



GRADUATION PROJECT

Degree in Dentistry

FACTORS AFFECTING PATIENT SATISFACTION AFTER ORTHODONTIC TREATMENT

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RESUMEN

Introducción: El objetivo principal de la ortodoncia es mejorar la función y la estética dental. En el contexto actual, el tratamiento ortodóncico desempeña un papel crucial en la autoestima y la calidad de vida en general. Los alineadores transparentes (AC) y los aparatos fijos (AF) son las principales soluciones de tratamiento, cada una de las cuales ofrece ventajas e inconvenientes. La satisfacción del paciente, sobre todo en lo que respecta a la comodidad y los resultados del tratamiento, es un factor determinante del éxito de la atención, especialmente en adultos.

Objetivo: El objetivo de esta investigación fue analizar la satisfacción de los pacientes adultos que reciben tratamiento de ortodoncia con AC o AF, centrándose en su calidad de vida durante el tratamiento mediante el OHRQoL. **Métodos:** Se estableció una pregunta de investigación a medida y se realizó una revisión bibliográfica en PubMed y en la biblioteca universitaria online (Biblioteca CRAI Dulce Chacón). La búsqueda se centró en estudios que compararan la satisfacción de los pacientes con el tratamiento de ortodoncia con alineadores transparentes frente a aparatos fijos en adultos y menores mayores de 16 años. Solo se consideraron publicaciones en inglés desde 2015 hasta 2025. **Resultados:** Las investigaciones muestran consistentemente que los pacientes que utilizan alineadores transparentes informan de una mayor comodidad inicial y menores puntuaciones OHIP, especialmente en relación con el dolor y el estrés psicológico. Sin embargo, con el tiempo, ambos tipos de tratamiento muestran mejoras en la calidad de vida, y las diferencias desaparecen. **Conclusiones:** Los alineadores transparentes ofrecen ventajas significativas sobre los aparatos fijos en cuanto a comodidad, estética y reducción del dolor durante las etapas iniciales del tratamiento. Aunque ambos enfoques mejoran la calidad de vida, los pacientes pueden preferir los alineadores transparentes por su aspecto discreto y su mayor comodidad, lo que pone de manifiesto la necesidad de una ortodoncia adaptada a las necesidades individuales.

PALABRAS CLAVE

Odontología, Ortodoncia, Satisfacción, Calidad de vida, OHRQOL

ABSTRACT

Introduction: The main aim of orthodontics is to improve dental function and aesthetics. In today's context, orthodontic treatment plays a crucial role in self-esteem and overall quality of life. Transparent aligners (CA) and fixed appliances (FA) are the main treatment solutions, each offering advantages and disadvantages. Patient satisfaction, particularly with regard to comfort and treatment results, is a key determinant of successful care, especially in adults. **Objective:** The aim of this research was to analyze the satisfaction of adult patients receiving orthodontic treatment with CA or FA, focusing on their quality of life during treatment using the OHRQoL. **Methods:** A tailored research question was established and a literature review was conducted on PubMed and in the online university library (Biblioteca CRAI Dulce Chacon). The search focused on studies comparing patient satisfaction with orthodontic treatment using transparent aligners versus fixed appliances in adults and minors over the age of 16. Only English-language publications from 2015 to 2025 were considered. **Results:** Research consistently shows that patients using transparent aligners report higher initial comfort and lower OHIP scores, especially in relation to pain and psychological stress. However, over time, both types of treatment show improvements in quality of life, and the differences fade. **Conclusion:** Transparent aligners offer significant benefits over fixed appliances in terms of comfort, aesthetics and pain reduction during the initial stages of treatment. Although both approaches improve quality of life, patients may prefer clear aligners for their discreet appearance and increased comfort, highlighting the need for orthodontic care tailored to individual needs.

KEYWORDS

Dentsitry, Orthodontics, Satisfaction, Quality of Life, OHRQOL

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1. INTRODUCTION

1.1. Orthodontic treatment

1.1.1. General context of orthodontic treatment

The main aim of orthodontic treatment is to improve the patient's overall health. According to the World Health Organization (WHO), health is defined as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (1).” From this perspective, orthodontics plays a key role in promoting oral health. The WHO defines oral health as “state of the mouth, teeth and orofacial structures that enables individuals to perform essential functions such as eating, breathing and speaking, and encompasses psychosocial dimensions such as self-confidence, well-being and the ability to socialize and work without pain, discomfort and embarrassment (2).” In this sense, orthodontics aims to improve oral function and aesthetics by encompassing a range of medical interventions designed to correct malocclusions and align teeth (3). These treatments go far beyond simple functional correction, improving the appearance of smile, an essential component of the physique in modern society (4). In fact, a harmonic, well-balanced smile is frequently seen as a genuine social asset that has a significant impact on one’s self-esteem and how others see them. As a result, an increasing number of patients of all ages are pursuing orthodontic treatment to enhance their physical appearance and, in turn their quality of life, in addition to correcting functional issues (5).

1.1.2. Historical and theoretical concept

Orthodontics has been the subject of much research, initially focused on improving appliances to optimize correction. In the 1980s, epidemiological studies led to a better understanding of the prevalence of malocclusions and the effectiveness of treatment (6). In the 1990s, the introduction of randomized controlled trials marked a turning point, enabling numerous studies of orthodontic treatment to be carried out (6). At the same time, emphasis was placed on patient satisfaction, taking into account their expectations and comfort. Technological innovation has transformed the aesthetic field with the arrival of transparent aligners (Invisalign) and lingual appliances, offering greater comfort (7). Today, 3D modeling, custom-made aligners and intra-oral scanners enable more personalized, precise and rapid treatments, better meeting patients' aesthetic and functional needs.

1.1.3. The growing importance of orthodontics for quality of life

The demand for orthodontic treatment has risen sharply with the possibility of benefiting from these more comfortable, aesthetic and less restrictive treatments (8). In our modern society, the importance of appearance leads many patients to seek better dental alignment to boost their self-confidence. And the advent of social networking has only reinforced this trend. In addition, functional motivations still play a key role: through bite or jaw problems that are sources of long-term discomfort. Orthodontics improves dental function, reducing chewing problems and jaw tension, promoting better oral health and overall physical and emotional well-being (9). However self-esteem has a greater influence on quality of life than the severity of the malocclusion (10).

1.2. Patient satisfaction

1.2.1. Patient satisfaction factor

Patient satisfaction refers to an individual's perception of the quality of care received, encompassing expectations, experiences and results. It is therefore multidimensional, and is influenced by several key factors that play a determining role in their positive or negative perception of treatment:

- Comfort during treatment: orthodontic appliances are often a source of pain and discomfort, and the sensation of discomfort or, on the contrary, comfort plays a crucial role for the patient (11). Treatments such as transparent aligners, which minimize pain, could be more comfortable for patients and promote satisfaction (7).
- Aesthetic results: for many patients, improving the appearance of their smile is one of the main objectives of orthodontic treatment. Indeed, an aesthetically pleasing smile and harmonious tooth alignment boost self-confidence and contribute directly to the perception of treatment success (11).
- Practitioner communication: a professional, responsive practitioner helps to build patient confidence and enhance the overall experience by taking the time to explain treatment steps and address patient concerns (12). The relationship with the orthodontist and his team has a major impact on satisfaction (11).
- Cost of treatment: orthodontic treatment often represents a major investment, making the financial aspect a significant factor (5). Patients expect to receive a quality service commensurate with the amount invested, so the relationship between cost and results has a strong influence on final satisfaction.

- Type of treatment : Modern treatments, such as clear aligners and lingual appliances, provide discreet and aesthetic options, meeting patients' expectations for greater comfort and discretion (7,8). The choice of treatment type, when properly explained and adapted, contributes greatly to the patient's comfort.
- Treatment duration: treatments that drag on or exceed initial expectations can generate frustration in patients, affecting their perception of the experience. On the contrary, a treatment that meets deadlines or is completed more quickly than expected is often perceived positively.

1.2.2. Satisfaction as an indicator of success

In adult patients satisfaction has become a cornerstone of treatment outcome, including both the technical result of the clinician, as well as the patient centered experience that occurs during a particular treatment modality. This highlights the patient-centered nature of orthodontic treatment, where comfort and quality of life are key factors in assessing treatment satisfaction. Studies show that there is a strong association between patient satisfaction and compliance with treatment, as satisfied patients are more likely to adhere to the care plan (13). Moreover, satisfaction multiplies the chances of enduring results, since engaged and satisfied patients are more active during the retention stage, consolidating outcome stability (13). Thus, while satisfaction is subjective, it has significant implications for clinical performance of orthodontic treatment, as it plays an active role in the long-term outcomes.

1.2.3. Importance of confort during treatment

Comfort is at the heart of patient perception of treatment, making it one of the main factors influencing patient satisfaction (11). Although other elements such as aesthetic results, cost or the quality of communication with the practitioner are undeniably important, comfort is distinguished by its immediate and constant nature throughout the treatment. Unlike aesthetics, which are measured post-treatment, or cost, which is usually considered at the start, comfort is experienced each day, relentlessly reminding the patient of their treatment experience. With orthodontic care trending towards patient-centered treatment modality, identification and modulation of discomfort has become a priority. Persistent discomfort can compromise adherence to the protocol, impact the patient's mood, and decrease motivation to receive treatment. But it should be pointed that virtually all branches of orthodontics involve limits physical and psychological which match the strength of the appliance system employed. For instance, transparent aligners are considered to be more comfortable and less restrictive than fixed appliances (7). So, in a context where these discreet devices are becoming more

widespread, it becomes pertinent to question the potential impact of this evolution on the satisfaction of patients treated with fixed appliances.

1.3.Complexity and challenges

1.3.1. Patient variability

Patient satisfaction plays an essential role in orthodontics, but remains highly subjective. The patient's age and gender are two components that directly affect satisfaction: teenagers, for social reasons, attach great importance to the aesthetics of the smile, while adults tend to focus on functional aspects such as chewing or dental pain (14,15). Gender also plays a key role, influencing not only pain tolerance during treatment but also aesthetic expectations of the results (16). Initial oral health is also a variable to be taken into account, as a patient with severe problems will have different expectations to those of a patient with minor aesthetic needs. This diversity raises the question of how to manage these variables to achieve standardized, comparable results in a patient satisfaction study.

1.3.2. Subjective perception of results

Perception of results, particularly quality of life, is highly subjective. The evaluation of treatment outcomes may vary depending on personal expectations, even if they are objectively positive. Whether a patient views a therapy as successful depends on a number of factors, including the reported improvement in smile aesthetics, functioning and general quality of life. To take it into account, we need to consider the notion of Oral-Health Related Quality of Life (OHRQoL): that considers how oral health affects the person's functioning (biting, chewing, speaking), sensations of pain/discomfort, and psychological (appearance, self-esteem) as well as social well-being.

Moreover, methods and tools have been developed to more objectively measure oral health and quality of life:

- OHIP (Oral Health Impact Profile): Measures the impact of oral health on quality of life. It is a questionnaire that evaluates the physical, psychological and social consequences of orofacial problems across several dimensions (pain, discomfort, handicap, etc.). Used to assess the impact of orthodontic treatment on patients' daily lives. Several versions exist (OHIP-49, OHIP-14 for a short version) (17).

- STAI (State-Trait Anxiety Inventory): Measures anxiety at a given moment (state anxiety) and general anxiety (trait anxiety). It's a 40-item questionnaire (20 for state anxiety, 20 for trait anxiety). Particularly useful for assessing patient anxiety before and during orthodontic treatment (18).
- VAS (Visual Analog Scale): Subjective measure of a symptom (pain, discomfort, anxiety). This is a visual scale in which the patient indicates his or her feelings between two extremes (e.g.: "No pain" to "Extreme pain"). Useful for monitoring the evolution of symptoms throughout treatment (19).

2. OBJETIVE

2.1. Formulation of research question

2.1.1. General characteristics

Population: adult patients undergoing orthodontic treatment.

Intervention: orthodontic treatment with clear aligners.

Comparison: orthodontic treatment with fixed appliances.

Results: Patient satisfaction with an essential factor: oral health-related quality of life (OHRQoL) during treatment.

2.1.2. Formulation of the research question

In adult patients undergoing orthodontic treatment, to what extent do clear aligners influence patient satisfaction in terms of quality of life via OHRQoL compared with fixed appliances?

2.2. Objective

The aim of this research is to evaluate the satisfaction of the adult patient regarding orthodontic treatment: clear aligners vs fixed appliances, focusing on quality of life.

This studies wants to determine which treatment option is associated with greater patient satisfaction, focusing on quality of life during treatment measured by OHRQoL.

2.3. Hypothesis

Null hypothesis (H_0): There is no significant difference in adult patient satisfaction with OHRQoL depending on the type of orthodontic treatment: clear aligners and fixed appliances.

Alternative hypothesis (H_1): In adults undergoing orthodontic treatment, clear aligners significantly improve patient satisfaction in terms of OHRQoL compared with fixed appliances.

3. MATERIAL AND METHODS

This study wants to evaluate the factors contributing to patient satisfaction with orthodontic treatment, especially the impact of clear aligners versus fixed appliances on quality of life measured through OHRQoL.

3.1. Methodology

3.1.1. Eligibility criteria

Inclusion criteria:

- Studies comparing patient satisfaction with orthodontic treatments using clear aligners versus fixed appliances.
- Studies interesting on quality of life and OHRQoL, including emotional factors (e.g. anxiety), symptoms (e.g. pain), and functional aspects (e.g. chewing).
- Studies focusing on adult patients or including minor patients older than 16 years.
- Studies from 2015 to 2025 published in English.
- Cross-sectional studies or meta-analyses.

Exclusion criteria:

- Studies treating dental topics unrelated to orthodontics (e.g. prosthesis).
- Studies without a clear focus on orthodontic treatment.
- Research interesting on highly specific orthodontic treatments without offering a broader perspective on clear aligners and fixed appliances.
- Systematic reviews or literature reviews.

3.1.2. Information sources

A comprehensive literature review was conducted to find studies published between 2015 and 2025 that reported patient satisfaction in orthodontics. The primary focus was on the influence of clear aligners and fixed appliances on quality of life during the treatment. The search utilized multiple databases, including PubMed, and the online university library (Biblioteca CRAI "Dulce Chacón").

3.1.3. Search strategy

Combination of search terms:

To ensure a targeted search, the following combination of keywords was used:

- Satisfaction
- Clear aligners
- Fixed appliances
- Quality of life
- OHRQoL

Search equation creation:

The specific Boolean query applied across databases was: (((satisfaction) AND (clear aligners)) OR (fixed appliances)) AND (quality of life)) AND (OHRQoL)

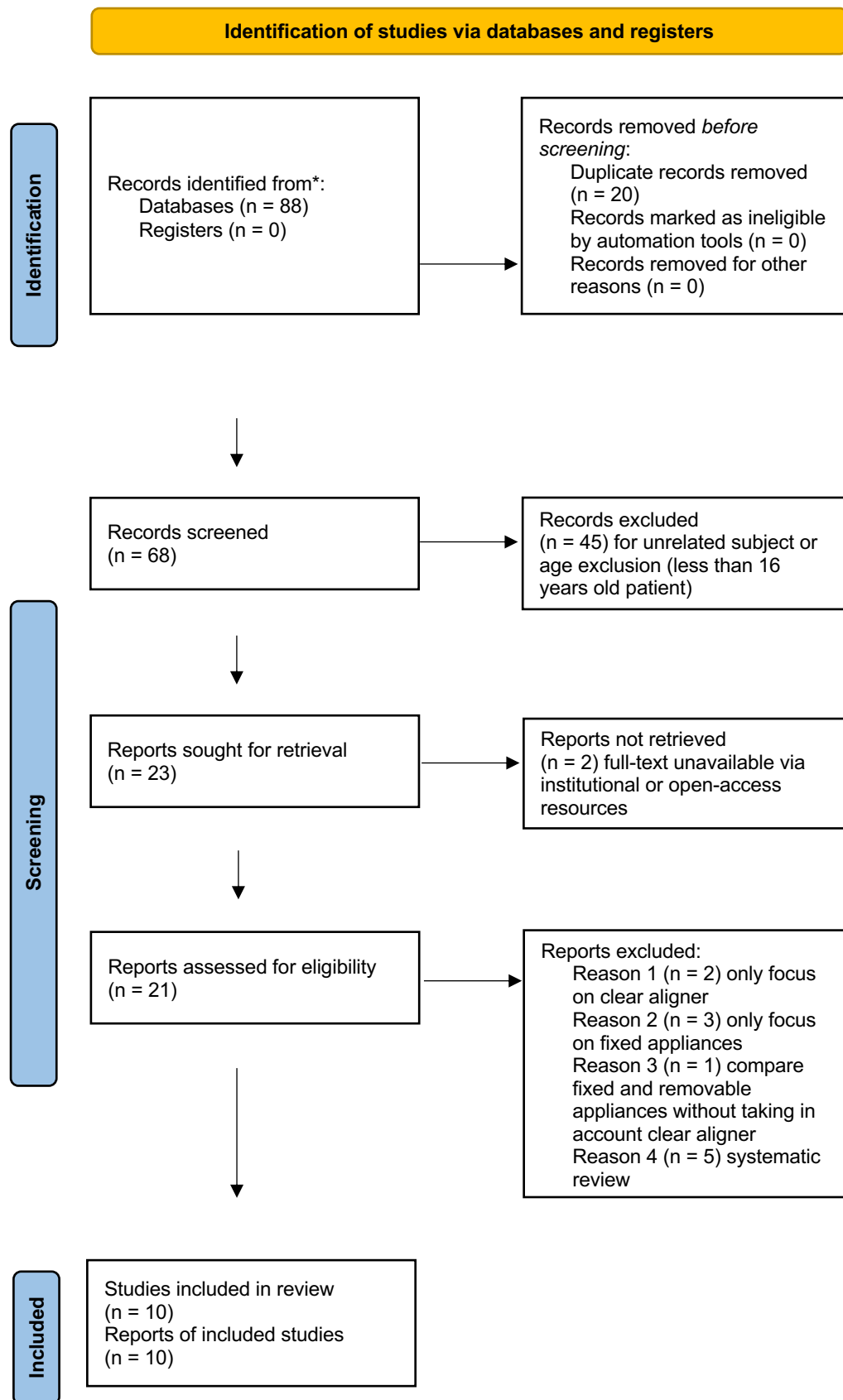
The search was limited to English language publications.

4. RESULTS

4.1. Study selection

The search results were screened for relevance based on titles and abstracts. Eligible studies were then selected for full-text review, applying the inclusion and exclusion criteria. To ensure a thorough review, reference lists of included studies were manually screened for additional relevant articles not identified during the database search.

Figure 1. PRISMA 2020 flow diagram (20).



4.2. Summary of results

This analysis is focused on 10 studies on clear aligners (CA) and fixed appliances (FA) comparison in orthodontics. These consist of 4 randomized clinical trials (RCTs), 2 prospective observational studies (cohorts), 3 cross-sectional studies and 1 observational pilot study. The studies included between 40 and 120 patients, a sample size appropriate for significant results while controlling some variables in good conditions for orthodontic studies.

Several dimensions of patient experience were assessed using standardized tools:

- Oral quality of life: mainly assessed using the OHIP-14 (Oral Health Impact Profile) questionnaire in 8 studies. This tool measures the impact of treatment on general well-being, masticatory functions and psychosocial limitations.
- Pain and discomfort: analyzed in 2 studies using the Visual Analog Scale (VAS), enabling patients to rate the intensity of their pain on a scale from 0 to 10. Measurements were taken mainly during the first days and weeks following device activation.
- Anxiety and stress: assessed in 4 studies using the STAI (State-Trait Anxiety Inventory), which distinguishes anxiety linked to specific situations (state) from anxiety linked to enduring personality traits.

Taken together, these tools make it possible to analyze the impact of orthodontic treatment on patients' quality of life, and thus on their satisfaction with their health.

Table 1. Data collection of the selected articles.

	Year, Author, Country	Study type, Sample	Intervent°/ Control Measuring tools	Results
Article 1 (21)	2023 Koralp Kozan, Ayça Arman-Özçırpıcı, Sinem İnce-Bingöl, Azize Atakan-Kocabalkan Turkey (Başkent University, Ankara)	Comparative study. 44 patients (22 in each groups), adult (>16years). Patients with malocclusion of easy to moderate severity that needs treatment in both dental arches.	Clear Aligners (CA) / LFA (Lingual Fixed Appliances). Reliable self-reported questionnaire (VAS and yes/no questions) to measure: psychosocial discomfort, physical discomfort, and treatment satisfaction.	After 1 month (T1), 3 months (T2), and 6 months (T3) Changes in mean (SD): <u>Social reaction:</u> CA T1: 0.91 ± 0.97; T2: 0.41 ± 0.67; T3: 0.50 ± 0.67 LFA T1: 3.55 ± 2.46; T2: 1.73 ± 1.28; T3: 0.86 ± 0.77 <u>Discomfort due to appearance:</u> CA T1: 0.73 ± 0.88; T2: 0.73 ± 1.08; T3: 0.32 ± 0.57 LFA T1: 4.77 ± 2.18; T2: 2.36 ± 1.40; T3: 2.09 ± 1.19 <u>Impact on social life:</u> CA T1: 1.36 ± 1.22; T2: 0.59 ± 0.73 ; T3: 0.32 ± 0.57 LFA T1: 2.91 ± 2.04 ; T2: 1.27 ± 1.12 T3: 1.27 ± 0.83 <u>Severity of pain:</u> CA T1: 2.86 ± 2.08; T2: 1.14 ± 1.28; T3: 1.00 ± 1.07 LFA T1: 3.91 ± 2.88; T2: 1.59 ± 1.53; T3: 1.82 ± 1.71 -> <i>Highly significant (p < 0.05) for all (except severity of pain).</i>
Article 2 (22)	2024 Laura Correa, Alberto Albaladejo, Adrián Curto	Pilot study, observational. 80 patients (40 in each groups), adult (>18 years). Patients with malocclusion of easy to moderate severity that needs treatment in both dental arches.	Brackets (MBT prescription stainless steel) / Aligners (Invisalign). OHIP-14 (Oral Health Impact Profile) for OHRQoL. STAI (State-Trait Anxiety Inventory) for anxiety.	At the beginning (T0) and 1 month after starting treatment (T1) OHIP-14 Mean (SD): CA: T0: 27.33 (± 6.22); T1: 27.33 (± 6.83) LFA: T0: 21.80 (±3.34); T1: 33.98 (± 6.81) -> <i>Highly significant (p < 0.01).</i> Highest factor difference: Mean (SD): <u>Functional limitation:</u> T0: 3.70 (± 1.13) ; T1: 4.61 (± 1.51) <u>Physical pain:</u> T0: 3.48 (± 1.06) ; T1: 4.85 (± 1.71) <u>Psychological discomfort:</u> T0: 3.65 (± 1.08) ; T1: 4.21 (± 1.35). <u>Physical disability:</u> T0: 3.48 (± 0.99) ; T1: 4.28 (± 1.21) <u>Psychological disability:</u> T0: 3.58 (± 1.18) ; T1: 4.58 (± 1.18) -> <i>Highly significant (p < 0.01)</i> Anxiety-Trait (T0): LFA: 28.32 (± 2.70) CA: 29.98 (± 2.66) -> <i>Highly significant (p < 0.01)</i> Anxiety-Trait (T1): LFA: 27.83 (± 2.92) CA: 29.08 (± 2.94) -> <i>Not significant (p > 0.05)</i>
Article 3 (23)	2024 Yasemin Tunca, Yesim Kaya, Murat	Randomized Controlled Trial. 60 patients (30 in each groups), adult (>18 years).	Conventional fixed orthodontic treatment (Group A) / Clear aligners (Group B).	Before treatment (T0), at the beginning (T1), after 10 days (T10) and 20 days (T20)

	Tunca, Siddik Keskin.	Patients with angle class I malocclusion and 4-6 mm arch length deviation in both dental arches.	OHIP-14 (Oral Health Impact Profile) for OHRQoL. STAI (State-Trait Anxiety Inventory) for anxiety. VAS (Visual analogue scale) for pain level.	OHIP-14 Mean (SD): FAT T1: 18.73 ± 7.75; T2: 16.50 ± 7.45; T3: 14.53 ± 7.07 CAT T1: 13.07 ± 7.32; T2: 13.10 ± 7.91; T3: 12.43 ± 9.24 -> <i>Not significant (p > 0.05) except 1st day (p = 0.049).</i> There were no significant changes in the STAI-S and STAI-T values within or between the two groups. VAS: Pain level comparaisn: Significantly higher for FAT at key time points (2 hours, 6 hours, 1st day, and 3rd day) FAT: 2 hours: 1.5 (0 – 10) 6 hours: 4 (0 – 10) 1st day: 5.5 (0 – 10) 3rd day: 3 (0 – 10) CAT: 2 hours: 0.5 (0 – 3) 6 hours: 2 (0 – 5) 1st day: 3 (0 – 6) 3rd day: 1.5 (0 – 4) -> <i>Highly significant (p < 0.01)</i>
Article 4 (24)	2021 Meiya Gao, Xinyu Yan, Rui Zhao, Yue Shan, Yiyin Chen, Fan Jian, Hu Long and Wenli Lai China (West China Hospital of Stomatology, Chengdu)	Prospective cohort study. 110 patients (55 in each grouos), adult (>18years). Patients with orthodontic treatment in both dental arches.	Clear Aligners (CA) / Fixed Appliances (FA) VAS (Visual analogue scale) for pain perception. STAI (State-Trait Anxiety Inventory) for anxiety. OHIP-14 (Oral Health Impact Profile-14) for OHRQoL.	OHIP-14 Mean difference FAT-CAT: Patients treated with clear aligners showed lower pain levels, reduced anxiety and better oral quality of life (OHRQoL) compared with those treated with fixed appliances. OHIP-14 scores were significantly higher in the fixed appliance group, particularly for functional limitations, physical pain and physical disability, on days 1, 7 and 14.
Article 5 (25)	2022 Alaa M. H. Alfawal, , Ahmad S. Burhan, Ghiath Mahmoud, Mowaffak A. Ajaj, Fehmieh R. Nawaya and Ibrahim Hanafi.	Randomized Controlled Trial (RCT) 44 patients (22 in the fixed group, 22 in the aligners group), adult (>18 years). Patients with mild to moderate malocclusion .	Clear Aligners (CA) / Fixed Appliances (FA) OHIP-14 (Oral Health Impact Profile-14) for OHRQoL.	1 week (T1), 1 month (T2), 3 months (T3), 6 months (T4) after the start of the treatment. OHIP-14 Mean (SD): CA: T1: 14.14 (3.66) T2: 9.59 (2.70) T3: 8.18 (3.17) T4: 5.27 (2.62) -> <i>Highly significant (p < 0.01)</i> FA: T1: 25.18 (4.15) T2: 15.59 (2.91) T3: 11.46 (2.63) T4: 8.59 (2.59) -> <i>Highly significant (p < 0.01)</i> High factor of difference: Physical pain Psychological discomfort Physical disability Highly significant improvements (P < 0.001), suggesting they are key drivers of overall quality-of-life enhancement.

Article 6 (26)	2024 Gabriela Luiza Nunes Souza, Esdras de Campos França, Marcelo de Araújo Lombardi, Giselle Cabral da Costa, Najara Barbosa da Rocha and Lucas Guimarães Abreu Brazil	Cross-sectional study. 61 patients (33 in the aligners group, 28 in the fixed group), adult (>18 years).	Clear aligners (CA) / Fixed appliances (FA). OHIP-14 (Oral Health Impact Profile) for OHRQoL. Poison regression: physical pain dimension score.	<u>OHIP-14 Mean (SD):</u> CA: 10.21 (8.50) FA: 14.18 (8.01) -> <i>Highly significant (p < 0.01)</i> <u>Highest factor difference: Mean change (CAT-FAT):</u> Physical pain: -1.308 Physical disability: -0.902 Psychological disability: -0.894 Psychological discomfort: -0.603 Social disability: -0.542 -> <i>Not significant (p > 0.05) except physical pain (p < 0.01)</i> <u>Poison regression: physical pain dimension score:</u> 1.39 times higher in the adjusted model and 1.48 times higher in the non adjusted model for FA vs CA.
Article 7 (27)	2025 Susie Paes da Silva, Vinay Pitchika, Uwe Baumert, Heinrich Wehrbein, Rainer Schwestka-Polly, Dieter Drescher, Jan Kühnisch, and Andrea Wichelhaus Germany	Cross-sectional, multicenter study. 900+ orthodontic patients, adult (16–61 years)	Clear aligners (CA) / Fixed appliances (FA). OHIP-14 (Oral Health Impact Profile) for OHRQoL.	<u>OHIP mean (SD):</u> CA: 9.9 (8.7) FA: 13.1 (9.5) <u>Factor affecting OHIP mean (SD):</u> functional limitation: 1.2 (1.4) physical pain: 3.1 (2.0) psychological discomfort: 2.2 (2.0) physical disability: 1.6 (1.7) psychological disability: 2.0 (1.9) social disability: 1.2 (1.7) handicap: 1.2 (1.4) total: 12.6 (9.6)
Article 8 (28)	2022 Adrián Curto, Alejandro Alvarado-Lorenzo, Alberto Albaladejo and Alfonso Alvarado-Lorenzo Spain (University of Salamanca)	Prospective observational cohort study. 120 patients, adult (>18 years). Patients with dental crowding between 2 and 6 mm.	Only Fixed appliances (FA). OHIP-14 (Oral Health Impact Profile-14) for OHRQoL. STAI (State-Trait Anxiety Inventory) for anxiety.	<u>Anxiety State:</u> 27.93 (27.41–28.46) -> <i>Highly significant (p < 0.01)</i> <u>Trait Anxiety:</u> 26.78 (26.26–27.31) -> <i>Not significant (p > 0.05)</i> <u>OHIP-14:</u> 11.93 (11.53–12.32) -> <i>Not significant (p > 0.05)</i> <u>Highest factor of OHIP-14:</u> Psychological disability: 3.20 (3.00–3.40) Functional limitation: 2.52 (2.37–2.66) Physical pain: 2.38 (2.28–2.47) Psychological discomfort: 2.34 (2.23–2.46) -> <i>Highly significant (p < 0.01)</i>
Article 9 (29)	2022 Samer T. Jaber, Mohammad Y Hajeer, Ahmad S. Burhan, Youssef Latifeh.	Randomized Controlled Trial (RCT) 36 patients (18 in each groups), adult (>18 years).	Clear aligners (CA) / Fixed appliances (FA) OHIP-14 (Oral Health Impact Profile-14) for OHRQoL.	1 week (T1), 2 weeks (T2), 1 month (T3) and 6 months (T4) after initiation treatment <u>OHIP-14 Mean (SD):</u> CA: T1: 12.94 (7.54) T2: 7.71 (5.68) T3: 5.82 (3.96) T4: 4.12 (3.18) -> <i>Highly significant (p < 0.01)</i>

	Syria (University of Damascus)			FA: T1: 22.88 (9.60) T2: 16.41 (9.27) T3: 14.12 (9.07) T4: 10.12 (6.84) -> <i>Highly significant (p < 0.01)</i> High factor of difference of OHIP-14: Functional limitation Physical pain Physical disability Highly significant improvements (P < 0.001), suggesting they are key drivers of overall quality-of-life enhancement.
Article 10 (30)	2018 Carlos Flores-Mir, Jeremy Brandelli, and Camila Pacheco-Pereira Canada (University of Alberta)	Observational cross-sectional study. 122 patients (81 in the aligners group, 41 in the fixed group), adult (>18 years).	Clear aligners (CA) / Fixed appliances (FA)	Overall Satisfaction: Both Invisalign and bracket-based treatment resulted in statistically comparable satisfaction levels across all examined dimensions. Eating and chewing satisfaction: 47% Invisalign: 100% satisfaction 24% bracket: 100% satisfaction -> <i>Significant (p < 0.05)</i> Patient Willingness to Redo Treatment: More than 90% of patients in both groups indicated they would be willing to undergo treatment again.

Table 2. Outcomes of the selected articles.

Article	Outcomes
1 (21)	Patients using fixed lingual appliances (LFA) showed a stronger social response at the outset, but more marked improvement over time, particularly at 3 and 6 months. Although LFA patients experienced more discomfort due to the appearance of the appliance, overall treatment satisfaction was very high in both groups, with similar scores at 6 months (95.5% for aligners and 86.4% for LFA).
2 (22)	The LFA group showed a greater deterioration in quality of life and an increase in discomfort after one month. However, both groups showed a deterioration in quality of life. Anxiety levels were lower in the LFA group at baseline, but the difference between the groups was no longer significant after one month.
3 (23)	A difference in OHIP-14 scores was observed on day 1, but no difference in anxiety levels or quality of life in the long term. Clear aligners showed less pain and better initial quality of life compared with fixed appliances.
4 (24)	Patients treated with clear aligners had lower levels of pain and anxiety, as well as better oral quality of life (OHRQoL) compared with those treated with fixed appliances. OHIP-14 scores were significantly higher in the fixed appliance group, particularly for functional limitations, physical pain and physical impairment, at days 1, 7 and 14.
5 (25)	The clear aligner group showed better oral quality of life (OHRQoL), less initial pain, better eating comfort, and better psychological well-being than the fixed appliance group. Treatment with aligners lasted 26% shorter and led to higher satisfaction.
6 (26)	Transparent aligners showed significantly lower OHIP-14 scores, particularly for physical pain and physical disability. The removability of aligners appears to have contributed to greater comfort and less discomfort than fixed appliances.
7 (27)	Orthodontic treatment adversely affected oral health quality of life (OHRQoL), with pain being the most significant factor. Fixed appliances caused more discomfort than clear aligners.
8 (28)	Patients treated with clear aligners showed improved oral health quality of life and lower anxiety levels compared to patients treated with fixed appliances. A strong correlation was observed between psychological impairment scores and anxiety levels.
9 (29)	Transparent aligners showed lower levels of pain and discomfort, as well as improved ability to eat compared with fixed appliances. The psychological impact was greater for patients with fixed appliances, particularly in the first months of treatment. Patients in both groups showed higher satisfaction with the aligners.
10 (30)	Satisfaction scores were similar between Invisalign and brackets. However, a significant difference was observed in satisfaction related to eating and chewing, with 47% Invisalign patients showing 100% satisfaction, compared to only 24% of brackets patients.

5. DISCUSSION

5.1. Overview of differences in oral health-related quality of life (OHRQoL)

The impact on oral health in patients with FA was significantly worse than in those using CA from the point of initiation of treatment (1 week) according to OHIP-14 score (22.88 ± 9.60 vs 12.94 ± 7.54 with CA) (29). This trend persisted in the short term (1 month), with FA patients having a greater mean OHIP-14 score (14.41 ± 9.27) than CA patients (7.71 ± 5.68) (29). In addition, patients using transparent aligners had a lower OHIP-14 score, reducing the negative impact on the psychological and functional aspects of treatment (28).

On the longer term, there is a considerable improvement in OHRQoL for both groups. Nonetheless, CA patients were still faring better. The OHIP-14 index for CA patients at six months is 5.27 ± 2.62 versus 8.59 ± 2.59 for FA patients (25). This evolution indicates that, even though clear aligners have some immediate benefits like comfort and aesthetics, fixed appliance patients adapt stepwise and have their OHRQoL improve in the long term. The initial significant impact on OHRQoL in patients with fixed appliances gradually disappears. As a result, there appears to be a more favorable experience with clear aligners at the onset of treatment compared with the initial perception of patients treated with fixed appliances. Although satisfaction questionnaires show a gradual increase in satisfaction and oral well-being in patients treated with fixed appliances over time.

Thus the impact of braces on oral health-related quality of life (OHRQoL) varies according to the type of treatment used. Overall, patients undergoing clear aligners (CA) exhibit better OHRQoL than those using fixed appliances (FA), particularly at the beginning of treatments. This discrepancy is reinforced by the OHIP-14 index assessing the effect of treatment over numerous quality-of-life aspects.

5.2. Key factors in quality of life with OHRQoL

5.2.1. Pain and discomfort

Pain is a key factor affecting patients' quality of life during orthodontic treatment, and affect directly patient satisfaction.

According to the visual analog scale (VAS), patients with FA experienced higher pain intensities at critical times: two hours after adjustment (1.5 vs. 0.5), six hours later (4 vs. 2), on the first day (5.5 vs. 3.0) and on the third day (3.0 vs. 1.5) (23). This finding is corroborated by other studies which show that fixed appliances initially cause more pain. In the same way, pain scores are

generally lower for clear aligners, particularly during the third and fourth days after adjustment, with a mean difference of 0.97 after three days and 0.59 after four days, as highlighted in a systematic review (31). Furthermore, analysis of physical pain using the OHIP-14 scale showed an unfavourable score for FA, with a 1.308 increase compared to CA, indicating a more negative impact on quality of life (26).

Although pain tends to diminish over time, and the levels experienced by the two appliances eventually converge, the initial discomfort caused by fixed appliances remains a significant concern for many patients. However, long-term effects remain unclear, with research reporting varying delays before pain subsides: three days (23), one week (25), two weeks (24), and even up to a month (22). As a result, patient who prefer optimum comfort tend to opt for clear aligners, which are considered less painful at the beginning of treatment.

5.2.2. Psychological well-being and anxiety

Psychological well-being, an important part of oral health-related quality of life (OHRQoL), includes elements such as anxiety and emotional distress. These factors play a key role in treatment satisfaction and adherence to care plans. Studies using the State-Trait Anxiety Inventory (STAI) revealed no significant differences between the two groups in anxiety levels throughout treatment (22,23). However, preliminary evaluations have shown that patients with CA had slightly higher trait anxiety scores than those with FA (29.98 ± 2.66 vs. 28.32 ± 2.70) (22). This suggests that fixed appliances, often perceived as less aesthetic, may offer reassurance due to their more established use and predictable effects. The familiarity with fixed appliances likely provides patients with a sense of security, as they are more accustomed to the results and the overall treatment process. This established understanding could help reduce initial anxiety, as patients feel more confident in the outcomes associated with these traditional devices.

From the start of treatment, psychological discomfort increased in all groups, but patients with clear aligners reported a faster improvement in self-esteem and overall psychological well-being (22). This indicates that its discreet design may provide psychological benefits, boosting self-confidence and sociability compared to fixed braces. On the other hand, although there may be a slight temporary increase in trait anxiety with clear aligners, this difference does not persist in the long term (22). Furthermore, some research suggests that individuals with clear aligners experience a reduced level of anxiety, probably due to their minimally invasive aesthetic design (26).

In sum, even without significant fluctuations in anxiety levels between different groups over time, transparent aligners appear to promote psychological well-being through their discreet appearance (22).

5.2.3. Functional limitations and eating disorders

Functional limitations, have an important impact on patients quality of life during orthodontic treatment, especially for chewing and speaking. Compared to those with fixed appliances, patients with clear aligners experience fewer eating difficulties, resulting in lower physical disability scores. Indeed, although both groups showed an increase in functional limitations at the start of treatment, those with fixed appliances showed much more pronounced negative variations (22). This suggests that transparent aligners are associated with less dietary restriction during treatment.

One of the major advantages of transparent aligners is their ability to be removed, allowing patients to remove them during meals, thus reducing eating discomfort. This allows greater dietary freedom and reduces interruptions caused by discomfort. Indeed, tray users report a much more pleasant chewing experience, with fewer interruptions during meals (25). This flexibility of the aligners directly promotes greater comfort during meals, making these moments more enjoyable.

Even if some patients with clear aligners experience speech difficulties at the beginning of treatment, these tend to diminish over time, suggesting a phase of adaptation (32). On the other hand, dietary problems experienced by those with fixed appliances tend to persist and affect their overall quality of life more severely. This discrepancy highlights the practical advantages of aligners, which promote greater eating comfort and a better quality of life by allowing freer, more varied and less restrictive diet. In terms of eating satisfaction, one study revealed that 47% of patients using Invisalign were totally satisfied with their chewing and eating experience, compared with only 24% of users of fixed appliances (30). This distinction underlines the advantage of aligners in this area.

5.2.4. Social impact and aesthetic concerns

Aesthetic considerations play a key role in the choice of orthodontic treatment, particularly in adults, who are more sensitive to the aesthetic concerns of their appliances. Research has shown that clear aligners offer significant aesthetic benefits, significantly reducing the social impact (25). On the other hand, people using fixed appliances frequently reported discomfort in social

contexts due to brackets and wires, resulting in a much more negative initial social perception (25).

The results of the study also indicate that, over time, the social impacts of the two devices becomes less marked. Thus, fixed-device users slowly acclimatized to their devices, and their impact on their social lives became more subtle.

Indeed research data indicate that users of clear aligners (CA) experience a notable improvement in social interactions over time, with a significant reduction in social discomfort. This contrasts with users of fixed appliances (FA), who show a more gradual decrease in social discomfort (21). In terms of appearance-related discomfort, CA users report less aesthetic discomfort overall, with a notable reduction as treatment progresses, while FA users report higher discomfort scores at each stage of treatment (21). Similarly, the impact on social life is less pronounced for CA users, who experience less disruption to their social interactions than FA users, who report a greater impact throughout the treatment period (21).

These results indicate that transparent aligners have a less invasive social and aesthetic impact, and enjoy greater community acceptance, notably thanks to their ability to integrate into users' daily lives through their design, making them attractive to those who prioritize aesthetics.

5.2.5. Long-term quality of life and treatment satisfaction

Studies show that variations in oral health-related quality of life (OHRQoL) become less pronounced over time, even if clear aligners initially provide a more favorable treatment experience (25,29). Indeed, after six months' follow-up, there were no statistically significant differences between the two groups in terms of treatment satisfaction. In fact, 95.5% of patients using transparent aligners and 86.4% of those wearing fixed appliances expressed satisfaction, with no relevant difference ($P > 0.05$) (21). Moreover, the results of a systematic review revealed that there was no significant variation in long-term satisfaction levels between the two groups, confirming that both treatments deliver favourable results in terms of overall satisfaction (32). Although the clear aligners showed significantly higher quality of life (QOL) scores during treatment, reflecting increased satisfaction with aesthetics and comfort, no significant difference was observed in long-term QOL improvement between the groups (25). In fact, OHIP-14 scores, which assess the influence on oral quality of life, showed a significant difference only on the first day of treatment ($p = 0.049$), but not over the long term (23). In addition, both types of treatment helped to improve patients' OHRQoL, illustrating the effectiveness of each method in enhancing this quality of life over time.

In the short term, transparent aligners were particularly appreciated by patients concerned about their comfort and appearance, due to their transparency and ease of use. However, the long-term results indicate that both clear aligners and fixed appliances succeeded in enhancing patients' quality of life, confirming the efficacy of both approaches. Overall, the data reveal that over 90% of patients in both groups would be willing to repeat treatment if necessary, illustrating a high level of satisfaction with both fixed appliances and clear aligners (30).

5.3. Alignment and divergence from previous systematic review

Research data comparing clear aligners (CA) and fixed appliances (FA) with regard to oral health-related quality of life (OHRQoL) indicate a generally positive inclination towards clear aligners, especially at the start of treatment. In our analysis, patients using clear aligners reported better quality of life, with less impact on pain and discomfort (21). These results are confirmed by our findings, which show a more rapid reduction in pain in patients with clear aligners compared with those using fixed appliances, who experience higher pain intensity on the third and fourth days after adjustment (22).

The findings of our research are consistent with previous work, which points out that those wearing clear aligners generally experience less pain and discomfort at the beginning of treatment (31–33). The idea that clear aligners provide a less invasive and more comfortable procedure is supported by several studies, which consistently report higher OHRQoL scores for clear aligner users after one week, one month and six months (31–33).

From a psychological standpoint, it appears that transparent aligners, with their discreet appearance, attenuate negative psychological effects at the start of treatment. However, there was no significant difference in general anxiety between the two treatments. Our results support those found in the literature, which reveals that transparent aligners have a positive effect on self-confidence and social interaction (31–33).

With regard to functional limitations, systematic reviews indicate that patients with fixed appliances encounter significant difficulties, particularly when eating. Conversely, clear aligners, thanks to their removability and smoother surfaces, facilitate food consumption and reduce inflammation, corroborating our findings (28,32,34).

With regard to long-term satisfaction, several systematic reviews report that transparent aligners provide a better initial quality of life than fixed appliances, particularly during the first six months of treatment. Over time, however, the quality of life of both groups converges (32). At the end of treatment, OHRQoL appears similar between the two types (34). Both treatment

approaches can generate high satisfaction, although clear aligners are generally favored at early stage of the treatment (33).

5.4. Clinical implications

The findings of this research highlight the need of a personalized approach in the selection of orthodontic appliances, combining clinical efficacy with personal patient preferences. Transparent aligners shown benefit at the beginning, offering lesser pain, greater comfort and a more discreet appearance, making them highly attractive to many patients, especially adults (25).

This preference highlights the importance of taking into account patients' expectations and lifestyles to maximize their overall satisfaction with treatment. It seems essential that practitioners integrate these factors into their device selection process.

It is also essential to inform and educate patients about the discomfort and adaptation phases associated with the use of clear aligners (CA) and fixed appliances (FA). By making them aware of the initial discomfort and duration of adaptation periods, practitioners can better manage patient expectations. Such an approach would promote better adherence to the treatment plan, reducing anxiety linked to the initial stages of treatment and guaranteeing more satisfactory results.

Finally, the results indicate that advances in fixed appliance design could alleviate the disadvantages associated with fixed appliances. Innovations such as smaller brackets or aesthetically optimized materials could reduce concerns about the comfort and appearance of fixed appliances, making them more attractive to patients requiring conventional orthodontic treatment (28).

5.5. Research limitations

The studies included in this review have several limitations that need to be considered when interpreting the results of this review. A substantial limitation is the relatively small sample size in many studies that limits the generalizability of these findings to the greater demographic of orthodontic patients. The external validity of the findings would have been enhanced and the diversity of the patients necessitating orthodontics could have been further illustrated, had larger and more varied groups been included in subsequent work. Additionally, the large majority of the studies we evaluated are based on patient report, which can result in biases from subjective nature of experiences with pain, comfort and satisfaction. So they affect the reliability of the information obtained, and lead to differences of interpretation of results, which

can weaken the strength of conclusions. More objective and standardized measures should be considered for the future to enhance the reliability of future research, , as well as more rigorous longitudinal follow-up, in order to gain a more accurate understanding of patients' experiences and more effectively capture the real impact of orthodontic treatment on their quality of life.

5.6. Future research directions

There are several lines of research that deserve special attention in order to help us better understand how orthodontic treatment affects our patients. To begin with, researching the long-term psychological effects of orthodontic treatment might furnish crucial insights into how various modalities impact the mental health and overall well-being of patients across time (33). Such knowledge would allow treatment plans to be tailored to address both physical and psychological outcomes.

In addition, it is crucial to further explore the effects of orthodontic treatment on patients' social and professional relationships. By studying how different appliances influence social perception and professional interactions, practitioners could better address patients' specific needs based on their social and professional concerns (34).

Future research should also address technological developments in conventional fixed appliance designs. New materials and designs could minimize discomfort and improve aesthetics which could enhance the psychosocial aspect of the care plan and, consequently, improve compliance with orthodontic treatment (28).

Lastly, we must also explore the effect of clear aligners on long-term oral hygiene habits and how they affect periodontal health. As increasing numbers of patients opt for aligners due to their esthetic and comfort advantages, it is important to understand their role.

6. CONCLUSIONS

Transparent aligners offer significant benefits over fixed appliances in terms of comfort, aesthetics and pain reduction during the initial stages of treatment. Although both approaches improve quality of life, patients may prefer clear aligners for their discreet appearance and increased comfort, highlighting the need for orthodontic care tailored to individual needs.

7. SUSTAINABILITY

Sustainability in orthodontics can be defined in environmental, economic and social aspects. The choice between transparent aligners and traditional brackets has implications for each. From an environmental point of view, aligners, often made from single-use plastic, raise concerns in terms of waste management, unlike metal brackets, which are more durable but require mining resources for their manufacture. From an economic point of view, aligners are a more expensive treatment option for the patient, that may limit access to care among disadvantaged populations. Lastly, the social dimension relates to patient satisfaction, psychological well-being, and quality of life. Clear aligners, touted to be more discreet and comfortable, create a better experience and style of living for patients especially in adults, which leads to higher care outcomes.. A sustainable strategy would be to favor recyclable materials for aligners, while ensuring equitable accessibility to treatments, notably via more inclusive reimbursement policies. A more systematic assessment of the environmental and social impact of each option would enable practitioners and patients to make informed choices, supporting more responsible orthodontics.

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9. ANNEXES