

Consensus Statements and Recommended Clinical Procedures Regarding the Placement of Implants in Extraction Sockets

Primary authors: Christoph H. F. Hämmerle, Stephen T. Chen, Thomas G. Wilson Jr

INTRODUCTORY REMARKS

High clinical success rates have been reported when implants are placed according to standard indications. This has encouraged efforts to improve the success rates for implants placed in more demanding clinical situations. One of these indications is tooth replacement with implants placed into extraction sockets. Although the first clinical procedures for the placement of implants immediately following tooth removal were described long ago, it is only recently that the details of such clinical approaches have been studied in greater detail.

One of the aims of the present consensus meeting was to scrutinize the available literature to identify predictable and successful procedures for replacing extracted teeth with implant-supported reconstructions. In addition, where the data from the literature were inconclusive or absent, the clinical experience of the members of the consensus group was used as the basis for the recommendations.

In order to reach this aim, 2 reviews were written for group 1 in preparation for the consensus meeting. One review focused on implant placement immediately following tooth extraction, while the other focused on the delayed and late placement of implants. During the consensus meeting, it was decided by majority vote of the group that the 2 reviews be merged into a single paper. The purpose of this merger was to present 1 comprehensive review of the topic of timing of implant placement into extraction sockets and to avoid the presentation of duplicate information.

In addition to the data reported in the review, all information published in the literature before the

consensus meeting served as a basis for the consensus statements. Unpublished literature, which could not be scrutinized by all group members, was not considered in the decision process.

Topics were openly discussed within the group, and all participants were given the chance to express their interpretation of the data available in the literature. After thorough discussion, consensus was reached by taking a vote among the group participants. If a significant majority was obtained, the consensus statement in question was accepted. In situations where no significant majority could be reached, the discussions were either continued until such a majority was reached or, if a significant majority could not be reached, no consensus statement was produced on the topic in question. These same procedures were followed for reaching consensus on the new classification.

Although classifications that define timing for implant placement have been published in the past, the group agreed that the development of a new classification was necessary to incorporate increased knowledge in this field and to reflect the procedures commonly applied in clinical practice. There was consensus that such a classification should be based on morphologic, dimensional, and histologic changes that follow tooth extraction and on common practice derived from clinical experience. The classification adopted by the consensus group, which has not yet been validated, is depicted in Table 1. Key aspects of this classification are the following:

1. In clinical practice the decision to place an implant following tooth extraction is usually determined by the attainment of specific soft and hard tissue characteristics of the healing socket. These events do not necessarily follow rigid time frames and may vary according to site and patient factors. To avoid time-based descriptions, this classification uses numeric descriptors—types 1 to 4—that reflect the hard and soft tissue changes observed.

Correspondence to: Dr Christoph H. F. Hämmerle, Clinic for Fixed and Removable Prosthodontics, Center for Dental and Oral Medicine and Cranio-Maxillofacial Surgery, University of Zurich, Plattenstrasse 11, 8028 Zurich, Switzerland. Fax: +41-1-634-43-05. E-mail: hammerle@zzmk.unizh.ch

Table 1 Protocols for Implant Placement in Extraction Sockets and Their Advantages and Disadvantages

Classification	Definition	Advantages	Disadvantages
Type 1	Implant placement immediately following tooth extraction and as part of the same surgical procedure	<ul style="list-style-type: none"> • Reduced number of surgical procedures • Reduced overall treatment time • Optimal availability of existing bone 	<ul style="list-style-type: none"> • Site morphology may complicate optimal placement and anchorage • Thin tissue biotype may compromise optimal outcome • Potential lack of keratinized mucosa for flap adaptation • Adjunctive surgical procedures may be required • Procedure is technique-sensitive
Type 2	Complete soft tissue coverage of the socket (typically 4 to 8 wk)	<ul style="list-style-type: none"> • Increased soft tissue area and volume facilitates soft tissue flap management • Resolution of local pathology can be assessed 	<ul style="list-style-type: none"> • Site morphology may complicate optimal placement and anchorage • Treatment time is increased • Socket walls exhibit varying amounts of resorption • Adjunctive surgical procedures may be required • Procedure is technique-sensitive
Type 3	Substantial clinical and/or radiographic bone fill of the socket (typically 12 to 16 wk)	<ul style="list-style-type: none"> • Substantial bone fill of the socket facilitates implant placement • Mature soft tissues facilitate flap management 	<ul style="list-style-type: none"> • Treatment time is increased • Adjunctive surgical procedures may be required • Socket walls exhibit varying amounts of resorption
Type 4	Healed site (typically more than 16 weeks)	<ul style="list-style-type: none"> • Clinically healed ridge • Mature soft tissues facilitate flap management 	<ul style="list-style-type: none"> • Treatment time is increased • Adjunctive surgical procedures may be required • Large variations are present in available bone volume

- The classification clearly separates healing of the extraction socket into aspects of soft tissue healing and hard tissue healing.
- The type 1 procedure is chosen when an implant is placed immediately following extraction of a tooth. When advanced or complete soft tissue healing is desired, the type 2 procedure is preferred to immediate placement (type 1). When hard tissue healing is desired, types 3 and 4 are chosen to allow time for bone healing to occur.

Advantages and disadvantages of the 4 classifications are listed in Table 1.

CONSENSUS STATEMENTS

Socket Healing

Results of clinical, radiologic, and histologic studies indicate that bony healing of extraction sites proceeds with external resorption of the original socket walls and a varying degree of bone fill within the socket.

Bone Regeneration

Studies in humans and animals have demonstrated that at implant sites with a horizontal defect dimen-

sion (HDD; ie, the peri-implant space) of 2 mm or less, spontaneous bone healing and osseointegration of implants with a rough titanium surface takes place.

In sites with HDDs larger than 2 mm and/or nonintact socket walls, techniques utilizing barrier membranes and/or membrane-supporting materials have been shown to be effective in regenerating bone and allowing osseointegration.

Although scarce, the majority of the comparative data regarding the success of bone regeneration at peri-implant defects suggests no differences between type 1 and types 2 and 3 procedures.

Further comparative analyses of different methods of bone augmentation with regard to successful bone formation and stability over time are required.

Long-term analysis of the stability of the regenerated bone is focused almost exclusively on radiographic assessments of the interproximal bone and implant survival. There is a need for studies to evaluate the fate of the buccal bone plate—whether regenerated or not—over time.

Adjunctive Medication

In most studies reviewed, broad-spectrum systemic antibiotics were used in conjunction with implant placement types 1, 2, and 3. Controlled studies

evaluating the effect of systemic antibiotics on treatment outcomes are needed.

Survival of Implants

The survival rate of immediately placed implants (type 1) was reported in numerous studies to be similar to that of implants placed into healed ridges (type 4).

In the few studies available, short-term survival rates of implants placed in conjunction with types 2 and 3 procedures appear similar to those placed in types 1 and 4 approaches.

There have been relatively few reports on the subject of types 2 and 3 implant procedures, and only 2 of them were randomized with respect to timing of placement and augmentation methods used. Longitudinal studies of greater than 3 years' duration were limited to 2 reports.

There is evidence to suggest that the survival rate for implants placed immediately following extraction of teeth associated with local pathology is similar to that of implants placed into healed ridges. Further controlled studies are required to provide definitive information about the management of these situations.

Esthetic Outcomes

Esthetically pleasing treatment outcomes have received considerable attention in recent years; however, there are no controlled studies available evaluating esthetic treatment outcomes in types 1, 2, and 3 procedures.

PROPOSED CLINICAL APPROACHES

Patient Assessment

All candidates for extraction-site implants should meet the same general screening criteria as regular implant patients, regardless of the timing of implant placement.

Antibiotics

The literature is inconclusive regarding antibiotic use in conjunction with implant therapy. There is general agreement that the use of antibiotics is advantageous when augmentation procedures are performed.

Tooth Extraction

Extraction techniques that result in minimal trauma to hard and soft tissues should be used. The sectioning of multirrooted teeth is advised. All granulation tissue should be removed from the socket.

Site Evaluation

Site evaluation is critical to the determination of appropriate treatment modalities. Factors of concern include:

- Overall patient treatment plan
- Esthetic expectations of the patient
- Soft tissue quality, quantity, and morphology
- Bone quality, quantity, and morphology
- Presence of pathology
- Condition of adjacent teeth and supporting structures

Primary Implant Stability

The implant should not be placed at the time of tooth removal if the residual ridge morphology precludes attainment of primary stability of an appropriately sized implant in an ideal restorative position.

Thin Biotype

When treating patients with a thin, scalloped gingival biotype—even those with an intact buccal plate—concomitant augmentation therapies at the time of implant placement (type 1) are recommended because of the high risk of buccal plate resorption and marginal tissue recession.

If buccal plate integrity is lost, implant placement is not recommended at the time of tooth removal. Rather, augmentation therapy is performed, and a type 3 or 4 approach is utilized.

Thick Biotype

In cases involving a thicker, less scalloped gingival biotype with an intact buccal plate, the need for concomitant augmentation therapies at the time of implant placement (type 1) may be reduced, since thick biotypes have a decreased risk of buccal plate resorption in comparison with thinner biotypes. As buccal plate integrity is lost, the need for augmentation therapies increases.

When the buccal plate is compromised, negatively impacting the predictability of treatment outcomes, immediate implant placement is not indicated (type 1); rather, a type 2, 3, or 4 procedure is carried out. When the HDD is greater than 2 mm, concomitant augmentation therapy needs to be performed.

Adjunctive augmentation therapies may be indicated in any of the above situations to optimize esthetic treatment outcomes.

Implant Placement

The 3-dimensional positioning of the implant should be restoratively driven.