) than patients who were orthodontically treated using conventional fixed orthodontic appliances (19 months). - Orthodontic treatment using Invisalign is not as effective as treatment using conventional fixed orthodontic devices in achieving "great improvement" in cases of malocclusion. - There was no statistical difference in the reduction of PAR score between treatment with Invisalign and conventional fixed orthodontic appliance. - Both groups showed a reduction in the PAR score of more than 30% which indicated "great improvement". - Conventional fixed orthodontic appliances are significantly more effective than invisalign in reducing PAR scores.

Discussion

Malocclusion is a condition that deviates from normal occlusion or from a tooth's normal relationto other teeth. Class I Angle's malocclusion is easy to recognize; there are dental irregularities, including *crowding, spacing,* rotation, and crossbite (Riyanti E,2018).

Crowding is the most common malocclusion especially *crowding* on the anterior region. Crowded teeth are defined as a difference between the tooth size and jaw size, which cause the teeth into overlap position. Anterior *crowding* occurs more on the lateral incisors than the central incisors. It can occur because the central incisor erupts before the lateral incisors around age 7 and often occupies the lateral incisor position. So that at the age of 8-9 years, the lateral incisors eruption position

will be crowded (Riyanti E,2018).

Orthodontic treatment can improve facial esthetics, function, as well as the stability of the treatment outcome Good. There is 2 type of orthodontic treatment, removable orthodontic appliance and fixed orthodontic appliance (Bowman SJ,1999). Fixed orthodontic appliance is attached to the teeth by the dentist and can not be removed by the patient himself. The fixed orthodontic appliance has very high success and better treatment results (Natural MK, 2012).

The components of a fixed orthodontic appliance consist of *Brackets, Bands, Archwire, Elastics, O-Rings* and *Power Chains* (Natural MK, 2012).

1. Brackets

Fixed orthodontic appliance components attached to the teeth, which works to generate controlled pressure on the teeth.

2. Bands

A fixed orthodontic appliance made of seamless stainless steel. These are custom-fitted ring-shaped devices designed to wrap around the tooth and be cemented in place.

3. Archwire

An archwire in orthodontics conforms to the alveolar or dental arch that can be used with dental braces as a source of force in correcting irregularities in the position of the teeth.

4. Elastics

Available in various sizes and thickness. Elastics are used with braces to apply additional force to the teeth.

5. O-Rings

An elastic binder is used to attach *the archwire* to *the bracket*, which is available in a wide variety of colours and makes the bracket more attractive (Natural MK, 2012).

Fixed orthodontic indications:

1. Correction of tooth rotation
2. Correct the overjet
3. Reduction of *overbite* with tooth intrusion of incisor teeth
4. Movement of several teeth on one or both jaws
5. Open bite correction needs to be extruded
6. Correction of moderate to severe dental malocclusion
7. The patient is cooperative in achieving the result they wanted
8. Good *oral hygiene*

Fixed orthodontic contraindications:

1. The patient is uncooperative
2. Bad oral hygiene (Ke Y, 2019)

Patients with malocclusion who want orthodontic treatment but have esthetic considerations can use invisalign. In 1998, after Align Technology released invisalign, requests for invisalign increased among malocclusion patients. Invisalign is a thin plastic aligner that is transparent and invisible and can be taken out by the patient. Like splints, Invisalign covers the clinical crown to the gingival margin (L Valentina,2018). Most patients treated with invisalign have crowding anterior teeth (Millett D, 2000).

Invisalign is made of thick polyurethane 0.75 mm relief designed with *Computer Aided Design* (CAD) to become virtual models. This virtual model created a simulation of the expected tooth movement. *Computer Aided Manufacturing* (CAM) produced a series of aligners to earn desired tooth correction. Obedience to the patient is an essential factor in achieving the result wanted. The patient is instructed to wear the aligners at least 22 hours a day, and *aligners* must be replaced after using them for 7-14 days. Each a*ligner* can move teeth 0.25-0.3mm(L Valentina,2018; K Kislaya, 2018).

Invisalign indications:

1. Teeth crowding and *spacing* 1-5 mm
2. Deep overbite
3. Narrowing of the dental archskeletal
4. Mild relapse after treatment fixed orthodontics
5. Patients with permanent teeth that fully erupted
6. Cooperative patient.

Invisalign contraindications:

1. Teeth *crowding* and *spacing* more

than5mm
2. Skeletal discrepancies anterior-posterior more than 2mm
3. Discrepancies in relation centric and occlusion centric
4. Teeth rotated more than 20 degrees
5. Open bite
6. Tooth extrusion
7. Teeth with a slope of more than 45 degrees
8. Teeth with clinical crownsshort
9. have lost a lot tooth (Rahul S,2917).

The peer Assessment Rating Index (PAR)is an instrument in the form of a ruler used to determine the results of orthodontic treatment. The PAR index not only measures deviation from occlusion ideal, but also evaluate the results of quantitative orthodontic treatment by comparing the dental models before and after treatment by comparing the dental models before and after treatment (L Valentina,2018). The score PAR index is measured from several components:

1. Anterior Alignment (Upper and Lower Jaws)
For the anterior alignment on the upper and lower jaw, contact point shift measurement was performed, starting from the left canine mesial to the point mesial contact of the right canine. Evaluation scores on both these segments are for measuring crowded teeth, spacing and impacted teeth. For teeth Impacted canines are noted on the segment anterior maxilla and mandible. Following the score used; (0) for the contact point which is shifted 0-1 mm, (1) for point contacts are shifted 1.1-2 mm, (2) to contact point shifted 2.1-4 mm, (3) for contact points shifted 4.1-8 mm, (4) for a contact point that is shifted more of 8 mm and (5) for impacted teeth. The score is multiplied by one.

2. Right and Left Buccal Occlusion
In this measurement, the score is recorded inastate of occlusion of the right posterior teeth and left. Recording starts from the canines to the last molar tooth. Here's the score used; (0) good interdigitation, (2) <½ units of full interdigitation and (3) >½ units of full interdigitation. The score for occlusion buccal to the right and left multiplied by one.

3. Overjets
This score assessment is intended for all incisor teeth. Assessment is done by placing the PAR index ruler parallel to the occlusal plane and the radial arch tooth. The following scores are used; (0) for *overjet* more than 0-3 mm, (1) for *overjet* 3.1-5 mm, (2) for *overjet* 5.1-7mm, (3) for 7.1-9 mm *overjet,* and (4) for *overjet* >9 mm. The score is multiplied by six.

4. Overbite
Like *overjet,* score scoring *overbite* is also intended for all incisors teeth. Assessment is done by measuring the overlap distance in the vertical direction of maxillary incisor to length clinical crowns of lower incisors. The following scores are used; (0) teeth upper incisors cover less than 1/3 or equal to 1/3 the length of the crown of the lower tooth incisors, (1) upper incisors cover more than 1/3 but less than 2/3 lower incisor crown length, (2) upper incisors covering more than 2/3 lower incisor crown length and (3) the upper incisor teeth cover the samewith or more than the crown length lower incisor teeth. The score is multiplied by two.

5. Midlines
Midline score assessment or median line assessed from the midline of upper teeth against the midline of the lower dental arch. The line between maxillary central incisors against the midline lower incisors represents the midline of the dental arch. However, if lower incisor teeth have been removed, the assessment of the midline score is not recorded. The following scores are used; (0) noshift or shift up to ¼ width lower incisor teeth, (1) ¼-½ shift lower incisor width, and (3) displacement of more than ½ of the incisor width lower. The score is multiplied by 4 (L Valentina, 2018).

Furthermore, the results of the assessment obtained are totalled to find out the percentage improvement of treatment outcomes, and scores are calculated using the following formula:

PARscore = PART1-PART2/PART1x100

PART1 is the previous score, and PART2 is the score after orthodontic treatment. After that, the results obtained from the formula are categorized into three categories. The percentage of improvement:
The first category is the result of treatment is getting worse or no different (<30% improvement), the second category: improved (30% to 70% improvement) and the third: greatly improved (≧70% improvement) (L Valentina, 2018).

The results of research conducted by Lanteri et al. in 2018 stated that between invisalign and fixed orthodontic appliances was no statistically significant difference with consideration of variables (age, type sex, PAR index), but present a significant difference (P<0.05) between the mean PAR score before and after treatment for both groups. The overall results obtained good occlusal results,and there is no significant difference in the post-treatment score of the *invisalign* group and the *fixed orthodontic conventional* group. There was no statistically significant difference between both groups' post-treatment and *follow-up* scores (L Valentina, 2018).

Gu J et al.'s research in 2017 stating that *Invisalign* is not as effective as other treatments using a conventional fixed orthodontic appliance in achieving *"great improvement"* in treating malocclusion. Therefore, his research showed no difference in statistics on the reduction in PAR scores between treatments that use Invisalign and conventional fixed orthodontics. The Peer Assessment RatingIndex can still be used for determining the success of treatment orthodontics with invisalign and fixed appliance conventional in crowding anterior correction (L Valentina, 2018; Gu J, 2017).

CONCLUSION

Based on the PAR index score, more than 90% of patients treated with Invisalign show satisfactory treatment results but no significant difference compared to the fixed conventional orthodontics group.

Both Invisalign and fixed appliances were able to improve the malocclusion. However, Invisalign may not be as effective as fixed appliances in achieving "great improvement" in malocclusion. This study might help clinicians to determine appropriate cases for Invisalign treatment. Based on the results, further research might be necessary to compare the occlusal stability of treatment of Invisalign and fixed orthodontic appliances.

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