Patient-Reported and Clinical Outcomes of Implant-Supported Fixed Complete Dental Prostheses: A Comparison of Metal-Acrylic, Milled Zirconia, and Retrievable Crown Prostheses

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The purpose of this retrospective study was to assess the incidence of biologic and technical complications for implant-supported fixed complete dental prostheses (IFCDPs) and their relationship to oral health-related quality of life (OHQoL) and patient-reported outcomes. Metal-acrylic (MA), retrievable crown (RC), monolithic zirconia (MZ), and porcelain veneered zirconia (PVZ) prostheses were included. Patients who received an IFCDP at least 1 year prior to recall were identified. Exclusion criteria were: (1) an opposing complete denture and (2) time in service >70 months. A total of 37 patients with 49 prostheses, including 22 MA, 14 RC, 7 MZ, and 6 PVZ prostheses were recalled. Patient-reported outcomes were assessed via OHIP-49 (Oral Health Impact Profile) and a scripted interview with open-ended questions. All designs had high complication rates (12 of 22 MA, 10 of 14 RC, 2 of 7 MZ, and 5 of 6 PVZ). The most common complications were: (1) MA: posterior tooth wear, (2) RC: chipping and fracturing of the restorations, (3) MZ: wear of opposing restorations, and (4) PVZ: chipping of opposing restorations. Average OHIP-49 scores ranged from 7 to 29, indicating high OHQoL, patient satisfaction, regardless of prosthetic design ($P = .16$). The standardized interview highlighted that although most patients were extremely satisfied (73%), some continued to be bothered by material bulk (14%) and felt that maintenance of oral hygiene was excessively time-consuming (16%). In the context of this study, despite high complication rates and maintenance needs, all IFCDP designs resulted in high OHQoL and patient satisfaction.

Key Words: OHIP, oral health-related quality of life, hybrid, chipping, fractures, wear

Introduction

Although the prevalence of edentulism in the United States is declining, the absolute number of patients requiring care for complete edentulism continues to increase.[1] With the established success of dental implants, implant-supported fixed complete dental prostheses (IFCDPs) are now routinely available as an alternative to traditional complete dentures.[2–5] Some authors even contend that an IFCDP should be considered the standard of care, particularly for the mandibular arch with limited osteomucosal support.[6–8]

Several prosthetic materials can be used for the fabrication of an IFCDP, the most well-studied of which is the metal–acrylic (MA) hybrid.[9,10] Long-term follow-up indicates that prosthetic tooth wear, tooth debonding and fracture, and fracture of the veneering acrylic complicate this treatment modality such that maintenance of the prosthesis should be expected.[10–14] With the advent of computer-assisted design–computer-assisted milling (CAD–CAM) technology, a number of alternative designs for IFCDPs have become feasible, including retrievable crown (RC), monolithic zirconia (MZ), and porcelain veneered zirconia (PVZ) prostheses.

Retrievable crown (RC) prostheses involve cementation of full coverage restorations onto milled titanium or zirconia bars, which has been suggested to allow for improved esthetics,

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biomechanics, hygienic maintenance, and long-term prognosis.[15–19] Monolithic zirconia has also become popular for the fabrication of IFCDPs due to its desirable chemical properties, high mechanical strength, and ability to be incorporated into a digital workflow.[20,21] Despite increased strength, catastrophic failures have been reported.[22–24] Furthermore, esthetic inadequacies of milled zirconia are often corrected using a porcelain veneer (PVZ), which has a tendency to chip and fracture.[25–29] Although techniques have been developed to minimize these complications,[17,22,27,30,31] reviews indicate that although survival is generally high, veneered zirconia can also have a high incidence of mechanical complications.[23,32,33]

A complete evidence-based evaluation of treatment outcomes must include not only an assessment of clinical complications, but also an evaluation of patient-centered outcomes.[34,35] Although there is no gold standard for determining patient satisfaction,[34] oral health-related quality of life (OHQoL) is the most commonly used measure of patient perception. It is thought to be a more comprehensive, patient-centered assessment of oral disease and therapy rendered. OHQoL is assessed using validated questionnaires, such as the Oral Health Impact Profile (OHIP).[36] In addition, structured patient interviews allow patients to report qualitative information about their experiences and provide clinicians with a deeper understanding of a particular inquiry. However, limited studies exist examining patient satisfaction and OHQoL with IFCDPs.[22,37–45] Only 1 study compares patient satisfaction across multiple IFCDP designs,[46] and no studies have examined the relationship between complications with IFCDPs and patient satisfaction.

The purpose of this study was to identify: (1) the incidence of complications associated with MA, RC, MZ, and PVZ implant-supported fixed complete dental prostheses, (2) the types of complications intrinsic to each, (3) patient satisfaction and oral health-related quality of life (OHQoL) measures between the various IFCDP designs, and (4) the relationship between the occurrence of prosthetic complications and OHQoL.

Materials and Methods

Study design and subjects

This study protocol (#2015-0445) was reviewed and approved by the Institutional Review Board of the University of Illinois at Chicago (UIC). All patients who received an IFCDP at the UIC Advanced Prosthodontics program at least 1 year prior to the date of recall were identified. Patients were included if they provided voluntary consent to participate in the survey and exam and if their prosthesis had been in place for longer than 12 months. Patients were excluded if the prosthesis had been in service for more than 70 months or if the prosthesis was in occlusion with a conventional removable complete denture. As no RC, MZ, or PVZ prostheses had been in service for >70 months, MA prostheses older than 70 months were excluded to reduce the effect of prosthesis age as a confounding variable. Similarly, no RC, MZ, or PVZ prostheses were identified opposing a conventional complete denture. Therefore, all MA prostheses opposing a complete denture were excluded. All prostheses included in this study opposed another IFCDP, natural dentition, or an implant-supported removal prosthesis.

Table 1

Complications assessed

Biologic
Radiographic pathology
Bone loss >1/3 implant
Length
Implant failure
Technical
Replacement of access plug
Screw loosening
Fractured teeth
Marked anterior wear
Marked posterior wear*
Fractured framework
Debonded framework
Patient-directed
Unsatisfactory esthetics
Unsatisfactory phonetics
Opposing arch
Complaint of pain
Marked wear
Fractured dentition

*Defined as obliteration of the central groove anatomy.

This study was conducted from September 1, 2015 through March 1, 2016. The face-to-face interview method was used both to reduce the risk of bias[47] and also to allow for clinical evaluation of the prosthesis. All patients were evaluated by the same provider (VHB) using a structured assessment protocol.

Questionnaire and exam

Following written consent, the patients completed the OHIP-49 questionnaire. OHIP-49 is one of the most commonly used instruments for measuring OHQoL. It is comprised of 7 subscales that evaluate impairment, including functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, and social disability. Patients respond to questions using a 5-point Likert scale coded from 0 = "never" to 4 = "very often." Thus, the total score ranges from 0 to 196; the closer the score is to 0, the better the patient's OHQoL. Perhaps the most important aspect of OHIP-49 is that it has been validated and demonstrates high internal reliability and test–retest reliability.[48–50] Patients were instructed to answer the each OHIP-49 question as it pertained to their experience since the final prosthesis was inserted. If patients had opposing IFCDPs, they were asked to complete separate OHIP-49 questionnaires for each prosthesis.

The patients were then interviewed using a prewritten script of 6 questions developed from a literature review and expert opinions. The interviews usually lasted 5 to 15 minutes, and the patients were not queued in any direction regarding their responses. The interviews were recorded and later transcribed. To provide a meaningful summary, the responses were minimally condensed. Responses were compiled around direct quotes to the greatest extent possible.

An intraoral exam was then performed and prosthetic complications assessed in the categories: biologic and prosthetic (divided into technical and patient-directed; Table 1). The

Table 2

Patient demographic information, separated by prosthetic material

	Metal–Acrylic	Retrievable Crown	Monolithic Zirconia	Porcelain Veneered Zirconia
Total prostheses	22	14	7	6
Average patient age (years)	67	64	63	62
Average length of service (months)	21	26	20	17
Gender				
Male patients (%)	27	50	43	33
Arch location				
Maxillary	36	57	71	50
Mandibular	64	43	29	50
Average no. of implants	5.2	6.5	5.7	5.3
Average cantilever length (mm)	11.5	6.4	10.7	10.9

percentage of prostheses free from complications at the time of recall was determined, not including complications to the opposing arch. "Prosthetic failure" was defined as complications severe enough that remake of the prosthesis was recommended by the provider.

Data analysis

Statistical analyses were performed using SPSS (v.20, Chicago, Ill) with significance levels set at $P < .05$. A 2-sided Fisher's exact test was used to determine significance between varying complication rates among materials. For patient satisfaction as assessed by OHIP, median scores were compared using a nonparametric Kruskal–Wallis test, as the data was found to be not normally distributed according to the Shapiro–Wilk test. Differences between median OHIP-49 scores for each prosthetic material were calculated. Pairwise comparisons between prosthetic groups were performed using Mann–Whitney U tests. Multivariate linear regression analysis was performed to assess the relationship between the occurrence of complications and a patient's reported OHIP score. Incidence of responses to patient interview questions was reported across prosthetic designs.

Results

General characteristics (Table 2)

In total, 37 patients with 49 prostheses (25 single arch; 24 double arch) met the inclusion criteria and presented to the clinic for dental examination. Specific details are provided in Table 2.

Complications (Table 3)

Biologic

No participants lost implants or displayed radiographic pathology other than marginal bone loss. One maxillary MA IFCDP and 3 maxillary RCs demonstrated radiographic bone loss greater than 1/3 the length of the implant, none of which resulted in implant or prosthetic failure.

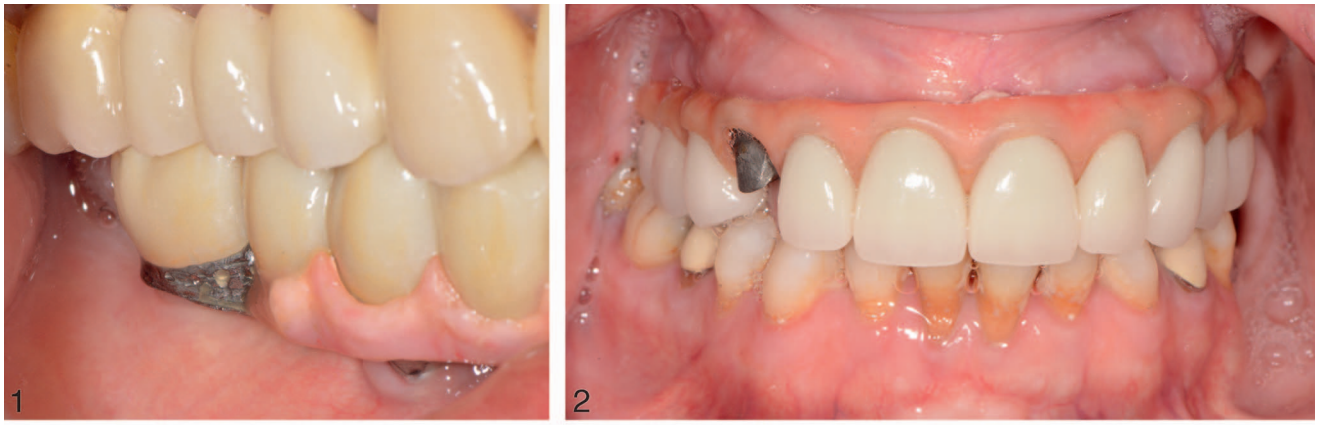
Prosthetic

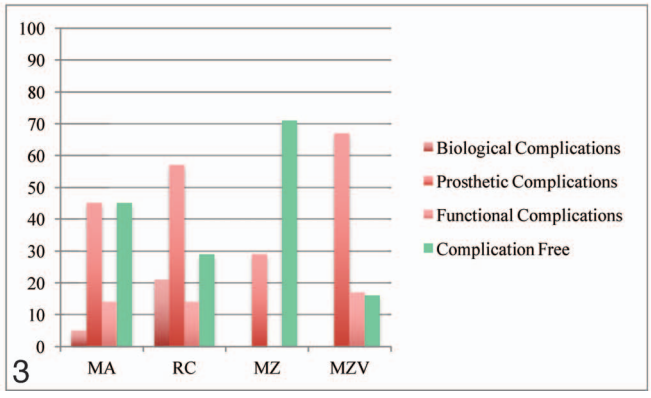
Four of 13 patients with zirconia prostheses presented with a chief complaint of loss of a screw access plug ($P = .01$). Not all screws could be accessed for looseness due to crown cementation over implant access holes in RC prostheses. However, no patients presented with prosthesis mobility due

Table 3

Prosthetic complications, distributed according to material

	Metal–Acrylic (n = 22)	Retrievable Crown (n=14)	Monolithic Zirconia (n = 7)	Porcelain Veneered Zirconia (n = 6)
Biologic complication				
Implant failure	0	0	0	0
Bone loss >1/3 implant length	1	3	0	0
Radiographic pathology	0	0	0	0
Prosthetic complication				
Replacement of access plug	0	0	1	3
Screw loosening	0	0	0	0
Fractured framework	0	0	0	0
Marked anterior wear	1	0	0	1
Marked posterior wear	10	3	1	2
Fractured teeth	4	6	0	3
Debonding of gingival material or crowns	0	4	0	0
Functional complication				
Esthetic concerns	2	0	0	1
Phonetic concerns	1	2	0	0
Average no. of complications per prosthesis	0.86	1.29	0.28	1.67





Figures 1–3. Figure 1. Area of debonded composite gingiva on retrievable crown (RC) implant-supported fixed complete dental prosthesis. **Figure 2.** Debonded RC after 70 months in function. **Figure 3.** Percentage of prostheses with complications. MA indicates metal–acrylic; MZ, monolithic zirconia; PVZ, porcelain-veneered zirconia.

to loose or fractured screws. Two prostheses (1 MA; 1 PVZ) demonstrated marked anterior wear. Both were mandibular prostheses that were deemed "failures" due to an excessive number of tooth fractures. Posterior wear, observed as obliteration of the central groove anatomy of at least 1 tooth, was the most commonly noted complication overall (10 of 22 MA; 3 of 14 RC; 1 of 7 MZ; 2 of 6 PVZ prostheses). The monolithic zirconia prosthesis identified as having wear was opposing implant-supported single-unit restorations, and the 2 PVZ prostheses identified with wear were opposing each other. The second most commonly noted complication was chipping and fracturing of teeth (4 of 22 MA; 6 of 14 RC; 3 of 6 PVZ prostheses). Additionally, 4 of the RC prostheses had complications categorized as "debonding." Three had lost portions of the composite gingiva (Figure 1) and 2 had crowns that debonded from the frameworks (Figure 2).

Functional

Patients who were dissatisfied with the esthetics of their prostheses (2 of 22 MA and 1 of 6 PVZ) stated that they felt their provider had not listened or been able to achieve the esthetics they desired. One patient with a MA prosthesis and 2 patients with RC prostheses felt that their speech had been affected and did not resolve to their satisfaction over time.

Complication incidence (Figure 3)

Overall, MZ had the lowest complication rate (Figure 4), while PVZ prostheses had the highest with only 1 of 6 prostheses being entirely complication-free.

Table 4

Incidence of complications occurring in opposing arch

	Metal–Acrylic (n = 22)	Retrievable Crown (n = 14)	Monolithic Zirconia (n = 7)	Porcelain-Veneered Zirconia (n = 6)
Complications to the opposing arch				
Wear of opposing	4	3	2	3
Chipping/fractures of opposing	4	5	1	4
Average no. of complications to opposing arch per prosthesis	0.36	0.57	0.43	1.17

Figures 4–7. Figure 4. Monolithic zirconia prosthesis with no complications. **Figure 5.** Failed metal–acrylic prostheses. **Figure 6.** Failed retrievable crown prostheses. **Figure 7.** Failed porcelain-veneered zirconia prostheses.

Complications to the Opposing Arch (Table 4)

The frequency of wear to the opposing dentition with MA (4 of 22) and RC (3 of 14) prostheses was similar. This complication seemed to occur with greater frequency for zirconia prostheses with (3 of 6) and without (2 of 7) porcelain veneer, but the trend was not statistically significant ($P = .155$). Tooth fracture in the opposing arch was also common. Two of the MA, 2 of the RC, and 2 of the PVZ prostheses with fractures were in patients with both upper and lower prostheses which were deemed to have failed.

Prosthetic failures

Six prostheses in 3 patients were deemed prosthetic failures; 2 MA prostheses opposing each other (Figure 5), 2 PVZ opposing each other (Figure 6), and 2 RC prostheses opposing each other (Figure 7). All of the failures were due to excessive chipping and fracturing of the prosthetic teeth. No MZ prostheses failed for any reason.

Oral health-related quality of life

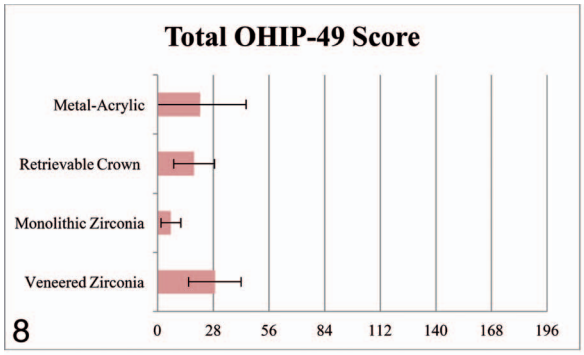
Average OHQoL scores were low across all prosthetic groups, indicating that patients had an excellent OHQoL and were satisfied. The differences between prosthetic groups were not statistically significant ($P = .16$). Patients with PVZ prostheses reported the most complications that negatively impacted their OHQoL, with an average total score of 29 (Figure 8). Patients with MZ prostheses reported the lowest score with an average of 7. The 7 OHIP-49 categories were also analyzed separately. The average scores were less than 1 (1 = "hardly ever") per question in every category and for every prosthetic material, with the exception of patients with MZV prostheses in the functional limitation category. In this category the average score per question was 1.18 (Figure 9). Across all prosthetic groups, patients ranked functional limitation as causing the greatest disturbance to their OHQoL and psychological or social disability as the least. The trend in each of the seven OHIP-49 categories was that patients with MZ prostheses had the lowest scores, the fewest complaints, and the greatest overall satisfaction.

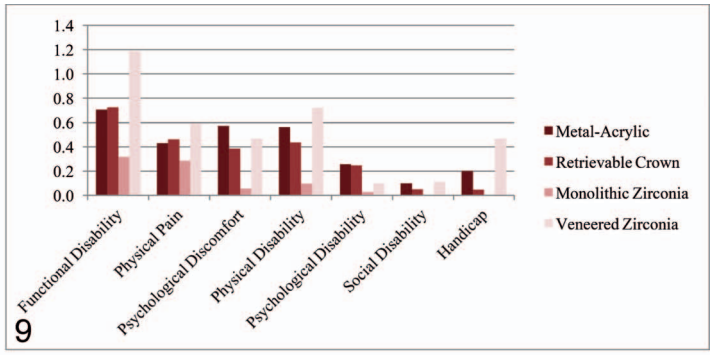
Patient interviews (Table 5)

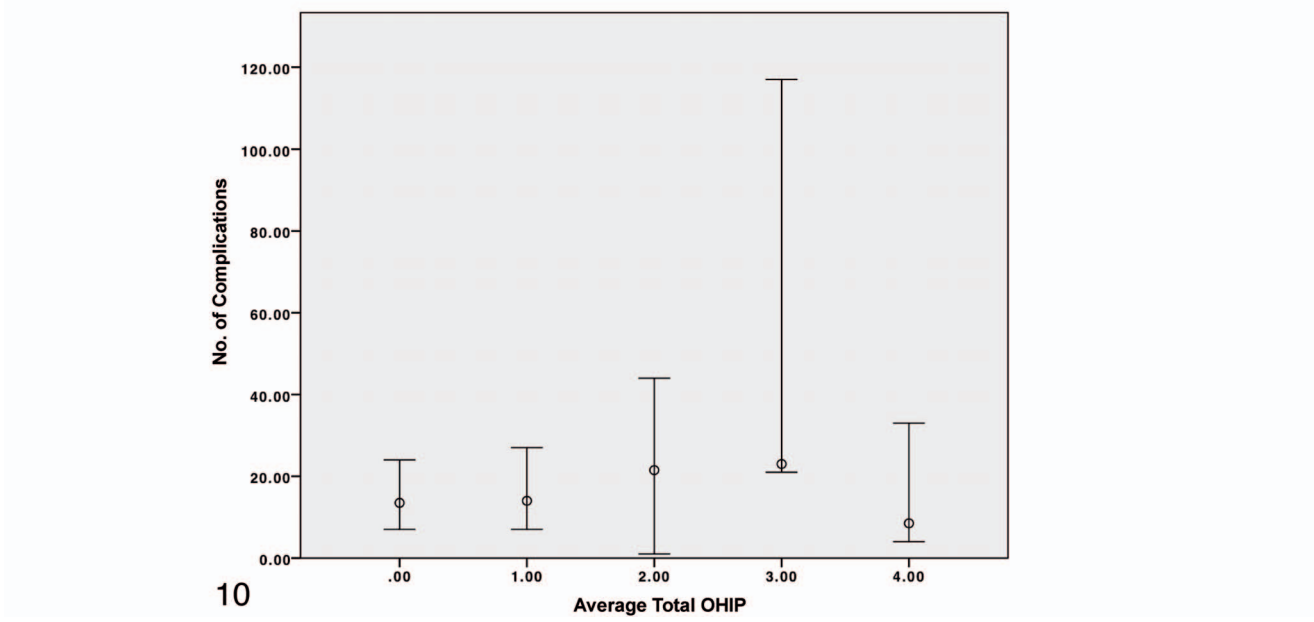
The findings from the patient interviews confirmed that patients were generally satisfied to very satisfied with their therapy and thought their prostheses "looked great." However, the results also highlighted that IFCDPs can have an impact on food selection and speech. Patients also perceived difficulty maintaining good oral hygiene and may be bothered by excess material bulk even more than 1 year after prosthesis delivery.

Relationship between complications and OHIP scores (Figure 10)

The overall correlation between OHQoL, as determined by total OHIP-49 score and the incidence of complications was assessed using multivariate linear regression. The number of complications was not found to be a predictor of OHQoL.







Figures 8–10. Figure 6. Average Oral Health Impact Profile (OHIP)-49 scores, separated by prosthetic material. **Figure 9.** Average response per OHIP-49 question, given on a 0- to 4-point scale (0 = never). **Figure 10.** Average total OHIP-49 scores relative to number of complications.

Discussion

Metal–acrylic

No implants failed in the course of this study, and technical complications were noted more often than biologic, with over half of the prostheses (29 of 49) having at least 1 technical complication. For MA prostheses, the most common complication observed in this study was posterior tooth wear, with 10 of 22 of prostheses displaying wear after only 21 months in function. One similar study found that tooth replacement due to wear was required in 22 of 46 prostheses after 5 years,[12] whereas another found that 8 of 46 patients required full-arch tooth replacement 10 times over an average follow-up period of 8 years and 3 months.[13] One reason the results of this study may indicate a higher incidence of wear is that many studies that evaluate wear with MA IFCDPs use full-arch tooth replacement, also known as retreading[51] as the endpoint. However, the literature shows that full-arch tooth replacement is usually only necessary after 5 to 10 years in service.[12,13,51] Due to the shortened duration of follow-up for this study, a definition of wear that could be objectively assessed and that would be visible within the duration of the study was established. It is important to note that this endpoint is different from that which is generally used in medium- to long-term studies, and there is no documentation regarding what percentage of these patients with posterior tooth wear will later require full-arch tooth replacement.

Another important factor that contributes to the risk of complications is the nature of the opposing dentition and/or prosthesis.[52] It has been demonstrated that the incidence of complications for prostheses opposing implant-supported fixed prostheses or natural dentition can be dramatically higher than for prostheses which oppose complete dentures.[52] All prostheses included in this study opposed natural dentition, another implant-supported fixed prosthesis, or an implant-supported removable prosthesis. Therefore, the risk of complications indicated by this study is likely to be higher than that of many studies, which include prostheses opposing traditional complete dentures.[9,13,14,53–56]

Another commonly noted complication, tooth fracture, was seen in 4 of 22 of MA prostheses. This is similar to the findings of Gothberg et al[53] who noted that fractures of the resin matrix,

TABLE 5

Patients' responses to open-ended survey questions, by percentage of total respondents (n = 37)

Question	Percentage
Question 1: In general, how satisfied have you been with your prosthesis, and what has impacted your satisfaction?	
I have been extremely happy (5 out of 5).	73%
I have been reasonably happy (4 out of 5).	14%
I have been only somewhat happy (3 out of 5).	14%
There is more bulk to the prosthesis than I expected.	14%
I am bothered by the space and/or margin between my prosthesis and my gums.	8%
Question 2: What do you think of the esthetics of your prosthesis?	
I think they look great.	89%
I wish I could change some aspect (whiter, longer, etc)	19%
I don't think they look very natural.	8%
I think they look very natural.	5%
I think they look even better than my natural teeth.	5%
Question 3: Please tell me about your bite and chewing function.	
Chewing is fine; I have no problems.	84%
I try to avoid certain foods (popcorn, ice, nuts) because I'm concerned about my prosthesis breaking.	38%
I eat anything I want.	32%
There are certain foods I avoid because I find they get stuck under the prosthesis.	13%
Small foods (such as rice) are challenging to chew.	11%
Chewing has never felt natural.	8%
I had to relearn how to eat.	5%
I wish there were more teeth in my prosthesis.	5%
Question 4: What do you think about speaking with your prosthesis?	
I have no problems speaking.	46%
There was an adjustment period, but I have no problems with my speech now.	41%
My speech was never affected; I had no adjustment period.	19%
I still have problems speaking certain words.	19%
My teeth were so messed up before that I think it is even better now.	14%
I still need to be conscientious when speaking in order to pronounce certain words correctly.	5%
Question 5: Please tell me about cleaning your prosthesis.	
I have had good success with my Waterpik.	59%
I do not find keeping it clean to be problematic or onerous.	54%
I spend at least 15–20 minutes daily cleaning my prosthesis.	16%
It does not take me more than 5 or 10 minutes to clean.	14%
Keeping my prosthesis clean is a challenge.	14%
I had to learn new techniques in order to clean properly.	14%
Question 6: Please tell me about any issues related to your jaw joint or any grinding habits.	
I have noticed no changes and have no problems.	84%
I wear my occlusal guard every night.	32%
I do not wear an occlusal guard.	22%
I have an occlusal guard, but do not wear it regularly.	16%
I have occasional soreness in my jaw joint.	8%
I have developed painless clicking and popping in my jaw joint.	3%

including of the acrylic resin teeth, were noted in 17 of 75 patients after 3 years. This is also corroborated by Purcell et al,[12] who found that 9 teeth broke in 46 prostheses within a 2-year time frame

One interesting finding of this study was that no instances of chipping or fracturing of the acrylic gingiva were noted with MA prostheses. This finding is different from several studies that reported resin veneer fracture to be a prevalent, if not the most prevalent, prosthetic complication.[9,10,55,56] Two potential reasons for this difference are that all prostheses included in this study were delivered in an academic environment with careful attention paid to ensure adequate prosthetic space and that all prostheses had a milled titanium bar substructure rather than a cast framework.

Retrievable crown

The most common complication observed in the retrievable crown prostheses included in this study was chipping and or fracturing of at least 1 restoration (occurring in 6 of 14 prostheses), all of which were porcelain-fused-metal restorations. This is similar to the results of Maló et al who found that mechanical complications occurred in 27 or 55% of prostheses restored with bilayer all-ceramic restorations, most of which were chipping and fracturing of the crowns.[15] However, it should be noted that several reports have been published using monolithic lithium disilicate restorations cemented onto a milled bar, with marked improvement in mechanical complications.[16,18]

Monolithic zirconia

For MZ prostheses, the most common complication noted in this study was wear of the opposing arch (2 of 7). This study is one of the first to examine clinically wear opposing full-arch zirconia restorations. Although in vitro studies indicate that well-polished zirconia can result in very little wear to the

opposing arch, the few clinical studies that exist on this topic demonstrate mixed results.[57,58] If the results of this study are consistent in larger sample sizes, it could indicate that either zirconia is not being polished ideally in routine clinical practice or that in vitro studies may not be adequately modeling clinical wear.

Porcelain-veneered zirconia

With PVZ prostheses, chipping and fracturing of the porcelain veneer was a commonly noted complication (3 of 6 prostheses). Early studies on full-arch porcelain-veneered zirconia noted similar or worse findings. For instance, in 2010 Larsson et al noted that 9 out of 10 prostheses chipped within the first 3 years.[28] These results might indicate that patient and provider desires for esthetic translucency leading to the selection of laminated zirconia can place the patient at risk of chipping. However, more recent studies on PVZ have indicated that with proper cutback design and laboratory protocols, incidence of complications may be dramatically reduced.[27,30] Many laboratory protocols have recently changed as a result of the chipping identified in earlier studies. The incidence reported in this study may indicate the laboratories had not yet adopted the developing changes in processing. It may also indicate that in the real world, laboratories may not be complying with the extended firing cycles now being recommended.

Oral health-related quality of life

The most important finding from the overall OHIP-49 scores was that the average patient had a very high OHQoL, patient satisfaction, regardless of the prosthetic material selected. Average OHIP-49 scores among prosthetic designs ranged from 7 to 29, which is consistent with Limmer et al.[22] Limmer et al is the only study to publish patient satisfaction data with MZ IFCDPs and found that 12 months after enrollment in the study, the average OHIP-49 score was 18 after having completed therapy with mandibular monolithic zirconia IFCDPs. The studies that examine MA IFCDPs have used OHIP-14,[37,39,40] and have reported correspondingly low OHIP-14 scores, also indicating high OHQoL. No studies have examined OHQoL with either RC or PVZ prostheses. No statistically significant differences were noted in oral health-related quality of life among the different prosthetic designs ($P = .16$), indicating that in the context of this study, all designs provided a treatment solution which satisfied patient expectations. Analysis of the individual subsections of the OHIP-49 questionnaire found a trend that functional limitation was the most important factor for all groups when measured as an average value per questions. Similarly, other recent articles indicate that patients with MA and MZ prostheses noted the greatest reduction in the categories of functional limitation, pain, and psychological discomfort.[22,39]

Effect of complications on oral health-related quality of life

In this study the number of complications was not found to be a predictor of the patient's OHQoL, overall satisfaction. This differs from some implant-supported overdenture studies, which have found a relationship between patients' OHQoL and therapeutic efficacy, functionality, and comfort, particularly during speech and mastication.[7,59,60] Additionally, it has been demonstrated with implant-supported overdentures that ongoing maintenance such as relining, adjustments, and changing the nylon retentive elements negatively impact patient well-being.[34] In contrast, a recent systematic review of patient satisfaction with conventional complete dentures notes that there is limited data to support a correlation between technical specifications of the denture and reported patient satisfaction.[61] Instead, psychosocial factors, such as the patient's relationship with the prosthodontist and patient self-image, including the patient's perception of esthetics and speech, cannot be underestimated.[61–63] Additionally, socioeconomic factors, such as employment status and level of education, as well as patient age and prior dental experiences have been found to play an important role in patient satisfaction with complete dentures.[35,60,64–66] These factors could play a similarly important role in patient satisfaction with IFCDPs, and might obscure a possible relationship between patient satisfaction and complications.

Patient interview

For the novel patient interview, the questions were open-ended. Therefore, patient responses were open-ended and varied in focus based on individual patient experiences. To summarize effectively, responses were pooled across all material types. Most patients were very (14%) to extremely satisfied (73%) with their therapy and thought their prostheses "looked great" (89%), which is consistent with previously published studies (Table 3).[39,40] In this study, some patients mentioned difficulty adjusting to the material bulk (14%) and frustration with food entrapment in the space between the prosthesis and the natural gingiva that went beyond a hygiene issue (8%). A similar concern was addressed by Oh et al who found that 13.8% of patients were dissatisfied with the way foreign substances got caught under their prosthesis.[39]

Most patients (84%) felt that chewing with their prosthesis was satisfactory, which is consistent with other clinical reports.[39,40] A third of patients felt that they could eat anything they wanted (34%), which was not mutually exclusive from the group of patients (38%) who actively tried to avoid foods they perceived as hard (ice, popcorn, nuts) and more likely to damage their prostheses. Unlike other reports, no patients noted any disruption of meals[40] or problems with chewing trauma to the lips and cheeks.[39]

In terms of the effect of the prostheses on speech, a wide variety of responses existed, ranging from "I have no problems" to "I had problems initially, but am fine now" to "I still have to focus on speaking clearly." Only a small percentage of patients (5%, Table 3) felt that they were still not able to speak clearly, whereas some (14%) said that their speech had actually improved since initiating therapy. Oh et al[39] reported 100% satisfaction with "comfort during pronunciation." Martín-Ares et al[40] reported that patients hardly ever had difficulty pronouncing certain words, and had significantly fewer problems with pronunciation than patients with complete dentures or overdentures.

Regarding hygiene of the prostheses, many patients (59%, Table 3) commented that a Waterpik helped significantly in

keeping their prostheses clean. Many patients (54%) commented that they did not feel that cleaning their prosthesis was particularly challenging or onerous, although some (16%) did mention that this took approximately 15–20 minutes daily. According to Martín-Ares et al, difficulty cleaning the prosthesis was the patient's biggest complaint with IFCDPs. Even still, they noted that these concerns arose infrequently.[40]

Limitations

The outcomes of this study reflect multiple providers treating patients according to their individual needs, rather than a prescribed study protocol. This may have allowed the introduction of clinician bias in planning prosthetic design and material selection, potentially reducing the reported complications for MA and PVZ prostheses, in particular. If a patient had certain characteristics that the provider might assume put the patient at risk for complications (ie, history of bruxism, young age, male gender, low Frankfort-mandibular plane angle, prior history of complications), he or she might have been planned for a more durable MZ prosthesis. Additionally, if the provider noticed a large number of acrylic tooth fractures during the provisional phase, a different prosthetic material may have been selected for the final prosthesis. Therefore, MA, and possibly PVZ prostheses could have had a greater incidence of complications if the patients had been randomized for prosthesis design. Although this lack of randomization and the influence of provider bias may raise concern regarding comparisons of complications among prosthetic materials, the data indicates that in an appropriate patient population, MA prostheses can result in acceptable clinical performance and high patient satisfaction.

One potential shortcoming of this study was that it did not assess the percentage of patients who routinely wore their occlusal guards. Although it was frequently mentioned in the patient interview section regarding TMJ concerns, routine use of occlusal guards was not quantified in any other way in this study. A more thorough assessment of occlusal guard use might have helped to understand the incidence of technical complications, including wear and fracture of both the prosthesis and the opposing arch. Practice guidelines now recommend such use when indicated by clinical signs.[67]

Due to the retrospective nature of this study, another limitation was difficulty differentiating between certain complications of interest (eg, occlusal wear) and iatrogenic causes (eg, occlusal adjustments). Additionally, the prostheses included in this study were fabricated by multiple laboratories with varying techniques. Lastly, it is important to note the small sample sizes for several of the study groups included in this paper, particularly MZ and PVZ prostheses. Therefore, the conclusions of this paper should be considered as preliminary, pilot study outcomes that need to be corroborated by future studies performed with larger sample sizes.

Conclusions

This retrospective study evaluated clinical and patient-centered experiences with MA, RC, MZ, and PVZ prosthetic designs. It is the first to report clinical OHQoL and patient satisfaction across multiple IFCDP prosthetic designs and relate it to the rate of complications. Results demonstrate overall patient satisfaction and high OHQoL across all prosthetic designs. However, future well-controlled prospective clinical trials are needed to corroborate our pilot results regarding the influence of prosthetic design on patient-centered outcomes. Within the limitations of this study, the following conclusions can be made:

1. Complications rates were high and varied based on prosthetic design and material.
2. Monolithic zirconia had the lowest incidence of complications.
3. Patients were satisfied with their prostheses regardless of prosthesis design and rate/occurrence of complications.
4. No difference in OHQoL was noted among patient-centered domains using OHIP-49.
5. Although patient interviews reported favorable outcomes, results indicate IFCDPs can have an impact on food selection, speech, and patient-perceived difficulty maintaining oral hygiene.

Abbreviations

ANOVA: analysis of variance
IFCDP: implant-supported fixed complete dental prosthesis
MA: metal–acrylic
MZ: monolithic zirconia
OHIP: Oral Health Impact Profile
OHQoL: oral health-related quality of life
PVZ: porcelain-veneered zirconia
RC: retrievable crown

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