Alternative Treatment for Edentulous Patients

Patients who are edentulous in the maxilla often desire a treatment that is esthetic, fixed in terms of retention and stability, and does not cover the palate, yet is easily cleansable. Although fixed, complete prostheses may meet the requirements of stability, retention and no palatal coverage, they may not allow the patient to maintain adequate hygiene, and they may not provide the required esthetic result in patients who need additional lip support due to loss of bone and soft tissue. This issue of Report on Prosthodontics demonstrates an alternative treatment option that can be best provided by a prosthodontist.

Choosing an Implant-supported Prosthesis for the Edentulous Maxilla

Edentulous patients may present with missing clinical crowns only, or they may present with missing teeth and a combination of resorbed alveolar bone and loss of soft tissue. Although design variations of implant-supported fixed prostheses include everything from metal-ceramic restorations to profile prostheses designed with ovate pontics to prevent phonetic problems related to air escape, these prostheses often do not provide adequate facial support and may be difficult for the patient to clean.

Often, the initial prosthesis that comes to mind to replace the missing hard- and soft-tissue structures and restore the patients' esthetic and functional health is the removable prosthesis. However, this prosthesis may not meet the patient's expectations for a fixed prosthesis. An alternative to the implant-retained overdenture, the Marius bridge is a fixed-removable design that consists of a milled titanium or cast mesobar that supports a patient-removable superstructure held in place with a locking mechanism.

Bedrossian et al from the University of the Pacific, California, provided a preliminary screening evaluation to aid the clinician in determining the most appropriate fixed implant-supported prosthesis for a patient. Using the presence or absence of a composite defect, visibility of the residual ridge crest and radiographic evaluation of the...
location of alveolar bone available for placement, the prosthodontist may make preliminary decisions with regard to prosthesis type and design prior to a full diagnostic workup. Patients missing soft tissue and supporting bone in addition to teeth are considered to have a composite defect. To evaluate the defect, the thickness of the patient’s denture may be examined. Patients who have no space between the cervical portion of the denture teeth and the edentulous ridge in either the horizontal or vertical plane have only a tooth defect. Figure 1 identifies the most appropriate prosthesis design based on presence or absence of a composite defect in conjunction with visibility of the residual ridge crest (anterior maxilla and buccal corridor) when the patient smiles.

The third criterion in this screening evaluation is the assessment of available bone for implant placement by region: Zone 1—anterior region, Zone 2—premolar region and Zone 3—molar region. Table 1 provides guidelines for prosthesis type based on placing 4 implants in available bone within the various regions. While completion of the preoperative prosthodontic workup will provide the definitive treatment plan, this screening protocol can quickly identify clinical limitations to a fixed implant-supported prosthesis that can be addressed by a Marius bridge. This protocol also shows the importance of the diagnostic and prosthetic skills of a prosthodontist and his or her role as an implant teammate.

### Table 1. Guidelines for surgical approach

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<thead>
<tr>
<th>Bone present for implants</th>
<th>Posterior surgical approach</th>
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<tbody>
<tr>
<td>Zone 1, 2, 3</td>
<td>Traditional implants</td>
</tr>
<tr>
<td>Zone 1, 2</td>
<td>Inclined implants, posterior implants</td>
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<td></td>
<td>Traditional anterior implants</td>
</tr>
<tr>
<td>Zone 1 only</td>
<td>Zygomatic implants or sinus-inlay grafting</td>
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<tr>
<td></td>
<td>followed by implants</td>
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<tr>
<td></td>
<td>Traditional anterior implants</td>
</tr>
<tr>
<td>Insufficient bone in any zone</td>
<td>4 zygomatic implants or Brånemark horseshoe graft followed by a traditional implant</td>
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**Figure 1. Flowchart of clinical evaluation.**


**Treatment Planning for the Edentulous Maxilla**

As in all phases of dentistry, diagnosis is critical to obtain a predictable outcome. Proper diagnosis and treatment planning are key to implant treatment, particularly in the edentulous maxilla. Jivraj et al from the University of Southern California provided criteria to guide the clinician through the decision-making process when planning treatment, based on diagnosis of the clinical situation of the edentulous maxilla. Six factors should be considered when determining the prosthesis design:

1. esthetics and patient desires,
2. type of support,
3. amount of resorption and interarch space,
4. number of implants,
5. implant distribution and
6. economics.

Several of these factors are interrelated. For example, severity of bone resorption has an impact not only on the type of support but on esthetics, amount of interarch space, and the number of implants and their distribution. The authors demonstrated this point through case studies that represent 4 different prosthesis designs: fixed ceramo-metal prosthesis, ceramo-metal prosthesis with pink ceramic, implant-supported overdenture, and implant- and tissue-supported overdenture.
Because 13–15 mm of interarch space is required, the implant-supported overdenture is an ideal solution for the patient with an atrophic maxilla who desires something more fixed in nature. Four to 6 implants are recommended for an implant-supported overdenture. A sufficient antero–posterior spread is needed to distribute the occlusal load and minimize the cantilever length.

This study demonstrated the importance of diagnosis in the development of the treatment plan. Without a thorough evaluation of the key factors that will affect the outcome of the edentulous maxilla, a successful result may not occur.


The Marius Bridge: A Fixed Solution Without Bone Grafting

Implant-supported prostheses are often the treatment of choice for the completely edentulous patient. However, when loss of alveolar supporting bone and soft tissue accompanies tooth loss, implant-retained overdentures have often been the prescribed treatment option. While these prostheses are resilient in nature due to their soft-tissue support, patients often desire a restoration with less resiliency. The Marius bridge was developed to provide a fixed removable solution for the edentulous maxilla that would restore the hard- and soft-tissue defects without bone grafting.

Unlike an implant-retained overdenture, the Marius bridge is not tissue supported; its acrylic extensions serve only to replace lost hard and soft tissue. It has a fixed mesostructure with a high precision attachment mechanism that allows the patient to easily remove its superstructure.

Aptekar, a private practitioner from Ontario, outlined the advantages and treatment sequence for a Marius bridge prosthesis. Due to its 2-part nature, this type of prosthesis is more readily cleanable. The removable superstructure permits ease of repair and/or modification. Upon removal of the superstructure, the mesostructure may be cleaned using traditional hygiene resources. Additionally, posterior implants may be placed at 30–45° angles, which allows for implant placement in areas where grafting might have been needed. This allows for implant therapy in patients who, due to cost constraints or anatomical considerations, might not otherwise have been treated with an implant-supported prosthesis. Table 2 lists the key concepts of this prosthesis design.

The accompanying case report featured a 60-year-old edentulous man who expressed dissatisfaction with his dentures. Four implants were placed in the maxilla, and 4 were placed in the mandible. At 5 months, all implants showed complete osseointegration. After a wax try-in, the patient received a custom-milled Procera framework and attachment bar. The Marius bridge was then attached, and the patient was shown how to remove the bridge with the key, and instructed on appropriate oral hygiene.

Fortin, a private practitioner from Quebec, et al reported on a 5-year retrospective clinical study of 45 consecutive patients treated with a Marius bridge in the maxilla. Patients required a flange extension for lip support and had sufficient bone to place ≥3.75-mm implants. A minimum of 4 implants were placed in each patient. Survival criteria were defined as a clinically stable and functional restoration and an absence of discomfort. Patients were also evaluated for their esthetic, phonetic, psychological and functional satisfaction.

The patients were assessed at 6-month intervals. Eighty-seven percent (39/45) of the patients were followed through the 5-year study period. The cumulative implant survival rate was 97%; the prosthesis survival rate was 100%. All patients were satisfied with the esthetic, phonetic, psychological and functional aspects posttreatment. The few complications noted over the 5-year period included 9 incidences of

<table>
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<th>Table 2. Key factors in the Marius bridge concept</th>
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<tr>
<td>1 Placement of implants in the posterior region along the anterior ascending wall of the maxillary sinus</td>
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<tr>
<td>2 Placement of implants in the anterior region adjacent to the incisal foramen</td>
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<tr>
<td>3 Use of an anterior undercut (approximately 20°) in the mesobar to provide primary retention for the superstructure with bilateral posterior locking mechanisms</td>
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<td>4 Presentation to the patient as a fixed bridge that is removable for oral hygiene</td>
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attachment component complications, 1 mesobar fracture and 3 observations of gingival inflammation.

These studies suggest that the Marius bridge is an excellent alternative treatment option for patients who desire the retentive and stability aspects of a fixed implant-supported restoration but who have lost both hard and soft tissue. The survival rates compare favorably with other implant-supported prostheses, indicating a viable long-term treatment option. However, the precise nature of the milled bars and attachment mechanism in the Marius bridge requires the prosthodontist’s expertise to ensure the desired outcome. The majority of complications involved the attachment mechanism, which would suggest the importance of regular follow-up care by a prosthodontist.


Implant-retained Maxillary Overdenture: A 10-year Follow-up

Visser et al from University Medical Center Groningen, the Netherlands, studied 39 consecutive patients with edentulous maxillae who reported problems wearing conventional maxillary dentures and were treated with an overdenture supported by 6 Brånemark implants and a milled-bar mesostructure with Ceka attachments. The patients’ inability to wear their conventional dentures was the result of anatomical problems (n = 24), gagging problems (n = 9) or other (subjective) problems (n = 6). In all cases the bone volume was insufficient for implant placement without sinus augmentation.

Surgical, prosthetic and follow-up care of the 3 groups, along with patient satisfaction, was evaluated over a 10-year period (average number of sessions, 57; average treatment time, 19.5 hours). Two patients required >1 augmentation surgery, and several patients required additional implant placement surgeries due to the loss of their implants. The overall 10-year implant survival rate was 86.1%; loss of implants occurred mainly in the first year after placement. The majority of prosthetic aftercare (an average of 7.4 hours over the 10-year period) consisted of routine examinations, oral hygiene care, and activation or replacement of Ceka attachments. Patient satisfaction remained high throughout the 10-year period.

The moderate survival rate observed in this study may be due in part to the large number of patients with severely resorbed maxillae who required major sinus augmentation, and the use of smooth-turned implants. These implants, placed between 1990 and 1996, have been superseded by implants with a Ti-Unite surface, whose survival rate is higher. Because these patients would not be candidates for implant-retained fixed partial dentures, this treatment modality may be the most effective. Most of the patients with gagging problems were unable to wear their conventional maxillary dentures; these patients showed a slightly higher satisfaction rate with implant-retained overdentures compared with the other 2 groups. This study presents a treatment option that may improve the quality of life among patients who might otherwise have difficulties functioning in society.


In the Next Issue:

- Indications and timing for the use of implants in the adolescent
- Recommendations for timing of implant placement in the growing patient
- Implants in children with ectodermal dysplasia
- Treatment options for congenitally missing mandibular second molars

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