Consensus Statements and Recommended Clinical Procedures Regarding Optimizing Esthetic Outcomes in Implant Dentistry

Dean Morton BDS, MS[1]/Stephen T. Chen, BDS, MDSc, PhD, FRACDS[2]/
William C. Martin, DMD, MS[3]/Robert A. Levine, DDS, FCPP[4]/Daniel Buser, DMD, Prof Dr Med Dent[5*]

INTRODUCTORY REMARKS

In the anterior maxilla, dental implant–supported prostheses need to replicate the dental hard and soft tissues in order to be esthetically acceptable. Three systematic reviews in Group 3 were prepared to address the topic of optimizing esthetic outcomes.

Following tooth extraction, the clinician has the choice of various time points to place implants. Implant placement postextraction is often accompanied by bone augmentation procedures to manage residual bone defects and enhance esthetic results. Thus, the first systematic review by Chen and Buser analyzed the influence of the timing of implant placement and bone augmentation procedures in relation to their effect on esthetic outcomes. Unfortunately, complications with implant treatment can occur. In the esthetic zone, these complications often lead to adverse esthetic results due to recession and deficiencies associated with the peri-implant soft tissues. The second paper by Levine et al therefore reviewed the literature on procedures to treat mucosal defects following the placement and restoration of implants in the esthetic zone. In order to achieve acceptable esthetic outcomes, a number of restorative procedures have been developed with the aim of optimizing esthetic outcomes with implant-supported prostheses. However, these procedures have not been evaluated in a systematic way to determine their efficacy in relation to esthetics. The aim of the third systematic review by Martin et al was therefore to assess the influence of various restorative procedures on esthetic outcomes.

From these three systematic reviews, a general observation was made that the available data on esthetic outcomes were predominantly represented by case series studies. Relatively few randomized controlled trials (RCTs) and cohort studies were identified, and a minority of these was judged to be at low risk of bias. Nevertheless, the case series studies provided invaluable information in establishing the current clinical trends in techniques and materials related to esthetic outcomes. Indeed, well-designed prospective case series studies of consecutively enrolled subjects with clearly defined inclusion and exclusion criteria can provide important information to validate clinical procedures and materials.

The group recognized that RCTs are not always feasible or ethical when clinical conditions that are known to increase the risk of adverse esthetic outcomes are under investigation. Implant treatment in the esthetic zone is a challenging procedure and classified as advanced or complex according to the SAC classification.[1] Most patients present with multiple esthetic risk factors and often have high expectations. If esthetic complications occur, they are usually difficult or im-

[1]Professor and Chair, Department of Oral Health and Rehabilitation, University of Louisville, School of Dentistry, Louisville, Kentucky, USA.
[2]Senior Fellow, Periodontics, Melbourne Dental School, The University of Melbourne, Parkville, Victoria, Australia.
[3]Clinical Associate Professor and Director, Center for Implant Dentistry, University of Florida, College of Dentistry, Gainesville, Florida, USA.
[4]Clinical Professor in Periodontics and Implantology, Kornberg School of Dentistry, Temple University, Philadelphia, Pennsylvania, USA.
[5]Professor and Chairman, Department of Oral Surgery and Stomatology, School of Dental Medicine, University of Bern, Bern, Switzerland.

Correspondence to: Dr Dean Morton, Professor and Chair, Department of Oral Health and Rehabilitation, University of Louisville, School of Dentistry, Louisville, KY 40292, USA. Email: dean.morton@louisville.edu

**On behalf of all participants and authors of Group 3: Mauricio Araújo, Diego Bechelli, Didier Blasé, Arne Boeckler, Paolo Casentini, David Cochran, Ivan Darby, Selim Ersanli, David Gratton, Guy Huynh-Ba, Chatchai Kunavisurat, Mario Roccuzzo, Hideaki Katsuyama, Francesca Vailati, Gerrit Wyma, Lei Zhou.*

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possible to manage. As a consequence, the prevention of esthetic complications should be a primary objective. Therefore, a conservative treatment approach is recommended to facilitate successful outcomes with high predictability and a low risk of complications.

Disclosure

All the group members were asked to reveal any conflicts of interest that could potentially influence the outcomes of the consensus deliberations. No such conflicts were identified.

ESTHETIC OUTCOMES FOLLOWING IMMEDIATE AND EARLY IMPLANT PLACEMENT IN THE ANTERIOR MAXILLA

Consensus Statement

The included studies reported on single-tooth implants in postextraction sites adjacent to natural teeth. For postextraction implant placement, esthetic outcomes determined by objective indices and positional changes of the peri-implant mucosa can be achieved in the majority of cases. However, adverse esthetic outcomes may occur.

Regarding the position of the soft tissues following immediate implant (type 1) placement, there is considerable variability. Following immediate implant placement, midfacial mucosal recession of 1 mm or more occurs in 9% to 41% (median, 26%) of sites between 1 and 3 years after implant placement.

The factors associated with midfacial recession for immediate implant placement are *(1)* thin facial bone plate, *(2)* lack of intact facial bone plate, *(3)* facial malposition of the implant, and *(4)* thin soft tissue biotype. Following immediate implant placement, the lack of a facial bone wall associated with increased mucosal recession is a frequent observation, based on two retrospective studies with small sample sizes.

Based on a small number of studies (one RCT and one case series), early implant placement (type 2 or 3) demonstrates no midfacial mucosal recession of 1 mm or more. Two studies of early implant placement (type 2) combined with simultaneous bone augmentation with guided bone regeneration (GBR) (contour augmentation) demonstrate a high frequency (above 90%) of a facial bone wall visible on cone beam computed tomography.

Treatment Guidelines

Esthetic outcomes can be achieved at postextraction sites irrespective of the timing of implant placement. Different placement times, however, present with specific treatment challenges and variable predictability of esthetic outcomes.

With immediate placement, a high level of clinical competence and experience in performing the treatment is needed. Careful case selection is required to achieve satisfactory esthetic outcomes. The following clinical conditions should be satisfied:

- Intact socket walls
- Facial bone wall at least 1 mm in thickness
- Thick soft tissue
- No acute infection at the site
- Availability of bone apical and palatal to the socket to provide primary stability

For immediate placement, a preoperative three-dimensional (3D) radiographic examination may be considered in determining the above-mentioned bony anatomical conditions and to assist in treatment planning.

For predictable esthetic outcomes with immediate placement with or without flap elevation, the following treatment requirements should be met:

- Correct 3D position of the implant platform (according to previous ITI recommendations).
- If that position falls within the extraction socket, a minimum distance of 2 mm between the implant platform and the inner surface of the facial socket wall should be present. A technique should be used to compensate for postextraction resorption, such as bone filler with a low substitution rate.

If these conditions are not met, immediate implant placement is not recommended.

The above-mentioned preconditions for immediate placement are rarely present. Thus, early implant placement (type 2) is the option of choice in most instances. If, however, it is anticipated that primary stability cannot be achieved, the postextraction healing period should be extended. Ridge preservation/augmentation procedures may be considered when implant placement needs to be delayed for patient- or site-related reasons.

To optimize the esthetic outcomes of early implant placement (type 2 and 3), the implant platform should be placed in the correct restoration-driven 3D position. Implant placement is combined with GBR using a low-substitution bone filler to overcontour the facial aspect of the ridge. This is followed by coverage of the augmentation material with a barrier membrane and submergence of the biomaterials.

Recommendations for Future Research

Further research is required to document the esthetic outcomes of postextraction implants using objective criteria. Studies should report on both positional and

volume changes of the peri-implant tissues (midfacial mucosal margin, implant papillae position, and bone volume).

In all study designs (case reports, case series studies, nonrandomized and randomized studies) the following core data should be reported:

- Full characterization of the socket dimensions
- Systemic, oral, and site-specific inclusion and exclusion criteria
- Consecutive enrollment of subjects with reporting of intention to treat and reasons for not treating
- Follow-up period of at least 1 year after the delivery of the final prosthesis
- The following baseline data should be described:
    - For immediate implant placement, the pretreatment position and volume of the marginal gingival tissue at the test site and the relationship to the adjacent/contralateral natural tooth.
    - For early (type 2 and 3) and late placement (type 4), the relationship of the test site(s) to the adjacent/contralateral natural tooth.
    - For reporting on esthetic indices, scores for the individual domains that make up the index should be reported. If the Pink Esthetic Score[2] is used, all seven domains should be evaluated and reported.
    - In addition to the mean, standard deviation, and range of the outcome variables, a frequency distribution analysis should be reported.
    - Patient-centered outcomes should be reported.

Further research is needed to investigate:

- The long-term stability of tissue volume
- The most suitable biomaterials to preserve/reconstruct the facial bone
- The influence of *(1)* the presence/absence of the facial bone, *(2)* dimensions of the socket, *(3)* thickness of the facial bone, and *(4)* position of the bone crest on esthetic outcomes

SOFT TISSUE AUGMENTATION PROCEDURES FOR MUCOSAL DEFECTS IN THE ESTHETIC ZONE

Consensus Statements

The included studies consisted predominantly of case reports and case series of small numbers and short duration. The studies did not always identify the etiology and timing of the facial soft tissue recession around single implants.

Periodontal soft tissue surgical procedures were applied to treat facial soft tissue recession. There is no consensus on how to treat a facial soft tissue defect in esthetic sites. In some of the papers, the implant restoration was removed and/or facially altered (crown, abutment, and/or implant) in order to facilitate the treatment.

Limited improvement of the soft tissue (including increase in soft tissue thickness, keratinized tissue width, and facial marginal soft tissue level) can be achieved following soft tissue augmentation procedures.

Following soft tissue augmentation procedures, complete resolution of the soft tissue defect ranged from 0% to 75% (3 studies; 32 patients).

Treatment Guidelines

A team approach and Esthetic Risk Assessment[3] should be utilized to improve predictability of an esthetic outcome and to reduce risk when managing soft tissue defects in the esthetic zone.

When soft tissue recession is found around a single-tooth implant, the clinician needs to diagnose the etiology based on evaluation of 3D implant position, restoration, existing hard and soft tissue support, as well as factitious (self-inflicted) injury such as tooth brushing and flossing trauma.

The surgical procedures to correct soft tissue facial recession around a single implant are complex. A systematic assessment and treatment protocol are required. The assessment should include the following:

- Patient's expectations
- Medical status
- Smoking habit
- Visibility of defect upon smiling
- Width of keratinized tissue remaining at the defect site
- Restoration contour
- Infection at the implant site
- Contributing patient-related factors
- 3D implant position
- Proximity of implant to adjacent teeth
- Interproximal radiographic bone loss
- Scarring of soft tissue at implant site

When the above-mentioned factors are favorable, hard and/or soft tissue augmentation procedures can be effective. The patient should be made aware of the high variability of the outcome. When the above-mentioned factors are unfavorable, hard and/or soft tissue augmentation procedures are less effective. Restorative modifications (abutment/crown replacement and/or reshaping) combined with a surgical approach may be indicated. Implant removal should also

be considered as an option. When an implant needs to be removed, techniques that minimize bone loss are preferred. Specialized implant removal kits are available and preferred to trephines.

Recommendations for Future Research

Future studies on the correction of soft tissue defects around single-tooth implants in esthetic sites should provide objective, quantitative outcome measurements.

The etiology of soft tissue defects on implants in the esthetic area need to be investigated. Future studies should include randomized trials comparing techniques to correct soft tissue defects on single implants in the esthetic zone. Alternatively, cohort studies involving sufficient numbers of patients, treated prospectively and consecutively, and having at least 12 months of follow-up could be evaluated.

Future research should distinguish if a surgical approach alone, a restorative approach alone, or a combination therapy is necessary. Future research should distinguish the optimal surgical technique, including incision design, and the type and shape of the augmentation material.

New therapeutic approaches and materials need to be investigated for the treatment of soft tissue defects around single and multiple implants in esthetic sites, such as the use of stem cells, growth factors, synthetic materials, etc.

THE INFLUENCE OF RESTORATIVE PROCEDURES ON ESTHETIC OUTCOMES IN IMPLANT DENTISTRY

Consensus Statements

The available literature does not demonstrate that esthetic outcomes can be improved by:

- The use of surgical templates (surgical guides)
- The utilization of implant-retained provisional prostheses
- The timing of provisional implant-retained prostheses
- The mode of prosthesis retention (cement- or screw-retained)

There is limited evidence (one study) reporting improved esthetic outcomes (color matching) in implant dentistry associated with ceramic abutment/prosthesis combination.

Esthetic outcomes can be improved (mean, 0.3 mm on the midfacial mucosal margin) by the presence of a horizontal offset, or platform switch (smaller abutment diameter).

Treatment Guidelines

The use of surgical templates, developed from a restoration-driven approach that communicates the optimal implant position in 3D respecting the comfort zones as reported in previous ITI publications, is recommended.

The use of provisional implant-retained restorations in the esthetic zone is recommended. Provisional restorations enhance communication between all members of the treatment team and the patient. They should be anatomically and functionally correct, and respect the emergence profile of the restoration apical to the planned mucosal margin (highest convexity) to allow for maximum tissue volume. Screw retention of the interim restoration is considered advantageous for multiple reasons (retrievability, tissue shaping, tissue health and maturation, ease of modification).

Immediate loading or restoration of an implant cannot be recommended as a routine procedure because risks are elevated and esthetic outcomes are variable. In agreement with previously published ITI documents, early loading of dental implants in the esthetic zone is recommended.

In sites of elevated esthetic risk, a horizontally offset (platform switched) implant/abutment design is advantageous for single-tooth replacements. Further, an oversized implant platform and prosthetic components must be avoided to respect the interproximal and facial regions of the site.

The abutment and prosthesis material are a patient- and site-specific choice for the clinician. Provided that the material chosen is of high quality and documented, the design of the abutment and/or prosthesis is more critical than the material chosen, for reasons including:

- Controlling emergence profile
- Material properties and strength
- Access to finish lines
- Retrievability

In patients with thin tissues, a tooth-colored abutment and/or final prosthesis emerging through the tissues can offer esthetic advantages. When the implant angulation allows, screw retention of the prosthesis offers clinical advantages.

Recommendations for Future Research

These recommendations may exhibit crossover with other groups in the ITI Consensus Conference due to the similarity of topic. The following are noted with specific reference to achieving esthetic outcomes in implant dentistry:

- In studies that address esthetic outcomes, documentation is needed to report the use and design of templates (ie, based upon a prosthesis-driven plan) utilized.
- Studies are needed that report the characteristics specific to the implant-retained provisional prosthesis (emergence profile and dimension in the tissue, material, mode of manufacture, timing of placement, surface texture, and retention).
- Regarding abutments and crowns, all aspects of the indications and use of materials, combinations, and compatibility of components in diverse treatment indications should be reported. In particular, the mode of manufacture should be detailed.
- The influence of the implant shoulder design in single and extended edentulous situations on esthetic outcomes should be reported.
- When using objective esthetic assessment indices, consistency in reporting should be utilized. A system for weighting the different factors that may contribute to esthetic outcomes should be developed.
- Research into the development of root/tooth-colored implant materials that exhibit proven mechanical and biologic properties with success and survival rates comparable to currently accepted implants is recommended.

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