

Full-Arch Removable vs Fixed Implant Restorations: A Literature Review of Factors to Consider Regarding Treatment Choice and Decision-Making in Elderly Patients

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Purpose: To review and analyze the literature regarding removable vs fixed implant prosthetic treatment for complete edentulism in elderly people. **Materials and Methods:** A narrative review of published articles was conducted. Electronic and manual searches were performed to identify studies comparing removable vs fixed implant modalities for edentulous patients and/or reporting on specific outcomes for fixed vs removable implant restorations in elderly patients. **Results:** It is evident that there are differences in mechanical and biologic maintenance needs due to differences in prosthetic materials and designs for fixed vs removable implant restorations. Anatomical restrictions, age-related problems, lifestyle, cost, maintenance needs, access to dental services, and past experience (both of the provider and the patient) all play a role in prosthesis selection for these patients. Patient expectations and their financial means will define their choices. Patient-reported outcome measures are not standardized, and any assumptions made based on different studies need to be carefully evaluated. **Conclusion:** The decision-making pathway for determining what type of implant-supported prosthesis is preferable for edentulous patients is complicated by many variables that must be considered when treatment planning for maximum benefit for the patient. Detailed explanations of potential outcomes, complications, difficulties, and benefits of therapeutic options is mandatory. Proper assessment of patients' expectations and desires before treatment is critical for a successful outcome. *Int J Prosthodont* 2021;34(suppl):s93–s101. doi: 10.11607/ijp.7016

Improvements in life expectancy in recent decades have led to a significantly increased proportion of elderly people in the general population. In the United States, the number of adults aged 65 years or older is projected to outnumber children by the year 2034.¹ With regard to oral health, advanced age comes with a higher risk of tooth loss mainly due to caries, periodontal disease, history of repeated restorations, lack of regular oral health care and/or prevention measures, and caries due to polypharmacy-induced xerostomia.²

The World Health Organization's goal of functional dentition of at least 20 teeth for life^{3,4} is a very noble goal, but different countries have different policies regarding dental health, prevention, and maintenance, and this goal is not always easy to achieve. Globally, approximately 30% of adults aged 65 to 74 years (or 4% of the global population) are affected by edentulism, with the prevalence accelerating in low- to middle-income countries and becoming greater at older ages.⁵ In the US, the percentage of edentulism has decreased overall, while the percentage of older adults with a functional dentition has increased. Unfortunately, these changes seem to be significant only for the nonpoor⁶—the actual prevalence of complete tooth loss is twice as high among low-income groups in the same age groups, and the situation is similar worldwide.

Complete edentulism is a chronic condition with no cure. It can also be classified as a disability, since it limits two very important everyday functions: the ability to speak and to eat. Apart from a decrease in masticatory efficiency and word articulation,⁷

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the absence of all natural teeth has been associated with social embarrassment and isolation, deformity in facial appearance, and need for modification of nutrition. Altogether, it has been linked to reduced quality of life (QoL).^{8–10} It is also dependent on several socioeconomic factors,¹¹ which is why edentulism is less common among wealthier parts of the population.⁶

Any treatment for edentulism is considered to be only palliative, aiming at improving function and QoL for edentulous patients. Conventional removable prostheses are still the most affordable treatment option¹²; nonetheless, patients often complain of reduced retention and inability to chew food comfortably.^{13,14} In that aspect, implant-retained prostheses—removable or fixed—continue to increase in popularity, albeit being significantly more expensive. Based purely on numbers, there is and will continue to be an increased demand for implant restorations for completely edentulous patients. According to data from World Population Prospects, by 2050, one in four persons living in Europe and Northern America could be aged 65 years or over.¹⁵ And while there is compelling evidence that implant-retained and/or -supported prostheses are preferable to conventional removable prostheses and would represent the standard of care for edentulous individuals, a significant portion cannot afford and may never be candidates for implant therapy.¹² With that in mind, it can be predicted that there will be increased need for implant treatment in the future.

Life expectancy also continues to increase, leading to a growing number of elderly individuals forming an increasing percentage of the overall population, which will translate into expectations for longer service periods of various prostheses, more wear, and more complications, and therefore more need for further treatment and/or maintenance. All these factors are suggestive of an age shift of the population in need of implant rehabilitation (removable or fixed), which presents numerous challenges to confront, especially with geriatric patients.¹⁶

The purpose of this narrative review is to summarize the different factors that need to be considered when determining what type of implant-supported prosthesis (implant overdenture [IOD] or implant fixed prosthesis [IFP]) might be preferable for completely edentulous elderly patients in an effort to offer some guidance for the decision-making process.

MATERIALS AND METHODS

A narrative review was carried out investigating the question: What are the different factors that need to be taken into account when deciding on implant restorations for elderly patients? The authors undertook a literature search covering 1990 to May 2020 using the databases PubMed and Embase, selecting search terms and relevant synonyms on the following topics: fixed complete arch

implant prostheses; implant overdentures; and geriatric patients. Articles were included if they compared removable vs fixed implant modalities for edentulous patients and/or reported on specific factors or outcomes for fixed or removable implant restorations regarding elderly patients. In order to include all potential factors that may affect the decision-making process, a mixture of systematic reviews, RCTs, and retrospective/prospective studies were included. References in the articles found were also searched for additional articles, as well as articles citing the included papers. The factors that were identified were categorized in (1) age-related and socioeconomic factors; (2) complications and maintenance needs; and (3) patient-reported outcome measures (PROMs). As a result, the questions that arise regarding fixed vs removable implant restorations in elderly patients are: (1) How do the age and socioeconomic status of patients affect the treatment choice?; (2) How do the complication rates and maintenance needs of fixed vs removable prostheses affect the treatment choice?; and (3) How do PROMs for the two different implant restoration types affect the treatment choice? The goal of the review was not to analyze every factor in detail, but rather to summarize the factors that clinicians need to consider when deciding the type of implant reconstruction that might be preferable for elderly patients in general.

RESULTS

Age-Related and Socioeconomic Factors

Aging is often accompanied by an increased prevalence of cognitive and/or functional decline, frailty, and care dependency in geriatric patients.⁷ An important issue in this cohort is multimorbidity,¹⁷ which may result from polypharmacy and from issues such as xerostomia, which make dentures as a treatment option even less appealing. Many of these individuals may also have mobility issues, therefore requiring a reduced number and duration of appointments or showing no motivation or willingness to undergo invasive long procedures in the dental office. Last, it is very common to see individuals in this cohort experience significant decline in motor control (for example, Parkinson disease), which on its own may or may not favor one treatment option against another. All of the issues that are commonly seen in geriatric patients¹⁶ do not of course preclude clinicians from providing dental implant treatment modalities to them, but can favor a removable vs a fixed rehabilitation and vice versa.

Elderly patients are also often reluctant to receive any implant treatment. Apart from cost concerns, there is a fear of the actual surgical procedure.¹⁸ When considering implant rehabilitation in older patients, it is imperative to consider first the necessity of minimizing surgical trauma, if possible, and second, the fact that medical risk factors are arguably more common in this patient



cohort.¹⁶ Medical history and common age-related conditions (cardiovascular diseases, diabetes mellitus, osteoporosis, cancer, Parkinson disease, dementia, dry mouth, rheumatic diseases, malnutrition, and nutrient deficiencies) should be carefully assessed prior to making a final decision. If general health precludes more extensive surgeries (hard and soft tissue augmentation procedures, external sinus floor elevation), or, if there are anatomical limitations (nerve proximity, severely reduced ridge dimensions), then simpler implant options (such as IODs) might be preferable. The decision should always be made after careful consideration of the patient's desires and expectations. In every case, potential future functional decline must also be taken into account.¹⁶ A recent systematic review¹⁹ evaluated the effect of advanced age and common medical conditions on implant survival and concluded that implant prostheses in older patients are a predictable treatment modality, with a 5-year implant survival rate of 96.1%. The associated risks of common medical conditions are usually outweighed by the functional and psychosocial benefits of the implant therapy. According to the same study, clinical decision-making ought to rely on the patient's subjective gain in QoL, comfort, and overall well-being and not just on the actual implant survival rate. As an example, implants may be the only means to achieve a psychosocial and functional rehabilitation for patients affected with head and neck cancer.²⁰

Elderly patients can be separated into two categories: the older frail patients, and those who are in good overall physical and mental health, have high expectations, and look for stable, esthetic replacement of their lost dentition regardless of cost, as long as there is no functional compromise.¹⁶ Cost is undoubtedly a decisive factor in the selection of treatment modality.^{21–26} When finances are more limited, removable implant prostheses may be preferred over more costly fixed options, taking long-term maintenance needs into consideration as well. Apart from limited financial means, the first cohort has different actual needs and expectations, since they are often dependent on others for their everyday needs and may also reside in elderly homes with varying access to dental services.

The answer to the question of whether fixed or removable restorations are the best implant treatment option for elderly edentulous patients is not an easy one. Keeping in mind that complete edentulism varies tremendously with regard to several socioeconomic and general health-related factors, the edentulous population is extremely diverse. First and foremost, what makes an option successful or "better" must be defined. Every edentulous patient is unique, has different expectations and desires, and, unfortunately, does not have the same financial means. If the different public policies available around the world for this group of people are considered,²⁷ the question becomes even more complex and

difficult to answer. It is mandatory that each patient is handled separately and that an individualized risk assessment, taking into consideration the specific medical, mental, and physical issues the patient may have, is performed. The patients must be informed in detail of all the advantages and disadvantages, maintenance needs, and risks associated with each treatment modality. The older the patient population, the wider the variation becomes, because while they may all be edentulous to start with, their medical status changes with age, as do their expectations and needs. The clinician's job is to gather all the necessary information, identify high-risk patients, assess the risks, and communicate with the patient in a way that provides them with an individualized treatment option that best suits their expectations.

It is also important to keep in mind that in geriatric patients, implant success is not necessarily evaluated in a clinically relevant manner.²⁸ For example, a maxillary four-implant overdenture in a patient with severe manual dexterity problems may not be the best option, since his/her inability to take it out or clean it might actually preclude them from using it at all even if the implants are well integrated. For that reason, such a treatment would be considered unsuccessful in that case. Maniewicz et al²⁹ compared masticatory efficiency in completely edentulous dependent elderly individuals treated either with a conversion of their existing mandibular complete denture into a two-implant overdenture or a conventional reline of the complete denture and found no significant long-term changes in masticatory efficiency within or between groups, despite the significant increase of masticatory bite force in the intervention group compared to the reline group. They showed that the increased capacity of masticatory bite force was not exploited by the elders during habitual chewing, and therefore a simple reline might often be sufficient.

Moreover, the possibility that the "best" option is different in different age groups needs to be considered. There are two kinds of distinct groups that these treatment modality options are designed for. It is safe to suggest that expectations and goals will be different if the patient is an active, fit, independent 65-year-old professional when compared to a medically compromised and debilitated 90-year-old patient who is residing in a nursing home, who is most likely dependent on others for their daily care, and who may have additional mobility or dexterity problems. The latter category commonly includes people over 75 years old who are usually frail and not independent. Undoubtedly, different lifestyles between such groups can have a significant effect on the decision process and evaluation of the treatment.

Complications and Maintenance Needs

During the treatment-planning stage for implant restorations for elderly edentulous patients, one needs to

consider how fixed and removable prostheses perform in the short and long term regarding frequency of biologic and/or technical complications. Different lifestyles and varying degrees of frailty, as well as access to maintenance among seniors, can significantly impact treatment choice.

Implant therapy can be successfully provided in elderly patients since age alone does not affect the success of implants with high survival rates; however, concurrent medical conditions may necessitate extra care during and after surgery.³⁰ A meta-analysis by Kern et al³¹ aimed to analyze postloading implant loss for implant-supported prostheses in edentulous arches, evaluating the potential effect of type of prosthesis (removable vs fixed) and implant location (maxilla vs mandible), among other factors. Of 54 studies that were included in the qualitative analysis, it was shown that IFPs have a significantly lower risk of implant loss per 100 implant years (0.23 vs 0.35) when compared to IODs. Implant loss rates per 100 implant years were also significantly lower in the mandible vs the maxilla (0.22 vs 0.41), while higher implant success was shown when four implants were used in the mandible for an IOD instead of two. These results should be interpreted with caution since the majority of the data were derived mostly from single-arm cohort studies due to the lack of well-designed comparative studies (ie, RCTs). Overall, implants demonstrated a 5-year survival rate of 97.9% in the maxilla and 98.9% in the mandible, but the effects of implant length, diameter, and distribution were not evaluated. All of these factors can potentially significantly affect the long-term prognosis depending on the prosthesis type and design. The results are only in partial agreement with an older review by Bryant et al,³² which showed that the implant survival rate was 6.6% higher for mandibular IFPs than for maxillary IFPs, but that it may not be affected by variation across the established types of implant prostheses.

Important factors to consider when selecting a prosthesis design for treating edentulism are hygiene and maintenance needs. All implant prostheses need to be carefully designed so that the patient can easily perform hygiene care. A complex prosthesis may be challenging for medically compromised patients or patients who are dependent on others for their care; at the same time, manual dexterity problems and reduced motor skills may also favor one modality over another. Berglundh et al³³ showed a 4- to 10-times higher incidence of prosthetic complications associated with IODs in comparison to IFPs. Increased need for maintenance for IODs was also shown by Andreiotelli et al,³⁴ in which a higher incidence of prosthetic complications for a maxillary IOD was identified, especially without palatal coverage. The same study showed that an IOD in the mandible provides predictable results with improved stability, retention, and patient satisfaction. Overdentures need regular follow-ups and replacement of attachment systems (eg,

Locator abutment inserts or repairs).³⁵ Irrespective of the anchorage system used, adjustments to the overdenture attachment system were the most common mechanical problem in other studies as well.^{36–38} Locator abutments for IODs showed superior clinical results compared to the ball and the bar attachments with regard to the rate of prosthodontic complications and the maintenance of oral function.³⁹ Compared to the bar group, the magnet and ball groups presented the highest incidence of prosthetic complications and higher maintenance needs.^{34,40}

Of course, IFPs need maintenance as well, and complications are not uncommon. Papaspyridakos et al⁴¹ showed a 6.7% rate of veneer material chipping or fracture and a 6.1% rate for needing replacement of the opposing complete denture due to fracture. The overall complication rate was 24.6% per 100 years, which is significant in relation to the amount of repair and maintenance needed, time, and cost to both the clinician and the patient. After 10 years, only 8.6% (95% CI 7.1% to 10.3%) of the prostheses were still complication free. Seven studies were included in the review (only one RCT), and the most common biologic complication was peri-implant bone loss > 2 mm, with about 4% of cases for every year exposed, while the most common technical complication was screw fracture, with an annual complication rate of 2.1%. The majority of prostheses in the included studies⁴¹ were metal-acrylic. When assessing metal-ceramic IFP success, Wong et al⁴² found the fracture of porcelain veneers to be the most common complication. This was in agreement with a retrospective study on metal-ceramic IFPs,⁴³ according to which the cumulative rates for prostheses free of biologic complications were 50.4% at 5 years and 10.1% at 10 years, whereas for prostheses free of technical complications, these rates were 56.4% at 5 years and 9.8% at 10 years, confirming significant future maintenance needs for the patients. Bidra et al^{44,45} showed that full-arch zirconia IFPs have a very low failure rate in the short term, but have a substantial rate of minor complications related to chipping of porcelain veneers (16.1% porcelain chipping). The increased use of monolithic ceramic materials for IFPs in the last decade has resulted in reduced technical complications specific to material chipping and/or fracture. Tischler et al⁴⁶ showed a CSR of 96.8% for monolithic full-arch zirconia prostheses with porcelain veneer restricted only to the gingival region with overall minimal complications in all 49 monolithic zirconia prostheses, which were followed up to 4 years after insertion. This was in agreement with Barootchi et al,⁴⁷ who reported that zirconia IFPs presented higher initial costs than metal-acrylic hybrids, but with satisfactory outcomes, reduction of overall complications, and superior survival rates. In every case, the frequency of technical complications was also dependent on the type of opposing dentition. If a full-arch zirconia or metal-ceramic IFP opposes a

complete denture or metal-acrylic prosthesis, the acrylic resin denture teeth appear to be the weakest link.⁴⁸

Despite the growing number of patients in need of full-arch prostheses (fixed or removable), recall regimens in patients with implant-supported removable or fixed restorations are not widely enforced. Increasing evidence suggests that patients with implant-supported removable and fixed restorations require lifelong professional recall regimens to provide adequate maintenance customized for each individual. The use of specific oral topical agents and oral hygiene aids can improve professional and at-home maintenance of implant-supported restorations.⁴⁹ As mentioned above, there are differences in mechanical and biologic maintenance needs due to differences in prosthetic materials and designs. Therefore, individualized clinical practice guidelines for the recall and maintenance of patients with implant-supported dental restorations are necessary.⁵⁰

Reda et al⁵¹ evaluated the presence and extent of inequalities in the utilization of dental services. The meta-analysis included data from 117 studies conducted in 31 countries and showed that utilization of dental services was lower in male vs female participants, ethnic minorities or immigrants vs ethnic majorities or natives, those living in rural vs those living in urban places, those with lower vs higher educational position or income, and those without insurance coverage status vs those with such status. It is noteworthy that the observed inequalities did not significantly change over the assessed 12-year period and were universally present. The same group²⁷ conducted a meta-analysis with the goal of assessing the proportion of individuals regularly/preventively utilizing dental services and how this was affected by demographic, health-related, and social factors. Their study revealed that the global mean proportion of individuals regularly/preventively utilizing dental services was only 54%, while in countries with higher developmental status, more individuals regularly/preventively utilized services. Age did not have a significant effect on the utilization of services in adults, but the actual use of services was significantly decreased in younger children, individuals with poorer general and oral health, edentulous individuals, and individuals with less supportive family structures or poor health literacy.

Finally, implant restorations in geriatric patients should be designed keeping in mind that future physical and/or mental deterioration may necessitate replacement of attachments or superstructures with a simpler prosthesis or removal of them altogether for easier oral hygiene in the last stages of life.²⁸ It is important that this capacity to downgrade is feasible in a relatively straightforward and cost-effective way. For example, IFPs that are screw-retained can be replaced by IODs or even by conventional complete dentures (CDs) without major interventions if deemed necessary.

Patient-Reported Outcome Measures

Before attempting to answer the question regarding the best implant treatment for complete edentulism, how the various different implant prosthetic options (IODs or IFPs) are rated needs to be evaluated. Different methods are utilized in the literature to draw conclusions, including comparisons of masticatory bite forces, stability, or retention, chewing efficiency, and practitioners' clinical judgement. Clinicians' experience with different implant treatment modalities can also affect the choice they present as better to their patients, and this is related to their clinical comfort level with different types or designs of implant prostheses. However, it is unclear if researchers or clinicians are more suited to evaluate the different options than the actual patients who wear the prostheses. Therefore, what is most important in the end is actual patient satisfaction.

In the literature, two items are most commonly assessed as PROMs: the impact of the prosthesis on QoL and patient satisfaction. The Oral Health Impact Profile (OHIP) is the most commonly used instrument for measuring impact on QoL. The OHIP questionnaire covers seven domains: functional limitation, physical pain, psychologic discomfort, physical disability, psychologic disability, social disability, and handicap.⁵² While QoL is usually evaluated with structured questionnaire items, a definition of "satisfaction" is not accurately described in most studies. Generally, though, it assesses functional aspects, social aspects, and overall satisfaction.^{53,54} The methods used to evaluate PROMs are heterogeneous among studies. The diversity of PROM measurement tools—with some instruments not being properly validated—may also add to this heterogeneity. As a result, measurements vary significantly in terms of type of scale and scores calculated. Overall, the utilization of PROMs in clinical research is unfortunately not standardized. Therefore, assumptions made from the results of different studies need to be carefully evaluated, as they may actually be misleading. Given the potential for PROMs to extrapolate accurate outcomes, there appears to be a need for the establishment of standardized tools.⁵⁵

The literature is unclear regarding which treatment modality is preferable. There appears to be a trend of IFPs overriding IODs in some studies, but this does not often reach statistical significance.^{56–61} With regard to the mandible only, de Souza et al⁵⁷ evaluated the satisfaction level of patients rehabilitated using the Brånemark protocol or an IOD and concluded that considering the patients' desires in choosing the type of prosthesis is critical to treatment success. Both IOD and IFP groups showed an overall satisfaction of above 87%. There were no significant differences between the two groups in phonetic function, chewing ability, pain, improvement of self-confidence, or self-esteem. However, the reason why a specific option was selected

was very different between the two groups. More than half of the IOD patients selected the treatment because of cost, while the most popular reason in the IFP group was dissatisfaction with a previous prosthesis. A patient's prior experience with a prosthesis can significantly affect the decision for or against a removable vs fixed implant prosthesis among elderly patients. When both maxillary and mandibular cases were included, Oh et al⁶⁰ compared patient satisfaction and oral health–related QoL (OHRQoL) among fully edentulous patients treated with an IFP, IOD, or complete denture. The IFP and IOD groups showed no significant difference in patient satisfaction or OHRQoL, and both groups showed greater improvement compared to the CD group. Specifically, the OHRQoL dimensions of functional limitation, physical pain, psychologic discomfort, and psychologic disability in the IFP group, and functional limitation in the IOD group, improved greatly in comparison to the CD group. There were again no significant differences between the IFP and IOD groups in any dimension of the OHIP-14.

The above findings are not in agreement with an older study by Brennan et al,⁶² who assessed patient satisfaction after treatment and OHRQoL before and after treatment with IODs and IFPs. The IOD group showed significantly decreased overall satisfaction and less satisfaction with chewing capacity and esthetics, while the IFP group appeared to be less satisfied with cost and had more difficulty performing oral hygiene. Significantly decreased levels of satisfaction regarding oral hygiene with IFPs was also reported by Martín-Ares et al.⁵⁸ According to Brennan et al,⁶² overall OHRQoL was high for both fixed and removable groups, but the IFP group demonstrated significantly lower psychologic discomfort and psychologic disability compared to the IOD group. Among all patients who had similar numbers of implants placed, those who received an IOD were less satisfied and had lower OHRQoL than the patients who had an IFP. Given the way the selection of the type of prosthesis took place, it was derived that subjective, patient-related factors are major determinants of satisfaction and treatment outcomes. The importance of patient-specific characteristics in the actual perception of improvement of OHRQoL was also highlighted by Reissmann et al.⁶³

Equally important is the evaluation of QoL changes over time depending on the prosthesis type. Martínez-González et al⁵⁹ evaluated two groups that were treated with an IOD or IFP before treatment and after 1, 3, and 5 years. It was shown that overall satisfaction increased after implant rehabilitation, irrespective of the type of prosthesis used. Patients rehabilitated with an IFP obtained a generally higher level of satisfaction than patients wearing an IOD. However, at 5 years, both groups showed similar levels of satisfaction.

The only study that showed a preference of IODs over IFPs was Heydecke et al,⁵⁴ in which patient satisfaction

Table 1 Factors Potentially Affecting the Decision-Making Process (IOD vs IFP) in Elderly Patients

Patient expectations and desires
Financial means (prosthesis and maintenance costs)
Patient satisfaction and improvement in quality of life
Patient motivation
Age
General health (multimorbidity, mobility issues, decline in motor control [ie, dexterity], extreme frailty or mental disability, periodontitis, smoking history, xerostomia)
Anatomical limitations
Maintenance/repair needs and access to dental services
Lifestyle/living arrangements
Patient experience with previous prostheses
Clinician experience

after treatment and choice of prosthesis were evaluated after all patients were given both options in a crossover study design. IODs received significantly higher ratings of general satisfaction than IFPs while providing a significantly better ability to speak and easier hygiene. A recent systematic review comparing IODs and IFPs⁵⁵ evaluated OHRQoL and patient satisfaction. IFPs and IODs showed no significant difference in PROMs, although there was a small trend of IFP overriding the IOD group in most of the 13 included studies. With regard to chewing function, phonetics, and esthetics, the majority of studies revealed no significant differences between the two groups, although the results were conflicting. The capacity to maintain oral hygiene seemed to favor IODs.

DISCUSSION

There are several factors that need to be taken into consideration when deciding between an IOD and an IFP for elderly patients (Tables 1 and 2).^{7,16–49,52–63} Cost should be at the top of the list, since it is often the most decisive factor. Other elements include patient expectations or motivation; patient age and overall health (especially in cases with substantial functional decline [motor and/or cognitive]); anatomical considerations or limitations; present and future ability to clean; access to maintenance and hygiene; and experience with previous prostheses.

It is also very important to consider if there is any difference between the maxilla and mandible. Patients most often complain about conventional mandibular prostheses' lack of retention or stability. It is widely accepted that the two-implant overdenture is regarded as the standard of care for mandibular edentulism,⁶⁴ while a mandibular IFP increases OHRQoL. On the other hand, patients seem not to have many problems in the maxilla even with conventional CDs when compared to the mandible, given the specific anatomy of the area

Table 2 Reviewed Studies and Their Categories When Deciding on a Fixed vs Removable Prosthesis in Elderly Patients

Category	Studies
(1) Age-related and socioeconomic factors	Langlois et al, ⁷ 2019; Schimmel et al, ¹⁶ 2017; Shwe et al, ¹⁷ 2019; Narby et al, ¹⁸ 2008; Schimmel et al, ¹⁹ 2018; Müller et al, ²⁰ 2004; Attard et al, ²¹ 2005; Zhang et al, ²² 2017; Bernabé et al, ²³ 2017; Esfandiari et al, ²⁴ 2009; Beikler and Flemmig, ²⁵ 2015; Vogel et al, ²⁶ 2013; Reda et al, ²⁷ 2018; Müller and Schimmel, ²⁸ 2016; Maniewicz et al, ²⁹ 2019
(2) Complications and maintenance needs	Müller and Schimmel, ²⁸ 2016; Park et al, ³⁰ 2017; Kern et al, ³¹ 2016; Bryant et al, ³² 2007; Berglundh et al, ³³ 2002; Andreioteili et al, ³⁴ 2010; Osman et al, ³⁵ 2012; Visser et al, ³⁶ 2005; Kiener et al, ³⁷ 2001; Rentsch-Kollar et al, ³⁸ 2010; Cakarar et al, ³⁹ 2011; Davis and Packer, ⁴⁰ 1999; Papaspyridakos et al, ⁴¹ 2012; Wong et al, ⁴² 2019; Papaspyridakos et al, ⁴³ 2019; Bidra et al, ⁴⁴ 2017; Bidra et al, ⁴⁵ 2018; Tischler et al, ⁴⁶ 2018; Barootchi et al, ⁴⁷ 2020; Gonzalez and Triplett, ⁴⁸ 2017; Bidra et al, ⁴⁹ 2016
(3) Patient-reported outcome measures	Allen and Locker, ⁵² 2002; Zitzmann and Marinello, ⁵³ 2000; Heydecke et al, ⁵⁴ 2003; Yao et al, ⁵⁵ 2018; De Kok et al, ⁵⁶ 2011; de Souza et al, ⁵⁷ 2016; Martín-Ares et al, ⁵⁸ 2016; Martínez-González et al, ⁵⁹ 2013; Oh et al, ⁶⁰ 2016; Quirynen et al, ⁶¹ 2005; Brennan et al, ⁶² 2010; Reissmann et al, ⁶³ 2017

and the sufficient retention that is usually attained.⁶⁵ IFPs definitely have less overall volume compared to removable IODs. Complete elimination of palatal coverage might increase comfort for some patients; however, the anatomical conditions required for maxillary IFPs often require that patients go through augmentation procedures, which are more invasive and costly and for which the actual treatment duration increases dramatically.⁶⁶ Alternatively, they require significant bone reduction for the ideal prosthesis design and specific space requirements, which can be very traumatic and probably not the best option for elderly patients.

Regarding comparison of the two options, IODs are more affordable, easier to clean, require less invasive surgery, and are usually simpler prostheses. Their main disadvantages include the comparatively increased need for maintenance, the concurrent appearance of denture-related conditions (ie, denture stomatitis), and patient complaints of a “foreign body” in their mouth. On the other hand, IFPs provide patients with a sense of security and become “part of the body.” They are, however, significantly more expensive, necessitate more invasive surgery, and are more difficult to clean.

How well the different treatment modalities perform also depends on the status of the opposing dentition. As far as the effect of opposing dentition on an implant restoration’s prognosis is concerned, there is an obvious lack of evidence in the literature. Parel and Phillips⁶⁷ conducted a retrospective analysis of implant performance for patients treated with 4 implants placed in 285 maxillae (1,140 implants) and 273 mandibles (992 implants) providing immediate function for complete-arch 4-implant-supported prostheses in an attempt to determine potential risk factors that may contribute to increased risk for implant failure in maxillary immediate function. Opposing natural dentition was among the risk factors identified, suggesting that either the use of

additional implants or delayed loading and the provision of a complete denture as an interim prosthesis may be more appropriate in the management of patients identified as being high risk. Gonzalez and Triplett⁴⁸ included 40 patients in a retrospective case series in order to evaluate the performance of the zirconia IFP with various opposing dentitions. Patients had three possible occlusal scenarios: (1) maxillary and mandibular zirconia IFP; (2) maxillary zirconia IFP and mandibular natural dentition; and (3) maxillary zirconia IFP and mandibular conventional metal-acrylic hybrid prosthesis. Complications were recorded up to 12 months after definitive prosthesis delivery. The study⁴⁸ showed that chipping of porcelain veneer was the most common complication, but with a relatively low incidence. Acrylic resin denture teeth may represent the weakest link when restoring complete edentulism with a maxillary zirconia IFP and mandibular conventional hybrid prosthesis.

CONCLUSIONS

The decision of whether to rehabilitate an edentulous patient with a fixed or removable implant prosthesis cannot be based solely on the literature. Patient expectations and satisfaction should guide the selection. Each dentist has personal preferences that play a role in the approach chosen. These preferences should not cloud judgment or cause the clinician to impose one treatment against another. The patient’s financial means, specific anatomy, clinical parameters, and—most importantly—needs and wishes should lead to the right choice for the specific patient. Prior patient experience with prosthodontic treatment and analysis of general patient health (including extreme frailty or mental disability, periodontitis, smoking history, history of snoring and/or sleep apnea, xerostomia) will also affect the decision-making process. In addition, facial esthetics and lip dynamics may drive

the decision related to the prosthetic design. In elderly patients, severe alveolar atrophy may indicate a removable solution, while advancing age may indicate converting from a fixed to a removable restoration. IODs are generally considered easier for maintaining oral hygiene, and this might be a factor when selecting a treatment for patients with difficulties conducting oral hygiene procedures. Regardless of a fixed or removable decision, the prosthesis design must facilitate adequate personal oral hygiene procedures, patients who receive such restorations must be adequately trained for their particular prosthesis, and long-term maintenance regimes should be encouraged.

Clinical decision-making must not only be based on the survival rate, but also on the patient's improvement in QoL, comfort, and overall well-being, which should outweigh the associated risks. When comparing IODs and IFPs, the reported outcomes in the literature are inconsistent. The majority of the reviewed studies reported that IFPs performed better in the aspects of overall satisfaction and OHRQoL, while some authors found IODs and IFPs were similar when comparing PROMs. The diversity of PROM measurement tools—with some instruments not being properly validated—may also contribute to this heterogeneity. For that reason, standardized tools need to be established.

On the basis of current evidence, it is not possible to support a solid conclusion of which type of prosthesis would result in better PROMs. No treatment for edentulism can be considered a panacea. Nothing works for everyone. Patients must be thought of as individuals with specific needs and different levels of risk, and the clinician's task is to diagnose properly and come up with the best treatment option and/or recommendation for them specifically.

Based on the above, it is absolutely essential to conduct a thorough discussion with the patient regarding their chief complaint and the potential outcomes, complications, difficulties, and benefits of the different therapeutic options. Financial means will drive decision-making for treatment choice and long-term maintenance. In cases in which either treatment is feasible, proper assessment of patients' expectations and desires before treatment is critical prior to deciding between a fixed or removable prosthesis. Only in this way is it possible to attain the desired outcome, which is essential to successful treatment.

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