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Esthetics and Full-Arch Implant Restorations

Management of edentulous patients with implant restorations can have a dramatic impact on the esthetic appearance of the dentofacial complex. Failure to visualize the intended result during diagnosis often renders definitive restorations inadequate structurally, functionally and esthetically. Appreciating factors that influence the esthetics of full-arch implant-supported restorations will permit their diagnostic consideration before therapy onset rather than after prosthesis placement, when it may be too late to make needed changes. In this issue of Prosthodontics Newsletter, we present a few esthetic considerations affecting the outcomes of these complicated restorations.

Overcoming Porcelain Chipping on Ceramic Crowns

Metal-ceramic fixed partial dentures (FPDs) provide reliable restorations but are often less than ideal from an esthetic perspective. All-ceramic crowns have shown survival rates comparable to those of metal-ceramic crowns but show significantly higher fracture rates in molars (as much as 1 in 5). Zirconia has a higher incidence of veneering porcelain chipping than do conventional tooth- and implant-supported metal-ceramic restorations.

Pozzi et al from the University of Rome Tor Vergata, Italy, conducted an exploratory study to test the survival and success of implants and prostheses in patients treated with monolithic lithium disilicate full-contour crowns bonded

on computer-aided design and computer-aided manufacture (CAD/CAM) complete-arch zirconia implant bridges. They hypothesized that this combination would overcome the drawbacks inherent in porcelain-fused-to-zirconia restorations.

Each study participant received 4 to 8 implants. Following a healing period of 3 months for the mandible and 4 months for the maxilla, open-tray implant impressions were obtained. CAD/CAM zirconium dioxide frameworks were designed based on the master cast and then reshaped to accommodate the proper seating of the single lithium disilicate crowns. After

the full-contour crowns were bonded to the framework, the remaining crowns were placed directly in the mouth.

During a 5-year follow-up, none of the 132 implants placed were lost, and all prostheses were functional at the end of the follow-up period. One chip of the veneering ceramic repaired by intraorally polishing was reported;

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Overcoming Porcelain Chipping On Ceramic Crowns

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no other mechanical complications occurred. All patients reported being functionally and esthetically pleased with their restorations.

Comment

Even if one of the crowns in this study fractured, this method would have allowed a fractured crown to be directly repaired immediately in the patient's mouth. The flexibility of employing single monolithic lithium disilicate full-contour crowns bonded on CAD/CAM screw-retained implant-supported zirconium dioxide complete-arch frameworks makes this technique one to be placed in the practitioner's armamentarium.

Pozzi A, Tallarico M, Barlattani A. Monolithic lithium disilicate full-contour crowns bonded on CAD/CAM zirconia complete-arch implant bridges with 3 to 5 years of follow-up. J Oral Implantol 2015;41:450-458.

Satisfaction With Maxillary Implant-Supported Dentures

Although implant-supported overdentures represent the standard of care for mandibular edentulism, scientific evidence pointing to the preferred treatment of maxillary edentulism is less clear. A denture retained with 2 implants could be a straightforward, minimally invasive and cost-effective treatment for patients with difficulty retaining

maxillary complete dentures. Zembic and Wismeijer of the Academic Centre for Dentistry Amsterdam (ACTA), the Netherlands, conducted a prospective clinical study of patient-reported outcomes for maxillary conventional dentures and implant-supported dentures.

The patients enrolled in the study had had an edentulous maxilla for ≥ 1 year and had been wearing definitive dentures for ≥ 6 months. Each patient reported difficulties with their existing dentures and had been referred to the clinic for implant treatment. When the patient's existing dentures met functional and esthetic criteria with only minor deviation, they were adjusted as needed. When the patient's dentures did not meet functional and esthetic criteria, new ones were made. Patients in both groups then received implant-supported dentures.

Outcomes were evaluated using the Oral Health Impact Profile (OHIP-20E), whose 20 questions fall into 7 domains covering a wide range of possible oral health problems that can have an impact on the patients' oral health-related quality of life. Patient satisfaction with their existing dentures before treatment, their revised dentures 2 months after beginning

treatment and their implant-supported dentures 2 months after insertion was measured using a 100-mm visual analog scale (VAS).

Of the 21 patients enrolled in the study, 12 received a new set of conventional maxillary dentures; the dentures of the remaining 9 were relined or rebased as necessary. Patients receiving new conventional dentures reported an increase in satisfaction across all OHIP domains. All patients subsequently reported further satisfaction after receiving implant-supported dentures. Significantly better scores were also seen when comparing general variables, including esthetics (Table 1).

Comment

The authors recommended that newly edentulous patients first be provided with adequate conventional dentures to allow for appropriate denture adaption. Patients who have already received conventional dentures and found them inadequate should benefit from treatment with maxillary implant-supported overdentures.

Zembic A, Wismeijer D. Patient-reported outcomes of maxillary implant-supported overdentures compared with conventional dentures. Clin Oral Implants Res 2014;25:441-450.

Table 1. Patient satisfaction score (mean mm on VAS) for old dentures, new dentures and implant-retained dentures.

	Old conventional dentures	New conventional dentures	Implant-retained dentures
General satisfaction	33.7 ^a	63.0 ^a	84.0
Comfort	33.2 ^a	65.2	75.0
Esthetics	58.6 ^a	76.5	83.7
Stability	39.1 ^a	57.2 ^a	73.0
Chewing ability	32.4 ^a	50.7 ^a	74.2
Cleaning ability	83.1	92.0	86.1
Ability to speak	53.3 ^a	62.2 ^a	26.9

^aSignificantly different from implant-retained dentures score ($p < .05$).

Satisfaction With Maxillary Dentures

While extensive evidence supporting the benefits of mandibular implant overdentures exists compared with conventional mandibular dentures, there is evidence evaluating patient-centered benefits of maxillary implant overdentures. Given the difference in cost and chair time required between complete dentures and implant and overdenture therapy, maxillary complete dentures remain an important treatment option.

Thalji et al from the University of Iowa conducted a systematic review of available literature to report the level of patient satisfaction with maxillary complete denture therapy. They also reported common complications with this therapy. For the data, they searched 4 major databases of medical publications and conducted a hand search of reference lists found in relevant articles. The search resulted in 31 articles that met the inclusion criteria of prospective comparative studies, cohort prospective studies and retrospective studies with >10 patients in each, for a total of 5485 participants ranging from 39 to 89 years in age.

The studies' general finding was an increase in oral health-related quality of life (OHQoL). Patients reported significant improvements in Oral Health Impact Profile for edentulous patients (OHIP-EDENT) scores and a preference for complete dentures rather than removable partial dentures. Improvements in esthetics and speech assessments underscored the role that maxillary dentures can play

in increased OHQoL. Satisfaction with maxillary dentures was greater than with mandibular dentures.

Comment

This systematic review indicated that providing new maxillary complete dentures for edentulous patients increased their OHQoL through meeting their high expectations for esthetic and phonetic rehabilitation.

Thalji G, McGraw K, Cooper LF. Maxillary complete denture outcomes: a systematic review of patient-based outcomes. Int J Oral Maxillofac Implants 2016;31 (Suppl):s169-s181.

A Template for Prosthesis Design

While an implant-supported fixed prosthesis can provide excellent esthetic, phonetic and hygienic results in patients with a minimally resorbed residual ridge, planning for patients with moderate or advanced loss of hard and soft tissue presents a complex challenge. Beyond the precise determination of implant position and angulation, determining the correct prosthetic parameters requires consideration of treatment decisions on esthetic results.

Avrampou et al from the University of Bern, Switzerland, attempted to evaluate and identify the key prosthetic parameters in the edentulous anterior maxilla that would guide the choice between fixed and removable implant prostheses when using treatment planning software. They studied the computed tomography (CT) scans or digital volume tomograms (DVT) of 43 patients evaluated for implant-

Figure 1. Classification for decision-making based on the proposed criteria.

		Mucosal Coverage (MucCov)		
		0 mm	0–5 mm	5 mm
Prosthesis Profile (ProsthProfile)	≥45 degrees	A Fixed prosthesis Crown design	B Probably fixed prosthesis Hybrid design	C Removable overdenture or total prosthesis
	30–45 degrees	B Probably fixed prosthesis Hybrid design		
	≤30 degrees	C Removable overdenture or total prosthesis		

supported prostheses after presenting with an edentulous maxilla. After establishing the central cervical point (C point), acrylic flange border (F point) and implant platform buccal end for each anterior tooth (I point), they created 4 measurements:

- vertical distance from the C point to the F point, representing flange height
- vertical distance from the I point to the F point, representing the coverage of the mucosa from the acrylic flange above the implant neck
- distance from the C point to the I point, an important measurement for the emergent profile of prosthetic reconstructions and the need for artificial soft tissue replacement
- buccal profile of the prosthesis as determined by the angle between the tangential line connecting the C point, I point and horizontal plane

From these determinations, the researchers proposed a classification for decision-making:

- **Class A:** a fixed prosthesis with a crown design (mucosal coverage ≤0 mm and prosthetic profile ≥45°)
- **Class B:** a fixed prosthesis with a hybrid design (mucosal coverage



0–5 mm and/or prosthetic profile 30–45°)

► **Class C:** a removable prosthesis with a buccal flange (mucosal coverage ≥ 5 mm and/or prosthetic profile $\leq 30^\circ$; Figure 1)

Among the study's patients, the majority required prosthetic materials to fill the space between the prosthetic crown and implant platform, along with a buccal flange to provide lip and facial support.

Comment

The study's proposed classification system can be used as a guideline to simplify the planning process by increasing the predictability of esthetic and functional treatment outcomes. Due to the prevalence of moderate or advanced maxillary atrophy among this patient group, fixed implant-supported prostheses with a crown design were suitable for only a few.

Avram̃ou M, Mericske-Stern R, Blatz MR, Katsoulis J. Virtual implant planning in the edentulous maxilla: criteria for decision making of prosthesis design. Clin Oral Implants Res 2013;24 (Suppl A100):152-159.

Wax Try-in as a Planning Tool

It has been recommended that a wax try-in be used to determine the appropriate type of prosthesis and its effect of the future prosthesis on oral tissue support. However, its diagnostic potential and the effect of subsequent design modification on the patient's lips have not been widely studied. Uhlendorf et al from the Latin American Institute of Dental Research and Education, Brazil, undertook a study to determine the reliability of

a wax try-in in planning a maxillary implant-supported fixed prosthesis.

The study enrolled 9 women who wished to replace their maxillary dentures with implant-supported fixed prostheses. All were in good general health with sufficient bone for implant placement, an esthetically adequate maxillary complete denture, and a dentate or rehabilitated mandible. Treatment planning included a wax try-in, which was obtained using

- anatomical impression
- functional impression using a customized tray
- construction and adjustment of the registration rim on a test base without a buccal flange in the anterior segment
- mounting in a semi-adjustable articulator
- mounting of teeth
- clinical testing

Absence of an anterior flange allowed the model to simulate lip esthetics of the future implant-supported fixed prosthesis. Eight patients were satisfied with the lip design created with the wax try-in in place; the ninth wanted greater lip support and agreed to use a removable acrylic epithesis to achieve the desired look. Cephalograms, one with the conventional denture and one with the wax try-in, showed the nasolabial angle and Steiner's S-line (the line connecting the midpoint of the nose and the soft tissue pogonion). A final cephalogram was obtained after placement of the implant-supported prosthesis.

No significant differences were found between measurements obtained with the wax try-in evaluation and the final prosthesis for nasolabial angle

and Steiner's S-line. Nor were any significant differences found for measurements of vertical or horizontal compensation.

Comment

These results showed that replacing maxillary dentures with a fixed implant-supported prosthesis effectively maintains a patient's lip profile. A wax try-in accurately predicts labial design and prosthetic compensation.

Uhlendorf Y, de Mattias Sartori IA, Moreira Melo AC, Uhlendorf J. Changes in lip profile of edentulous patients after placement of maxillary implant-supported fixed prosthesis: is a wax try-in a reliable diagnostic tool? Int J Oral Maxillofac Implants 2017;32:593-597.

In the Next Issue

Two-implant mandibular overdentures: bar vs stud attachments

Our next report features a discussion of this issue and the studies that analyze them, as well as other articles exploring topics of vital interest to you as a practitioner.

Do you or your staff have any questions or comments about **Prosthodontics Newsletter**? Please write or call our office. We would be happy to hear from you.

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