

Review Article

Shortened Dental Arch Concept and Its Effect on Oral Health-Related Quality of Life

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Abstract

Purpose: This review aimed to synthesize knowledge from the dental literature regarding the effects of the shortened dental arch (SDA) concept on patients' oral health-related quality of life (OHRQoL). **Materials and Methods:** A comprehensive search of English-language, peer-reviewed literature on the SDA was conducted using the Medline (PubMed), Embase (OVID), Scopus, and Google Scholar databases. Studies that evaluated oral health-related quality of life as an outcome were critically appraised.

Results: The literature reviewed indicates that patients with SDAs do not exhibit a statistically significant difference in overall OHRQoL scores compared to other study groups. **Conclusion:** When determining the most appropriate prosthodontic treatment for partially edentulous patients, it is essential to consider patient expectations and preferences. A fully rehabilitated dental arch does not always guarantee a successful outcome. Modern treatment approaches should prioritize function, patient satisfaction, and overall well-being rather than solely focusing on complete dentition restoration. The SDA concept offers significant advantages and may serve as a viable alternative to reduce the need for extensive restorative treatment in the posterior regions of the mouth.

Keywords

Shortened Dental Arch (SDA), Oral Health-Related Quality of Life (OHRQoL), Oral Rehabilitation, Patient-Centered Care, Functional Occlusion

1. Introduction

The loss of permanent teeth can occur due to either extractions performed by oral health care providers or the progression of oral diseases. In cases of dental caries, dentition may deteriorate as infected residual roots exfoliate. Similarly, periodontal diseases can lead to the complete loss of periodontal attachment, resulting in tooth loss. Historically, tooth extraction was the primary solution for dental ailments, particularly from the mid-1920s through the mid-20th century [1].

The advent of the baby boom generation ushered in revolutionary changes in dentistry. Two pivotal developments—the discovery of fluoride's impact on dental caries

and the invention of Borden's air rotor—transformed dental health practices. Fluoride was integrated into drinking water during this period, and dental offices became more patient-friendly [2-4]. These advancements improved the prospects of maintaining natural dentition into old age [5, 6]. However, despite these strides, achieving full dentition in old age remains an unfulfilled goal [2].

The primary aim of oral healthcare is the preservation of a natural, healthy, and functional dentition. Adult dentition undergoes continuous physiological and pathological changes throughout life [7]. Without preventive and restorative inter-

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ventions, these changes—exacerbated by an aging population—can culminate in partial or complete tooth loss, with subsequent oral functional deterioration [8-11].

Tooth number first emerged as a health metric during World War II, when the Armed Services identified a minimum number of occluding teeth necessary for effective chewing in combat. This threshold—20 natural teeth or a prosthetic equivalent—was widely cited as the standard for functional dentition [12]. For decades, achieving a full dentition was considered essential for optimal masticatory function. However, this notion was challenged by several authors, who critiqued the over-prescription of removable prostheses. Levi's 1974 editorial famously coined the term "28-tooth syndrome," criticizing the prevailing belief that complete dentition restoration was necessary [13-17].

The concept of functional dentition evolved in 1981, when Kayser observed that shortened dental arches [SDAs] with at least four occlusal units could provide sufficient functionality. This marked a paradigm shift, suggesting that dentists could consider alternative approaches to free-end partial dentures [13, 18, 19]. In 1982, the World Health Organization adopted 20 teeth as an oral health goal for developing countries, advocating for the retention of functional, aesthetic dentition of no less than 20 teeth [20]. This shifted the focus from replacing missing teeth to conserving functional dental arches, as over-prescription of prostheses often resulted in oral pathology [21-26].

From a public health perspective, the SDA approach offers significant advantages, especially in resource-limited settings. By prioritizing the preservation of functional arches over complete dental arches, treatment becomes less complex, less time-consuming, and more cost-effective [27-29]. Health systems can shift from curative interventions to preventive care, focusing on maintaining the remaining dentition [30].

While the SDA concept has faced criticism, with concerns about its association with conditions like TMD, malnutrition, and occlusal imbalances, evidence supporting these claims remains weak [31-38]. Current trends in oral healthcare emphasize functional occlusion and patient-centered, problem-oriented approaches, particularly for aging and vulnerable populations. The focus has shifted to improving function, satisfaction, and overall well-being without unnecessary or risky interventions.

Although the SDA concept is widely accepted among dental professionals and supported by a substantial body of observational evidence, it is not yet universally practiced [39-41]. Patient values and preferences play a crucial role in determining treatment pathways. Decisions about whether and how to manage a patient with an SDA should consider the patient's perception of the treatment's advantages and disadvantages. The concept of Shortened Dental Arches (SDA) has gained increasing relevance in the field of dental rehabilitation, particularly when comparing it to more traditional approaches that rely on full-arch implant placement. In patients with advanced oral bone loss, the availability of suffi-

cient bone volume often limits the possibility of placing the conventional eight implants typically required for a full arch rehabilitation. In such cases, the SDA approach offers a viable alternative, utilizing fewer implants to support a functional, limited dentition. According to some authors, as few as three implants can be sufficient to restore basic functionality and aesthetics, reducing the complexity and cost of treatment while still achieving satisfactory results. This approach is particularly beneficial for patients who may not be candidates for extensive implant surgeries due to bone deficiency or other health concerns. By focusing on functional occlusion and optimizing remaining natural teeth, SDA allows for a more conservative and less invasive solution, demonstrating a shift toward personalized treatment strategies that prioritize patient comfort and long-term oral health. [15, 18, 34, 42-44].

This review aims to synthesize the available knowledge on the impact of the shortened dental arch (SDA) concept on patients' oral health-related quality of life (OHRQoL).

2. Materials and Methods

This systematic review of the literature was conducted and reported following the quality standards outlined in the PRISMA 2021 checklist [45].

2.1. Search Strategy

A comprehensive search of English-language peer-reviewed literature on the shortened dental arch (SDA) was performed using databases including Medline (PUBMED), Embase (OVID), Scopus, the University of Sydney's full-text journals, and Google Scholar. The search was restricted to articles published between January 1974 and August 2022. The search terms included "Shortened Dental Arch," "SDA," "OHRQoL," "oral health-related quality of life," and "functional occlusion." Additionally, the reference lists of relevant articles were reviewed to identify other potentially eligible studies.

2.2. Eligibility Criteria

For the purpose of this review, SDA was defined as a partially dentate arch with premolar occlusion (either natural or restored using PFPs or implant supported PFPs) and no molars in at least one quadrant, with all anterior teeth intact or restored. The inclusion criteria were limited to randomized controlled trials (RCTs) and non-RCTs. Other study designs, such as case-control, cross-sectional, cohort studies, case series, case reports, analytical reviews, and narrative reviews, were excluded except when used as supporting literature to contextualize the review.

2.3. Outcome Measure

The primary outcome measure was Oral Health-Related

Quality of Life (OHRQoL), a multidimensional construct reflecting factors such as comfort during eating and sleeping, social interactions, self-esteem, and satisfaction with oral health [46]. Studies that assessed OHRQoL using validated tools such as the Oral Health Impact Profile (OHIP), the Oral Impacts on Daily Performance (OIDP), or similar validated questionnaires were included in this review.

Oral Health-Related Quality of Life [OHRQoL]

The relationship between health and quality of life has been widely discussed in medical literature for decades. Notably, poor health or the presence of disease does not necessarily equate to a poor quality of life [47]. By the late 1990s and early 2000s, this concept began to gain prominence in dental literature, leading to the development of various tools to measure oral health-related quality of life (OHRQoL) [20, 47-52].

Those who review the literature on dental health-related quality of life will recognize the diversity of approaches, definitions (both objective and subjective), and methods of

operationalizing and measuring this concept. Among the tools developed, the Oral Health Impact Profile (OHIP) and the Oral Impact on Daily Performance (OIDP) are particularly noteworthy.

The OHIP is a questionnaire designed to measure individuals' perceptions of the social impacts of oral disorders on their well-being. In 1997, Slade introduced a shortened version called the OHIP-14, comprising 14 questions, which has demonstrated reliability, validity, and precision [48, 49].

The OIDP is another validated tool for assessing OHRQoL, focusing on the impact and extent to which oral health may compromise an individual's daily activities. It is often used to inform oral health service planning [49, 50].

Given the variability in methods for measuring OHRQoL, conducting a meta-analysis may not be appropriate. However, the diverse approaches provide invaluable insights that contribute to a more comprehensive understanding of this multifaceted concept.

2.4. Selection of Studies

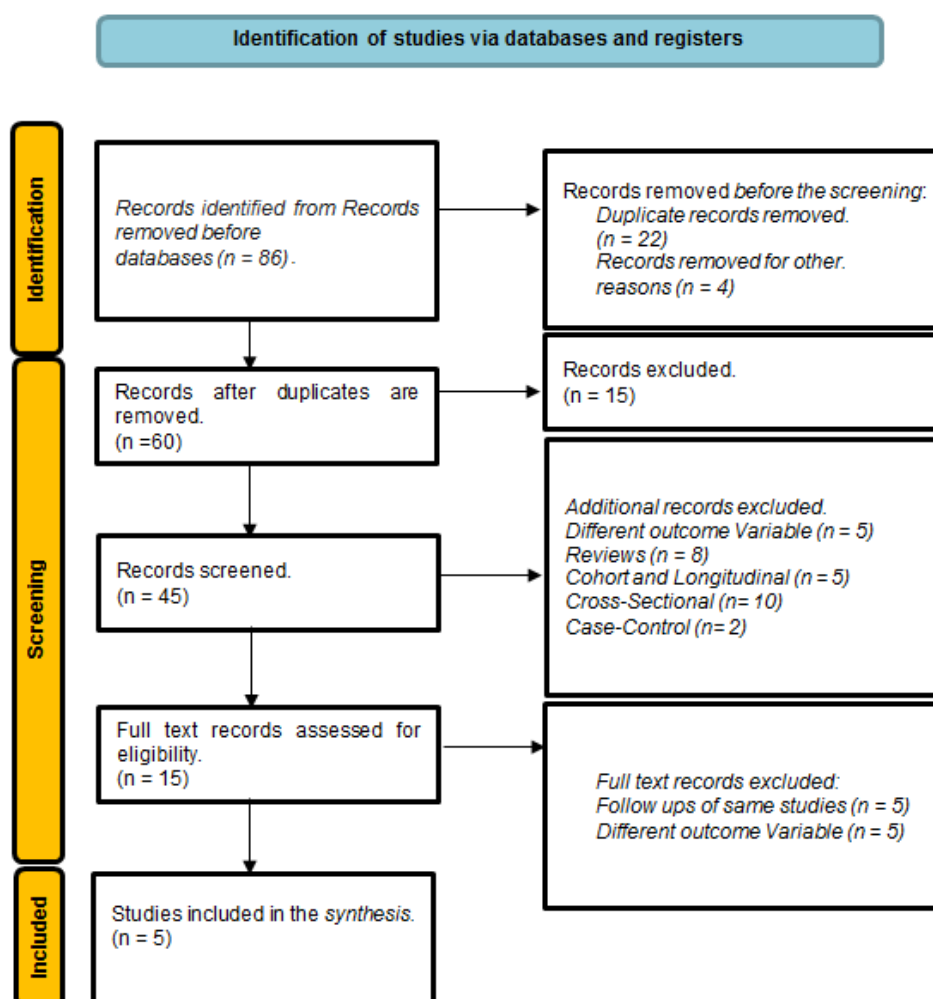


Figure 1. Presents a flowchart of the study process [45].

The review process consisted of four systematic phases. In the identification phase, reports were retrieved based on the outlined methodology, and duplicate records were removed. During the screening phases, titles and abstracts were carefully reviewed for relevance, excluding articles that mentioned the shortened dental arch (SDA) but were not scientific studies. Finally, in the eligibility phase, each full-text article was thoroughly evaluated to ensure it met the selection criteria for inclusion in this review.

3. Results

The search identified 86 articles, with 22 duplicates and four additional articles removed due to the lack of full-text availability online.

After the initial screening phases, 45 articles were considered potential candidates for inclusion. At the abstract screening stage, five articles were excluded for measuring different outcome variables, eight literature reviews were removed, and ten cross-sectional studies, five cohort/longitudinal studies, and two case-control studies were also excluded. During full-text assessment, five more articles were removed: five articles were reports of the same study from different observation points, and five studies measured different outcome variables that were not identifiable from the abstract. This left five studies

(RCTs/NRCTs) included in this review.

3.1. Risk of Bias

Among the five studies selected, one was a non-randomized trial. The studies included were conducted in Japan [53], Germany [54], the UK [56, 57], and South Africa [58]. Participant recruitment in all studies was based on convenience sampling, with the exception of the Japanese study, which did not randomise participant allocation, thereby presenting a higher risk of sampling bias. Due to the nature of the interventions, blinding of either the dentists or patients was not feasible in any of the studies.

As the questionnaires used in each study were self-administered by patients, the risk of outcome assessment bias was considered low. Longer-duration studies provided detailed accounts of patient dropout rates and their impact on the final analysis. Studies by Schierz et al. and McKenna et al. had multiple publications reporting results from different observation times of the same cohort, contributing to more reliable findings [56, 59-62]. Overall, the selected studies provided clear descriptions of their methodology and the interpretation of their results.

Table 1. Presents a visual representation of the risk of bias in each selected study.

Study	Schierz et al. 2001	Khan et al. 2017	McKenna et al. 2018	Fueki et al. 2015	Jepson et al. 2003
Random Sequence generation	Low	Low	Low	High	Low
Allocation concealment	Unclear	Low	Low	High	High
Blinding of participants and personnel	High	Unclear	Unclear	High	High
Blinding of outcome assessment	Unclear	Low	Low	Low	Low
Incomplete outcome data addressed	Low	Low	Unclear	Low	Unclear
Selective reporting	Low	Low	Low	Low	Unclear
Other source of bias	Unclear	Unclear	Unclear	Unclear	Unclear

3.2. Characteristics of the Studies

The study participants were recruited from dental university hospitals. All studies used Oral Health-Related Quality of Life (OHQoL) as the primary outcome, though different instruments were employed to measure it.

The majority of participants in these studies were women, with Schierz et al. (2021) [54] and McKenna et al. (2018) [56] presenting a more balanced gender distribution (46% males

and 54% females, and 45% males and 55% females, respectively).

Each study compared groups with Shortened Dental Arches [SDAs] to another group that received restorative treatments. In Schierz et al. [2021], both groups received treatment; the SDA group received a cantilevered premolar when the patient lacked an SDA with second premolars, while the PRDP group was treated with a denture retained by precision attachments. In Jepson et al. [2003], the SDA group was restored with a partial fixed denture [PFD] up to the first premolar and

compared to a group restored with a partial removable denture prosthesis [PRDP]. The other studies compared natural teeth SDAs with SDAs restored using PRDPs. Jepson et al. [2003]

reported the lowest dropout rate, with a 12-month follow-up peri.

Table 2. presents the characteristics of the included studies. [63].

Study	Schierz et al. 2001	Khan et al. 2017	Mckenna et al. 2018	Fueki et al. 2015	Jepson et al. 2003
Study design	RCT	RCT	RCT	NRCT	RCT
Sample	150	50	132	169	60
SDA Group	SDA (PFP)	SDA	SDA	SDA	SDA (PFP)
n	71	25	67	70	30
Treatment Group	SDA+PRDP+PA	SDA+PRDP	SDA+PRDP	SDA+pRDp+I	SDA+PRDP
n	79	25	65	99	30
Final follow up	79	16	89	89	30
Follow up (months)	180	12	24	12	12
Setting	UD Hospital	UD Hospital	UD Hospital	UD Hospital	UD Hospital
Male/Female %	46/54	22/78	45/55	28/72	42/58
Mean age at entry	59	55	74	63	67
OHRQoL Instrument	OHIP	OIDP+VAS	OHIP	OHIP	V. Questionnaire
Drop out %	47.3	32	32.6	47.3	20
Country	Germany	South Africa	United Kingdom	Japan	United Kingdom
Result	No difference P>0.05	Difference P<0.05	No difference P>0.05	No difference P>0.05	No difference P>0.05

PA: Precision attachment; I: implant-retained; UD: University dental; V: Validated; VAS: Visual analogue scale

4. Discussion

Historically, oral health has been defined simply as the absence of disease, but this narrow view fails to account for the diverse factors that influence an individual's overall health and well-being. More recent definitions of oral health have shifted towards a more comprehensive understanding, recognizing the interconnections between physiological, social, and psychological factors that shape a person's quality of life [QOL] [FDI, 2016] [64]. This updated definition reflects the growing importance of a holistic approach to dental care, where patient-centered outcomes such as function, satisfaction, and overall well-being are prioritized. It is essential that dental practitioners focus not only on restoring function but also on enhancing patients' subjective experiences and quality of life, especially in aging populations where conventional treatment approaches may not always be appropriate.

The concept of Oral Health-Related Quality of Life [OHRQoL] has been widely used in dentistry to measure the effectiveness of dental interventions. OHRQoL evaluates the

impact of oral health on a person's daily activities, emotional well-being, and social interactions [Cushing et al., 2021] [65, 66]. Studies have shown that OHRQoL is a sensitive and valuable tool in assessing treatment outcomes, especially in cases involving partially dentate individuals and different prosthetic options.

For example, Jepson et al. [2003] explored the outcomes of shortened dental arch [SDA] treatments in a randomized controlled trial [RCT]. They found improvements in patient satisfaction following both SDA and partial denture treatments, though no significant differences were noted between the two groups, possibly due to a small sample size [58]. However, the results suggest that either intervention can lead to an improvement in OHRQoL, supporting the notion that SDA, even without complex prosthetic interventions, can be a viable treatment option.

Similarly, Fueki et al. [2015] conducted an RCT in Japan that compared various treatments, including SDA, and found that patients in the SDA group had better baseline OHRQoL scores. This could be attributed to the patients' ability to adapt to their condition over time, an important factor to consider when evaluating treatment outcomes [54]. However, no sig-

nificant difference was observed at the 12-month follow-up, highlighting that patients with SDA may maintain stable OHRQoL values without the need for additional interventions.

Khan et al. [2017] investigated the satisfaction and self-reported quality of life among patients in a South African setting. They found that patients who received restorative treatment [RPDP] reported greater satisfaction compared to those with untreated SDAs [59]. This result is particularly significant in resource-limited settings, where access to advanced restorative therapies may be constrained, suggesting that even minimal intervention can yield satisfactory outcomes in terms of OHRQoL.

In contrast, McKenna et al. [2018] found that SDA patients showed improvements in their OHRQoL scores, particularly in psychological domains, with significant reductions in psychological discomfort at 12 and 24 months. This study highlights the psychological benefits of maintaining a functional occlusion in elderly patients, even if the restoration is minimal [55]. These findings reinforce the importance of a functional, patient-centered approach to dental care, which focuses on enhancing the patient's well-being rather than merely striving for full dentition.

Schierz et al. [2021] presented a long-term RCT comparing SDA and SDA plus PRDP with precision attachments, finding no significant differences in OHRQoL between the two groups. Both treatments showed clinical relevance, with improvements in the OHRQoL scores compared to baseline values [63]. The study demonstrated that, regardless of the specific treatment choice, the impact on OHRQoL is similar, reinforcing the idea that functional restoration, whether through SDA or prosthetic interventions, can yield beneficial outcomes. However, the authors acknowledged that long-term improvements in OHRQoL were not markedly superior for one approach, suggesting that individual patient preferences should guide treatment decisions.

These findings collectively support the growing evidence that a patient's OHRQoL is not solely dependent on the complexity or extent of restorative interventions but is influenced by the patient's ability to adapt to their oral condition and the psychological and social benefits of treatment. It is essential for clinicians to recognize that less complex, more conservative treatments can achieve satisfactory outcomes in terms of both function and quality of life, especially when tailored to the individual's needs and preferences.

The concept of Shortened Dental Arches [SDA] has sparked significant debate within the dental community over the past few decades. The findings from this systematic review show that, while SDA patients may not exhibit significant differences in Oral Health-Related Quality of Life [OHRQoL] compared to those receiving more comprehensive restorative treatments, the approach offers a viable alternative for many partially edentulous patients. This finding supports the growing recognition that, in certain clinical situations, preserving a functional and minimally restored dentition may be just as effective as more

extensive restorations in maintaining patient satisfaction and overall quality of life [13, 18, 39].

One key advantage of SDA is that it reduces the need for complex and costly restorative procedures, especially in aging populations. Previous studies have shown that maintaining a functional dentition, even with fewer teeth, can lead to comparable or even superior OHRQoL outcomes compared to more traditional full-arch rehabilitation [30, 31]. Additionally, this approach aligns with patient-centered care, emphasizing the importance of patient preferences and the need for personalized treatment plans [42-44]. By focusing on function, patient satisfaction, and overall well-being, SDA offers a more holistic approach to restorative dentistry that might be especially beneficial in resource-limited settings.

However, while the evidence supporting SDA is compelling, it is essential to consider individual patient needs and preferences. As demonstrated in the studies included in this review, the decision to adopt SDA as a treatment plan is highly dependent on a thorough assessment of the patient's oral health, as well as their expectations and desires for treatment outcomes [15, 18, 34]. As the body of literature on SDA grows, future research should continue to explore the long-term effects of this approach on both OHRQoL and the overall health of patients. Additionally, more robust studies, particularly randomized controlled trials [RCTs], are needed to clarify the clinical effectiveness and potential risks associated with SDA as a long-term restorative solution.

Moreover, while this review supports the benefits of SDA in terms of patient satisfaction, it is important to acknowledge the limitations inherent in the current body of evidence. The included studies varied widely in terms of methodologies, outcome measures, and follow-up periods, which complicates the ability to draw definitive conclusions across different populations and treatment settings. More standardized protocols for measuring OHRQoL, along with longitudinal studies that examine the long-term impact of SDA, would help further validate its effectiveness as an alternative to more invasive procedures.

Finally, the role of the dental professional in managing patient expectations is crucial. Educating patients about the potential advantages of SDA, including reduced treatment time and cost, should be part of the treatment planning process. In this regard, SDA represents a paradigm shift in restorative dentistry, where functional outcomes and patient satisfaction take precedence over merely achieving complete dentition.

5. Conclusion

Dentists who provide care to patients with limited financial resources or those who prefer not to acquire a prosthesis can find reassurance in evidence supporting the option of "no treatment" as a valid approach [18, 22, 26, 42, 44, 67-71]. For many patients, replacing missing teeth is not necessary unless they experience dissatisfaction with their ability to chew or their appearance [13, 72, 73]. The Shortened Dental Arch

[SDA] concept is based on the understanding that patients have an adaptive capacity to function despite missing teeth. However, this capacity varies, and not all patients may experience optimal function with the same number of teeth [18, 34].

The SDA concept is especially beneficial for individuals with complex systemic conditions, anatomical constraints, or those who simply do not wish to wear dentures [26, 47, 74]. Studies employing Oral Health-Related Quality of Life [OHRQoL] as a measure to assess oral health treatments contribute significantly to our current understanding of oral health. The concept of a successful oral health rehabilitation outcome differs between clinicians and patients. Additionally, the Hawthorne effect should be considered when evaluating the results of randomized controlled trials [RCTs], as the mere act of receiving care may influence the OHRQoL outcomes of participants [65]. Interestingly, while dentists are familiar with the SDA concept, its application varies widely among practitioners [75, 76].

The shortened dental arch [SDA] concept provides a cost-effective and practical solution for managing patients with posterior tooth loss, focusing on retaining or replacing anterior and premolar teeth. This approach ensures acceptable masticatory function, aesthetics, and oral health-related quality of life without requiring extensive prosthetic rehabilitation. SDA is particularly beneficial for elderly patients or those with systemic conditions or financial constraints, as it reduces treatment complexity, time, and costs. By adopting the SDA concept, clinicians can provide minimally invasive, patient-centred care tailored to individual needs, promoting functionality and overall well-being while avoiding unnecessary or overly complex dental treatments and surgeries.

Integrating the Shortened Dental Arch [SDA] concept into the design of full mouth rehabilitation using implant-supported "All-on-X" prostheses offers a potential paradigm shift in prosthodontic treatment planning. The "All-on-X" approach, which involves the placement of multiple implants to support a full-arch prosthesis, has been widely adopted due to its predictability and ability to restore both function and aesthetics for edentulous patients. However, when combined with the SDA concept, the treatment represents an innovative and patient-centred approach. It offers a potentially less invasive, more cost-effective solution for certain patient populations, particularly when full occlusal restoration with implants is not required. Careful patient selection, thorough assessment, and individualised treatment planning are crucial to ensure that the SDA approach provides an effective and long-lasting solution in full-mouth rehabilitation.

Abbreviations

SDA	Shortened Dental Arch
OHRQoL	Oral Health-Related Quality of Life
TMD	Temporo-Mandibular Disfunction
OHIP	Oral Health Impact Profile

OIDP	Oral Impact on Daily Performance
RCT	Randomised Control Trial
NRCT	Non-Randomised Control Trial
PRDP	Partial Removable Denture Prosthesis
PFD	Partial Fixed Denture
QOL	Quality of Life
FDI	World Dental Federation
All-on-x	Implant-supported Hybrid Dentures

Data Availability Statement

This study is a review and does not involve the collection or analysis of new data. All information and findings presented are derived from previously published studies, which are cited within the article. Readers are encouraged to refer to the original sources for detailed data.

Ethics Approval and Consent to Participate

This article is a review of existing literature and does not involve human subjects or the collection of new data. As such, it does not require ethical approval in accordance with the Declaration of Helsinki [1964] and its later amendments. All studies referenced in this review have been conducted in compliance with ethical standards, as reported by the original authors.

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Conflict of Interest

The author declares no conflicts of interest.

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