For a dental implant-supported prosthesis in the anterior maxilla to be esthetically satisfactory, it must replicate the region’s hard and soft tissues. Morton et al from the University of Louisville, Kentucky, developed a consensus statement regarding the optimization of esthetic outcomes in implant dentistry, which was delivered in 2013 as part of the Fifth International Team for Implantology (ITI) Consensus Conference. The consensus statement was developed based on evidence from 3 systematic reviews that had been delivered at the conference:

1. Chen and Buser assessed the impact of the timing of dental implant placement and bone augmentation techniques with regard to its influence on esthetic outcomes.

2. Levine et al addressed procedures used to treat mucosal defects subsequent to implant placement and restoration in the esthetic region.

3. Martin et al assessed the effect of various restorative procedures on esthetic outcomes.

These 3 systematic reviews relied on data primarily from case series, because relatively few randomized controlled trials and cohort studies have been conducted. Nevertheless, significant and valuable information was obtained from these reviews.

In the anterior maxilla, esthetic outcomes can be attained at postextraction sites regardless of implant placement time. However, for immediate placement, certain clinical conditions should be present, including:

- intact socket walls
- facial bone wall ≥1 mm thick
- absence of acute infection at the site
- availability of bone apical and palatal to the socket to provide primary stability

No consensus could be reached regarding soft tissue augmentation procedures to treat facial soft tissue defects in the esthetic zone. Some improvement of the soft tissue, such as...
Esthetic Outcomes With Immediate And Early Implant Placement

At the Third International Team for Implantology (ITI) Consensus Conference in 2003, Belser et al noted the lack of well-defined scales to evaluate esthetic outcomes for implants placed in the esthetic zone. Since then, a significant number of studies have reported esthetic results achieved with implants replacing maxillary anterior teeth using 2 standard esthetic measures:

1 positional changes in the peri-implant mucosa
2 esthetic indices, including the Pink Esthetic Score (PES), the White Esthetic Score (WES) and the Subjective Esthetic Score (SES)

The PES, which focuses on the soft tissue aspects of the anterior implant restoration, evaluates the mesial and distal papilla, the level of soft tissue margin, the alveolar process, and the soft tissue contour, color and texture. Each of these 7 soft tissue esthetic parameters is allocated a score of 0, 1 or 2, up to a maximum total score of 14. The WES allocates scores of 0, 1 or 2 to 5 prosthesis-related parameters, up to a maximum total score of 10. The SES ranks soft tissue–related outcomes, according to the amount of mucosal recession and volume of the soft tissues, on a scale of 1 to 4.

Chen from the University of Melbourne, Australia, and Buser from the University of Bern, Switzerland, performed a systematic review to determine quantitatively the esthetic outcomes of implants inserted in postextraction sites and to assess the impact of simultaneous bone augmentation on these outcomes.

A literature search on the topic yielded 1686 titles that included 114 potentially relevant full-text articles; the 50 selected for data extraction included 6 randomized controlled trials, 6 cohort studies, 5 cross-sectional studies and 33 case series.

Esthetic Parameters Outcomes

1 Outcomes based on changes in the peri-implant mucosa: Regarding positional changes of the midfacial peri-implant mucosa, the authors reviewed 3 randomized controlled studies and 4 cohort studies that compared outcomes based on the timing of implant placement. The results of these studies demonstrated no variances when the immediate and early implant-placement techniques were utilized. However, a slight degree of recession (approximately 0.5 mm) of the midfacial mucosa was observed following implant placement. Also, immediately placed implants demonstrated a more frequent occurrence of ≥1 mm recession of the midfacial mucosa. The potential for mucosal recession exists in cases where there are preexisting defects of the facial bone; thin facial bone; thin soft tissue biotype; and facial malpositioning of the implant. For the papillae, regardless of the timing of the implant placement, 0.5 mm to 1 mm of recession can be expected.

2 Outcomes based on esthetic indices: The large majority of studies employing esthetic indices were case series that used the PES. Results revealed that reasonable esthetic results can be obtained with both immediate and early implant placement.

Conclusion

The authors concluded that both immediate and early implant placement protocols can provide an acceptable esthetic outcome for single-tooth implants placed in the maxillary anterior and premolar regions.
regions following tooth extraction. Compared with early implant placement, immediate implant placement was observed to have greater unpredictability in outcomes and a higher incidence of recession of >1 mm of the midfacial mucosa 1 to 3 years after implant placement.

The integrity of the facial bone should be considered as a vital factor for long-term stability of esthetic outcomes. The resorption and modeling of the alveolar ridge in postextraction sites have the potential to influence esthetic results.


Association of Sinus Membrane Thickening with Unhealthy Teeth

Prior to undertaking surgery in the posterior maxilla, the dental clinician should investigate the anatomic variability of the bony structures (Figure 1), as well as the existing pathology of the maxillary sinus. The investigation should include bone quantity and quality, the periodontal status of the contiguous dentition, history of odontalgia and the existence of sinus pathology. Cone-beam computed tomography (CBCT) is one of the technological tools available to view the maxillary sinus and detect sinus membrane thickening or other pathology.

Block, a private practitioner from Louisiana, and Dastoury from the Louisiana State University School of Dentistry performed a retrospective review of patients in a private practice setting receiving CBCT for the purpose of

1 determining the prevalence of sinus membrane thickening in a consecutive series of patients
2 identifying the prevalence of healthy and unhealthy teeth associated with sinus membrane thickening
3 documenting the changes of the sinus membrane after the removal of unhealthy teeth

The authors evaluated 831 consecutive patients (1662 sinuses) with CBCT. The sinus membrane thickening was graded as follows:

- **Grade 1:** sinus membrane thickening of 0 mm to <2 mm (Figure 2)
- **Grade 2:** sinus membrane thickening of 2 mm to 5 mm
- **Grade 3:** sinus membrane thickening of >5 mm to the ostium
- **Grade 4:** sinus membrane thickening of soft tissue superior to the ostium

Mucosal thickening measured at >2 mm is considered to be a pathological sinus membrane. In the affected population, the greatest thickness appears to be found in the midsagittal sinus region and contiguous to the maxillary first and second molars. Odontogenic pathological tissues can initiate an inflammatory response in the adjacent sinus membrane.

The authors hypothesized that sinus membrane thickening would prove to be significantly related to the health of posterior maxillary teeth and that treatment of these unhealthy teeth would reduce sinus thickening after 3 to 6 months. An unhealthy tooth was defined as a tooth having a lytic lesion extending to its apical region of the tooth.

This review determined that the grade of sinus disease diminished following tooth removal, but the sinus disease failed to fully resolve. One possible explanation is epithelial metaplasia, with the ciliated mucosa changing from infected tissue to simple, noninfected cuboidal and stratified squamous keratinized mucosa.

The results of this retrospective review can be summarized as follows:

- Of the 831 patients, 46.7% (388 patients) had thickening of at least 1 sinus membrane.
- Of the 469 affected sinuses, 44.8% (210 sinuses) were associated with unhealthy teeth.
- Of the 30 sinuses associated with unhealthy teeth for which postextraction CBCT scans were available, 20 demonstrated a lower grade of sinus membrane thickening; 17 resolved to grade 1.

**Conclusion**

The prevalence of sinus membrane thickening adjacent to healthy and unhealthy teeth was almost equal. Preoperative evaluation of the maxillary sinus is particularly essential before initiating sinus augmentation.
procedures to increase the vertical bone height for the purpose of allowing implant placement, and in situations where odontogenic infection/pathology is present in the posterior maxilla.


Determining Micromotion At the Implant–Abutment Interface

Although studies demonstrate good survival rates for implant-supported prostheses, technical and biological complications occur frequently. One systematic review of single-implant crowns found a 12.7% collective occurrence of screw or abutment loosening. Stability of the screw-abutment junction is an essential ingredient to implant success. Micromotion at the implant–abutment junction interface, a result of technical problems, has been determined to be a major contributing factor of long-term implant failure.

Clinical loading may produce micromotion of the components at the prosthetic junction, which may result in prosthesis failure and an inflammatory process in the peri-

implant tissues from bacterial colonization in the microgap. The need to avoid micromovement between the implant and abutment, which affects crestal bone changes around 2-piece, nonsubmerged titanium implants, led to the introduction of platform switching as a likely remedy.

Additional parameters of micromotion phenomena at the implant–abutment interface include

- precision fit between implant and abutment
- antirotational features
- preload on the screws

Karl from the University of Erlangen-Nuremberg, Germany, and Taylor from the University of Connecticut conducted a study to assess micromotion at the implant–abutment interface. They fixed implant–abutment assemblies in a universal testing machine at a 30° angle, and then applied a cyclic load of 200 N to the assemblies 10×. The amount of micromotion was recorded through 5 consecutive loading cycles per specimen.

Results demonstrated that micromotion at the implant–abutment junction ranged from 1.52 µm to 94.00 µm. Lack of engagement of the antirotational features of the conical implants was associated with increased micromotion.

Casting onto prefabricated gold cylinders led to abutments with less micromotion than was found with copy-milled and stock abutments; computer-aided design/computer-assisted manufacture (CAD/CAM) zirconia abutments showed less micromotion than did CAD/CAM titanium abutments. Significant variations in micromotion were evident with clone abutments and clone implant systems, while tightening torque and micromotion showed an inverse relationship. The largest amount of micromotion occurred in implants with internal octagon connections, and the least amount of micromotion occurred in the internal trilobe connections.

Conclusion

The authors of this review utilized a novel mechanical approach to assess micromotion at the implant–abutment junction and measure the relative displacement of components that occurred at various magnitudes. They showed that it cannot be determined that a particular type of abutment will consistently result in a specific level of micromotion. They recommended that the dental clinician follow the manufacturer’s guidelines, including the recommended level of tightening torque, to reduce the possibility of micromotion. Routine retightening of the abutment screws is also needed.


In the next issue:

- Implants and lifelong craniofacial growth
- Implant survival and bone density
- Histological evaluation after coronectomy
- Prophylactic antibiotics for patients with replacement joints

Do you or your staff have any questions or comments about Report on Oral Surgery? Please call or write our office. We would be happy to hear from you.

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