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REVIEW

Impact of Fixed Orthodontic Appliance Treatment on Children's Mental Health, Quality of Life and Social Context: A Scoping Review

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Purpose: There has been a consistent upward trend in orthodontic treatment across all age groups. It is one of the longest and most common medical interventions for children. There is a growing interest in the connection between orthodontic treatment and children's oral health-related quality of life to provide an insight into treatment needs and outcomes, as well as long-term improvement in oral health. However, to our knowledge the impact of fixed orthodontic appliances on the mental health of the children, their social context and their families have not been sufficiently investigated and have not yet been summarized. The objectives were to provide an overview of empirical research regarding the impact of fixed orthodontic appliances on children's mental health, social context and families.

Patients and Methods: A comprehensive literature search was conducted across four databases. Studies investigating the effects and impact of fixed appliances on mental health, social context and families of children up to the age of 18 were included. Data were extracted by two independent reviewers. The studies were reviewed, their results compared and analyzed narratively.

Results: Ultimately, 30 studies were analyzed. The most common conclusions were that oral health-related quality of life worsens during and improves again after treatment. The extent to which orthodontic treatment limits or affects children's lives, their mental health, personality, personal development and behavior has not been extensively investigated.

Conclusion: Evidence of the impact of fixed orthodontic appliances on mental health and social context of children and their families is basically missing. However, this would be crucial for the consideration of evidence-based recommendations. Therefore, the impact of fixed orthodontic appliances should be addressed in further empirical studies.

Keywords: fixed orthodontic appliances, children, mental health, social context, orthodontics, oral health-related quality of life, scoping review

Introduction

Orthodontics involves the preventive and corrective treatment of functional disorders and malocclusions of the teeth and jaws.[1] Within orthodontics, the treatment with fixed orthodontic appliances, is a regular occurrence to correct malocclusions.[2]

The Children's Dental Health Survey conducted in 2013, showed that 3%, 21% and 16% of 8-, 12- and 15-year-old British children were under orthodontic treatment.[3] Between the ages of three and seventeen, 21% of all boys and 26% of all girls undergo continuous orthodontic treatment in Germany.[4] The utilization of orthodontic services peaks among 13-year-old girls (55%) and 14-year-old boys (51%). Orthodontic treatment ranks among the longest and most common medical interventions for children, with an average treatment duration of three to four years.[5]

Over many decades, dental research was predominantly focused on clinically-oriented outcome measures.[6] However, there has been a paradigm shift towards more patient-centered orthodontic treatment and the assessment of oral health-related quality of life (OHRQoL) has become more important.[7] OHRQoL is a comprehensive concept that is significantly influenced by various factors such as mental health, social relationships and environment and it describes the effects of orofacial diseases and dental interventions as perceived by patients.[8] Studies examining OHRQoL in orthodontics are

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important to provide an insight into treatment needs and outcomes, as well as long-term improvement in oral health.[9] There is a growing interest in exploring the relationship between orthodontic treatment and OHRQoL.[7] It is already known, that there is a deterioration in OHRQoL during orthodontic treatment, particularly in the early stages of treatment.[10,11] Pain, difficulty eating, change of speech, and diet changes affect the OHRQoL during orthodontic treatment.[12] Since the concept of OHRQoL is influenced by various factors, it is conceivable that children's mental health or social relationships are also influenced by orthodontic treatment. Especially because orthodontic treatment lasts several years and mainly takes place during puberty, a time of major physiological and psychosocial changes and profound socio-emotional development.[13,14] Additionally, orthodontic appliances are foreign objects inserted into a sensitive area of the body, causing physical and psychological discomfort.[15] Patients' psychological responses to orthodontic treatment are clearly a very significant concern.

However, most studies focus on the influence of orthodontic appliances on OHRQoL and do not consider a large number of other variables related to patients' physical and psychological well-being.[16] Particularly, the impact on mental health, families and social context of children wearing fixed orthodontic appliances has been inadequately investigated and have not been comprehensively summarized. In order to gain insights into this topic and to investigating the consequences of wearing orthodontic appliances, it is essential to investigate the relationship between treatment with fixed orthodontic appliances and the mental health, social context and family of children. Therefore, this scoping review aims to provide an overview of studies investigating mental health and the role of social context on children, including their families and peers while wearing fixed orthodontic appliances and to identify areas for a future agenda.

Materials and Methods

This scoping review was conducted in accordance with the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews) guidelines and the corresponding checklist.[17] This scoping review was also conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews.

Inclusion and Exclusion Criteria and Search Strategy

At the beginning, the inclusion and exclusion criteria were defined based on the research question and the PICOS scheme. Studies investigating the effects and impact of fixed appliances on mental health, social context and families of children up to the age of 18 were included. All inclusion and exclusion criteria are outlined in Table 1.

These search terms were generated through brainstorming sessions, conducting keyword searches and analyzing MeSH terms in databases. The various search terms were assessed for applicability, revised and/or removed from the search. In this way, the search strategy was continuously refined in an iterative procedure until its final version. The final search strategies are presented in Table 2.

Screening and Study Selection

A comprehensive and specific literature search was conducted in July 2023 and February 2024 in the electronic databases MEDLINE via PubMed, Web of Science, CINAHL und BASE. The last search day was February 15, 2024. In addition, a manual search was carried out. In addition, experts in this field were contacted. Title, abstract and full text screening was performed by two independent researchers. Any conflicts that arose were resolved through discussion with a third researcher, who acted as an independent supervisor.

Data Extraction

Given the heterogeneity of the publications included regarding design and method, the screeners proceeded to extract data from the articles included using a modified version of the Cochrane Data Collection Form for Intervention Reviews: randomized controlled trials (RCTs) and non-RCTs (Version 3). This was followed by a narrative synthesis of the main findings. The studies and their results were categorized using an inductive approach. In accordance with the JBI methodology, no formal assessment of the methodological quality of the studies included was undertaken.[18]

Table 1 PICOS Scheme, Inclusion and Exclusion Criteria

PICOS	Inclusion Criteria	Exclusion Criteria
Population	• Children and/or adolescents/teenagers (≤ 18 years)	• Children/adolescents with severe jaw anomalies • Children/adolescents requiring oral surgical and orthopaedic treatment (e g congenital malformations of the face and jaws, skeletal dysgraphia, injury-related jaw malposition's) • Children/adolescents with congenital or acquired and chronic diseases (Autism, borderline)
Intervention	• Orthodontic treatment with fixed orthodontic appliances	• Removable braces/appliances (Biteplate, Invisalign, mouth guard, removable retainer, Schwarz Appliance, Separators, Spring Aligner, thumb crip, (reverse) Headgear, Herbst® Appliance, positioners, Twin Block Appliance, distal jet appliance, rapid palatal expander, Class 2 carriere appliance)
Control	• No control • No treatment with fixed orthodontic appliances • Compared to another type of appliances	
Outcome	• Impact/effect on mental health (measured before, during and after treatment) • Impact/effect on the family, parents and social context	
Setting	• Outpatient dental practice • Orthodontic practice • Dental clinic/dental Facilities	

Table 2 Search Strategies

Database	Search Strategies	Results
MEDLINE via PubMed	((“child*”) OR (“teen*”) OR (“adolesc*”) OR (“adolescent”[Mesh]) OR (“child”[Mesh])) AND ((“orthodontic*”) OR (“orthodontics”[Mesh])) AND ((“family relations”) OR (“social environment”) OR (“social behavior*”) OR (“self concept”) OR (“quality of life”) OR (“social perception”) OR (“social support”) OR (“mental health”) OR (“social environment”[Mesh]) OR (“social behavior*”[Mesh]) OR (“quality of life”[Mesh]) OR (“self concept”[Mesh]) OR (“family relations”[Mesh]) OR (“mental health”[Mesh]) OR (“Social Perception”[Mesh]) OR (“Social Perception”))	1531
Web of Science	ALL=((“child” OR “teenager” OR “adolescent”) AND (“orthodontics” OR “orthodontic appliances” OR “orthodontic treatment”) AND (“family relations” OR “social environment” OR “social behavior” OR “self concept” OR “quality of life” OR “psychological well-being” OR “social perception” OR “social support” OR “mental health” OR “Social Perception” OR “psychological well-being” OR “oral health-related quality of life” OR “oral health” OR “peer support” OR “family support”))	337
CINAHL	(“child” OR “teenager” OR “adolescent”) AND (“orthodontics” OR “orthodontic appliances” OR “orthodontic treatment”) AND (“family relations” OR “social environment” OR “social behavior” OR “self concept” OR “quality of life” OR “psychological well-being” OR “social perception” OR “social support” OR “mental health” OR “Social Perception” OR “psychological well-being” OR “oral health-related quality of life” OR “oral health” OR “peer support” OR “family support”)	234
Base	(“child” OR “teenager” OR “adolescent”) AND (“orthodontic appliances” OR “orthodontic treatment”) AND (“family relations” OR “social environment” OR “social behavior” OR “self concept” OR “quality of life” OR “psychological well-being” OR “social perception” OR “social support” OR “mental health” OR “Social Perception” OR “psychological well-being” OR “oral health-related quality of life” OR “oral health” OR “peer support” OR “family support”)	523

Results

Paper Selection

The database searches identified a total of 2625 publications. Among these, 755 duplicates were removed. Therefore, titles and abstracts of 1870 publications were screened. Based on the inclusion and exclusion criteria, full texts of 71 publications were reviewed. Of these, 26 articles were included in this review. Additionally, manual searches resulted in the inclusion of four further studies. This resulted in a total of 30 studies for the data analysis. The search and selection results are reported in the "Preferred Reporting Items for Systematic Reviews and Meta-analyses" (PRISMA) flow diagram (Figure 1).

Characteristics of the Included Studies

Study details are shown in the data extraction table (Supplementary Table 1). The studies were published between 1994 and 2023 and included a total of 7.834 patients aged 11–18 years. Further study characteristics are shown in Table 3.

Study Objectives, Outcome-Parameters and Assessments

The majority of the publications investigated the impact, or effects caused by fixed orthodontic appliance treatment on OHRQoL[6,19–32] or overall quality of life.[32–36] Some studies explored children's perspectives of fixed orthodontic

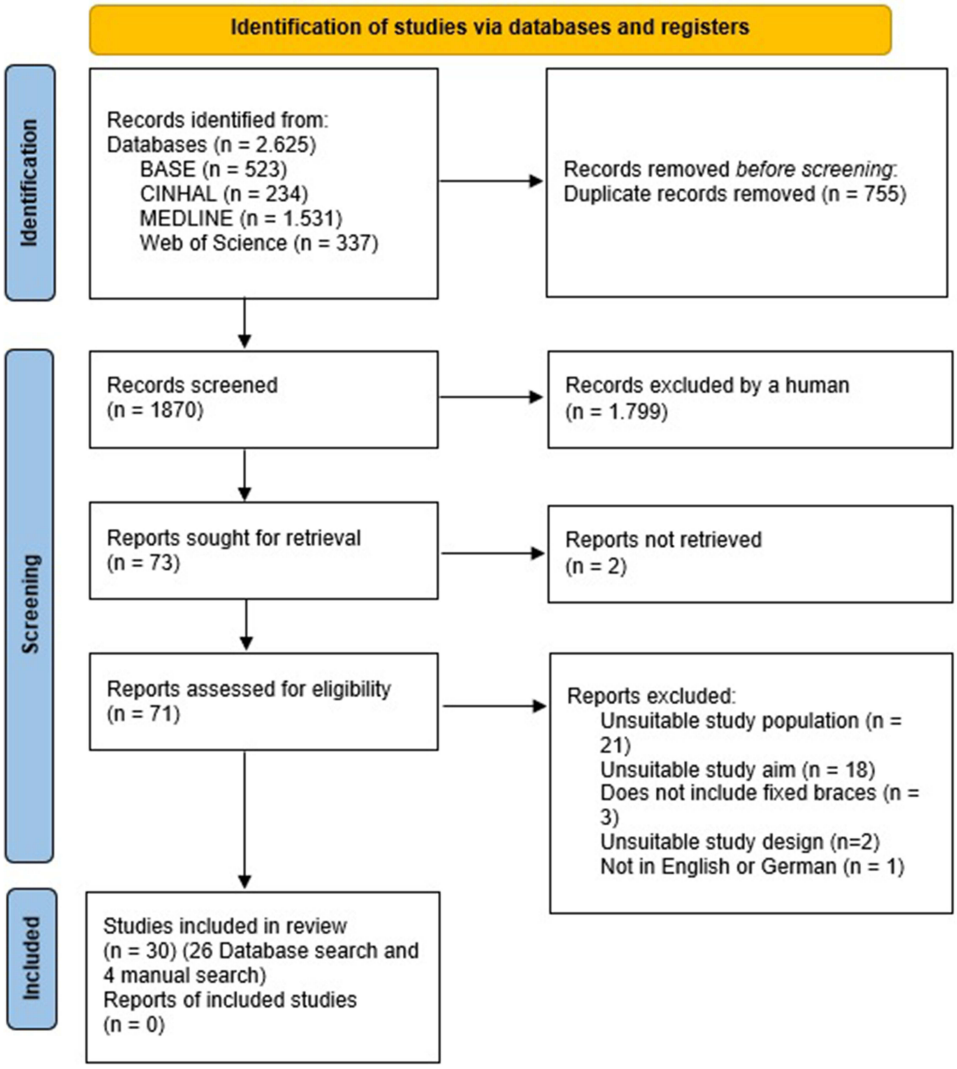

Figure 1 PRISMA Flow Diagram.

Table 3 Study Characteristics

Country	N*	Study Design	N*
Belgium	1	(observational) prospective cohort studies	9
Brazil	11	Population-based case-control study	1
Canada	1	Prospective studies	3
China	4	Follow-up study	1
Germany	1	Qualitative studies qualitative studies	3
India	2	(prospective) (controlled) longitudinal studies	6
Iran	1	Cross-sectional studies	5
Mexico	1	Descriptive study	1
Pakistan	1	Controlled randomized study	1
United Kingdom	6		
United States	1		

Note: *Quantity.

appliances treatment.[37–39] Two studies examined the relationship between pain and OHRQoL.[36,40] Other studies investigated the intensity and extent of impairment of daily life.[41,42] One study assessed the effect of orthodontic appliances treatment on the families of adolescents.[21,28,35] To measure the achievement of the study objectives, various assessments were used. All assessments relevant to the research question are presented in Supplementary Table 2.

Impact of Orthodontic Appliances on Children's Oral Health-Related Quality of Life

One of the most common findings was that children with fixed orthodontic appliances had a greater chance of displaying negative impact on OHRQoL than those in the control or waiting group.[23,25–29] More concretely, the results showed more frequent impact on the functional limitation, emotional well-being and social well-being of children wearing orthodontic appliances compared to those not undergoing treatment. OHRQoL is reported to be worse during treatment[22,23,25,27–33,38] which may suggest that treatment has an impact on oral health and affects the (oral health-related) quality of life.[6,16,19,24,27,30,43]

During the course of treatment, the most significant changes in OHRQoL appear within the first month of treatment.[22,24,27] During the initial phase of treatment, the level of OHRQoL usually decreased.[27,38] OHRQoL could gradually improve during treatment.[25,30,34,36,37] An improvement in OHRQoL after patients completed treatment, compared to the time (before or) during treatment was also demonstrated.[6,19,20,24,25]

Study results suggest that patients who had orthodontic appliance treatment had better OHRQoL at the follow-up compared to the control group.[25,26,32]

In terms of OHRQoL, pain was the most frequently reported impact on life as a result of orthodontic appliance treatment.[6,23–25,31,38,39,41,42] There was a significant correlation between pain and quality of life.[38,42] Patients reported moderate to severe pain[42] and increased pain within the first week after insertion,[24] followed by a gradual decrease.[31,35,44] An increase in oral symptoms and functional limitations during treatment was also found.[27,31,38] Marques et al[16] and Abreu et al[37] found no significant changes in oral symptoms and functional limitations.

Further influencing factors were: (psychological) discomfort, trauma, feeling of oral constraint, mouth sores, ulceration, shyness, anxiety, embarrassment, difficulty in relaxing, physical disability, impaired speaking, swallowing, difficulty biting and smiling.[22–25,27,35,38,41–44]

Impact of Orthodontic Appliances on Children's Mental Health

An improvement in emotional and social well-being in the first month of treatment as well as 6 and 12 months after placement was identified.[34,37] An improvement during and after treatment was also found.[22,27] There was also an improvement in self-confidence, self-esteem and social interactions.[40] They felt more comfortable, though less about their teeth, and were more confident when they smiled. Adolescents report improvements in dental self-confidence, dental appearance and a greater reduction in esthetic concerns.[33]

In contrast, children also reported a lack of confidence in public[24,44] and experienced anxiety and embarrassment[38] due to their fixed orthodontic appliance. Social well-being domains and self-esteem deteriorate during treatment.[20,32] Deng et al[33] reported no benefit of general psychological well-being after treatment and observed no significant pre-treatment to posttreatment change in patients' self-esteem and body image. Corradi-Dias et al[45] identified the most negative repercussions in the domains of physical impact and social impact during 6 months of fixed appliance treatment.

Impact of Orthodontic Appliance Treatment on the Social Context and Family

One study investigated the effect of orthodontic appliance treatment on the families.[21] The results show an improvement in the overall QoL of families during treatment. Significant differences were observed compared to the control group over the study period in parental/family activity, parental emotions and the overall Family Impact Scale. The results showed a highly beneficial effect of orthodontic appliance treatment on the families of adolescents, with the families' overall quality of life improving.

Discussion

Principal Findings

This scoping review provides a comprehensive overview of the impact of orthodontic appliance treatment on children's mental health, their families and social context. Most studies investigated the impact of orthodontic appliance treatment on OHRQoL. The prevailing findings indicated a deterioration in OHRQoL during treatment and an improved OHRQoL following treatment.

Some studies reported an improvement in emotional well-being during treatment.[19,22,27,30,35] One reason might be that orthodontic appliances become increasingly popular, are more widely accepted and society, especially peer groups, become accustomed to such appliances and adolescents feel more comfortable with their oral functions, resulting in rapid adaptation.[19,23,27,35,39,41,45,46]

However, study results on the social acceptance of fixed appliances vary. Patel et al[47] found that children do not make social judgements about other children purely on the basis of wearing a fixed orthodontic appliance. Another study showed, that some children were often teased and annoyed because of their appliance.[48]

In addition, some teens were aware of and prepared for the pain and discomfort of the appliances prior to treatment, due to instructions by the orthodontist.[30,36,39] In addition, the sensation of pain decreases as patients become accustomed to the pain and discomfort as the treatment progresses, as the sensations either disappear or are no longer the focus of attention.[16,31,35,39] However, as the largest changes in OHRQoL occur in the first month of treatment[22,23,42,44] longitudinal studies should investigate the impact of orthodontic appliances up until months or years after treatment has ended. Given that self-consciousness and embarrassment were still reported six months after orthodontic appliance insertion, it is suggested that this could indicate long-term psycho-social effects of orthodontic treatment.[24]

Some factors that have a negative impact on OHRQoL and especially on mental health might impact the emotional and social well-being of children.[22,23,26,29] They reported embarrassment, self-consciousness and a lack of confidence due to their appliances.[24] Self-confidence can be affected by the visibility of appliances, especially in social situations where attention is focused on the face and mouth.[44] This might be as a result of them considering themselves less attractive.[46]

In contrast, another study was able to show that the appearance of fixed appliances was not a concern.[39]

It is conceivable that there may have been a change in perception of the appearance over time. Longstaff et al[39] discovered that fixed appliances were described as a categorical measure of growing up.

However, the extent to which orthodontic appliance treatment and its impact on social and emotional well-being limits or affects children's lives, mental health, families, and behavior has not been extensively investigated. Particularly the impact on personality and personal development has not been investigated. Furthermore, it has not been investigated whether functional and socio-emotional limitations have long-term consequences or represent traumatic experiences for children. Especially when it is taken into account that orthodontic appliances are foreign objects inserted into a sensitive area of the body. Additionally, treatment lasts for several years and usually takes place during puberty,[49] a time of great

physiological and psychosocial change and a period of profound socio-emotional development.[20,32,49] Also considering that the perception of facial aesthetics influences psychological development from early childhood to adulthood.[50]

Only one study explored the impact of orthodontic appliance treatment on the family.[21] Orthodontic appliance treatment improved the families' quality of life, mostly within parental activities and parental emotions. Another study showed similar results and demonstrated that a reduction of an increased overjet by orthodontic treatment caused changes in the family overall, mainly by reducing the emotional pressures faced by parents.[51] In comparison, one publication suggested a negative impact of orthodontic appliance treatment on family's routines.[52] Given that only one study investigated the impact of orthodontic appliance treatment on the family, it can be assumed that additional data would be required before comprehensive statements could be made.

Interestingly, the impact of treatment costs on families was not addressed in any study, although the costs of dental treatment are considerably high[53] and treatment is associated with financial pressure.[5] Lower uptake of orthodontic treatment among patients with lower socio-economic status could be due to financial constraints.[54] Children who did not have supplemental insurance were less likely to receive orthodontic treatment.[49] It was also shown that children with low annual family income were less likely to receive orthodontic treatment. There is evidence that children and adolescents who are socially disadvantaged have a higher rate of untreated malocclusion, resulting in a significant burden on oral health.[55] However, studies have shown that lower socioeconomic group is associated with orthodontic treatment needs.[56] Utilization of orthodontic treatment appeared therefore to be largely inequitable Especially when it is taken into account that full reimbursement by health insurance companies may also be a disadvantage, and that overuse of specific groups has been discussed for some time in Germany.[1] It is therefore important to investigate the overuse and underuse of certain groups in further studies.

Limitations of the Included Studies

Only one study used a randomized controlled study design.[57] Mostly randomization was not used, because it is considered unethical to withhold orthodontic treatment from children who need or desire it.[19,22,31,36]

The study results reinforce this by showing that children in the waiting/control groups often drop out and/or switch to the treatment group. In addition, the quality of life for children in the waiting group is usually lower than that of children who have already undergone treatment.[6,25]

The results regarding psychological factors and factors influencing OHRQoL are limited to the subscales and items of the assessments. Additional factors can therefore not be collected and important aspects may be missing. Various assessments were used to measure the achievement of the study objectives, with the CPQ 11–14 and the Oral Health Impact Profile (OHIP-14) being the most widely used. However, using different assessments and self-generated assessments makes it difficult to compare study results.

Further studies with larger sample sizes, a randomized design and longer follow-up periods are required to validate these findings and increase understanding of how orthodontic appliances influences patients OHRQoL, mental health and family. Future studies should also employ other methodological approaches, such as qualitative research to ensure more in-depth and broader insights into the topic. Research topics in the field of clinical decision-making and patient care cannot be adequately understood through quantitative research alone.[58]

Implication for Practice

Due to the temporary increased risk of negative effects on OHRQoL during treatment, it is important to closely monitor self-perception, mental health, behavior and changes in social behavior during treatment.[24] By recognizing that children can experience psychosocial changes when wearing fixed orthodontic appliances, orthodontists can develop appropriate strategies to improve collaboration with patients and ensure successful treatment. Both patients and their families should be informed about the possible side-effects, including the most common impacts on daily life[6,23,30] to provide them with more realistic expectations about the treatment outcomes and possible experiences during treatment.[31,38]

Implications for Future Research

Future studies should investigate the extent to which orthodontic appliance treatment and its impact on social and emotional well-being limits or affects children's lives, mental health, families, and behavior. This can be done using

specific questionnaires and even more detailed qualitative studies. Future studies could also examine the perspectives of patients with different cultural backgrounds, as it is already known that the perception of quality of life depends on the culture of the individual, and therefore the effects of wearing an orthodontic appliance can certainly differ from country to country.[23] In addition, a different degree of malocclusion and type of appliance (eg, fixed and removable appliances or clear aligners compared to conventional fixed metal orthodontic appliances) and their influence on children's mental health, social context and families should be considered and compared in further studies.

Limitations

Because the quality, generalization and study characteristics such as the study population and design were heterogeneous, the comparability of this study's results are limited and therefore a narrative synthesis was given rather than a meta-analysis.

Conclusions

To our knowledge, this study is the first to summarize the effects of fixed orthodontic appliances treatment on the mental health of children, their social context and their families. However, the extent to which orthodontic appliance treatment and its impact on social and emotional well-being limits or affects children's lives, mental health, families, and behavior has not been extensively investigated. Results from trials with larger sample sizes, randomized designs, and longer follow-up periods, as well as qualitative research with comprehensive and in-depth data collection and analysis, would provide sufficient information on the influence of orthodontic appliances treatment to help provide patients with comprehensive information. Evidence of the impact of orthodontic appliance treatment on mental health and social context is crucial for deriving evidence-based recommendations. Therefore, the impact of fixed orthodontic appliances should be addressed in further empirical studies.

Data Sharing Statement

All data generated or analysed during this study are included in this published article and its supplementary information files.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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