Group 5 ITI Consensus Report: Implant placement and loading protocols

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CONSENSUS REPORT

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Abstract

Objectives: Working Group 5 was convened to discuss and find consensus on the topics of implant placement and loading protocols associated with single missing teeth in the anterior maxilla (aesthetic zone). Consensus statements, clinical recommendations, patient perspectives and future research suggestions were developed and presented to the plenary for discussion and approval.

Materials and Methods: Two systematic reviews were developed and submitted prior to the conference. The group considered in detail the systematic reviews and developed statements, clinical recommendations, patient perspectives and future research suggestions based on the findings of the reviews and experience of group members. Definitive versions were developed after presentation to and discussion by the plenary.

Results: Five consensus statements were developed and approved from each systematic review. Twelve clinical recommendations were developed by the group based on both reviews and experience. Three patient perspectives were developed, and five suggestions made for future research.

Conclusions: Based on the findings of the systematic reviews and experience of group members, the Type 1A protocol (immediate placement and immediate loading), when utilized in the anterior maxilla under favorable conditions, is considered predictable and is associated with high survival rates. The procedure is considered clinically viable and is associated with aesthetic outcomes, although surgical, technical, and biological complications can occur.

KEYWORDS
bone implant interactions, clinical assessment, diagnosis, loading, placement, prosthodontics, surgical techniques

1 | INTRODUCTION

Patients and clinicians desire increasingly rapid treatment options that maintain expected success and survival rates without increasing the risk of complications. The ITI has for more than two decades evaluated and reported on evolving protocols relating to implant placement and loading, objectively reviewing the state of the science and clinical practice. The developing knowledge base and volume of clinical expertise have been reported and updated regularly (Benic et al., 2014; Chen & Buser, 2009; Chen et al., 2004; Chiapasco, 2004; Cochran et al., 2004; Cordaro et al., 2009; Gallucci et al., 2009, 2014, 2018; Ganeles & Wismeijer, 2004; Grutter & Belser, 2009; Hammerle et al., 2004; Morton et al., 2004, 2014, 2018; Papaspyridakos et al., 2014; Roccuzzo et al., 2009; Schimmel et al., 2014; Schrott et al., 2014; Weber et al., 2009).

At the Third ITI Consensus Conference held in Gstaad, Switzerland (2003), consensus was found regarding terminology and classification of procedures relating to both the surgical and restorative phases of patient care (Chen et al., 2004; Chiapasco, 2004; Cochran et al., 2004; Ganeles & Wismeijer, 2004; Hammerle et al., 2004; Morton et al., 2004). Five years later (2008) at the Fourth ITI Consensus Conference held in Stuttgart, Germany, concepts relating to risk factors for complications were introduced and discussed (Chen & Buser, 2009; Cordaro et al., 2009; Gallucci et al., 2009; Grutter & Belser, 2009; Roccuzzo et al., 2009; Weber et al., 2009). By 2013 and the Fifth ITI Consensus Conference (Bern, Switzerland), the ITI was able to find and publish agreement regarding patient and site selection and provide recommendations relating to time points post-extraction (Benic et al., 2014; Gallucci et al., 2014; Morton et al., 2014; Papaspyridakos et al., 2014; Schimmel et al., 2014; Schrott et al., 2014).

It is important to note that many of these protocol changes were taking place in a fluid patient care environment. Dental implant macromorphology and surfaces, implant alloys, connections, abutments and restorative materials were becoming more conducive to success when incorporating accelerated treatment protocols. Knowledge regarding biomaterials, with respect to the relevance of specific site-related parameters, led to pivotal statements and recommendations being made at the Sixth ITI Consensus Conference (2018) in Amsterdam (Gallucci et al., 2018; Morton et al., 2018). Of great significance was consensus being found for treatment planning to be finalized for both implant placement and loading when the indication for extraction is confirmed and not after tooth removal. A classification system for placement and loading protocols for partially edentulous patients published as part of the proceedings brought treatment considerations together under a single umbrella for patients (Gallucci et al., 2018).

As part of the Seventh Consensus Conference in Lisbon (2023), Group 5 continued the above focus, specifically the Type 1A protocol (immediate placement and immediate loading) for the replacement of single maxillary anterior teeth (15–25 FDI). Immediate placement and loading of a single tooth, first reported by Wohrle (1998), has received a great deal of attention over the last 20 plus years as it is desirable to clinicians and associated with high patient-centred benefits.

Two systematic reviews were prepared for Group 5 to consider:

1. Hamilton A, Gonzaga L, Amorim K, Wittneben J, Martin L, Morton D, Martin W, Gallucci GO, and Wismeijer D. Selection criteria for type 1A (immediate implant placement and immediate loading) for single tooth replacement in the maxillary aesthetic zone: a systematic review and meta-analysis. (Hamilton et al., 2023).
2. Wittneben JG, Molinero-Mourelle P, Hamilton A, Alnasser M, Obermaier B, Morton D, Gallucci GO, and Wismeijer D. Clinical performance of immediately placed and immediately loaded single implants in the aesthetic zone. A systematic review and meta-analysis. (Wittneben et al., 2023).

2 | DEFINITIONS OF TERMS

Type 1A – immediate implant placement and immediate restoration/loading

- Immediate implant placement
  - Dental implants are placed in the fresh socket on the same day of tooth extraction, as part of the same procedure.
- Immediate loading
  - Dental implants are connected to a prosthesis in occlusion with the opposing arch within 1 week subsequent to implant placement.

- Immediate restoration
  - Dental implants are connected to a prosthesis held out of occlusion with the opposing arch within 1 week subsequent to implant placement.
- Survival
  - The presence of an implant in situ at the follow-up examination (Papaspyridakos et al., 2014).
- PES
  - Pink esthetic score (PES) (Belser et al., 2009; Fürhauser et al., 2005).
- WES
  - White esthetic score (WES) (Belser et al., 2009).

These definitions are in accordance with publications from previous ITI Consensus Conferences and ITI Treatment Guides (Benic et al., 2014; Chen et al., 2004, 2009; Chiapasco, 2004; Cochran et al., 2004; Cordaro et al., 2009; Gallucci et al., 2009, 2014, 2018; Ganeles & Wismeijer, 2004; Grutter & Belser, 2009; Hammerle et al., 2004; Morton et al., 2004, 2014, 2018; Papaspyridakos et al., 2014; Roccuzzo et al., 2009; Schimmel et al., 2014; Schrott et al., 2014; Weber et al., 2009; Chen & Buser, ITI Treatment Guide Volume 3., 2008).

Proceedings. ITI Consensus Conferences.

ITI Treatment Guide Volume 3.

The following consensus statements were developed from the two previously mentioned systematic reviews that assessed selection criteria and implant survival (Hamilton et al., 2023) and clinical performance (Wittneben et al., 2023) of immediately placed and immediately loaded dental implants (Type 1A) for single tooth replacement in the anterior maxilla (15–25 FDI) (region of aesthetic significance). All implants included in the two reviews exhibited a minimum of 12 months follow-up.

3 | SYSTEMATIC REVIEW PAPER 1

3.1 | Manuscript title

Selection criteria for Type 1A (immediate implant placement and immediate loading) for single tooth replacement in the maxillary aesthetic zone: a systematic review and meta-analysis.

3.2 | Preamble

The following consensus statements are based on a systematic review that assessed implant survival with Type 1A (immediate implant placement and immediate restoration/loading) protocol for implant replacement of single teeth in the anterior maxilla (15–25 FDI), with a minimum of 12 months follow-up. The review also assessed the reported patient and site-specific selection criteria that may influence survival outcomes. The review is based on data from 43 prospective (11 randomized control trials [RCTs] and 6 clinical controlled trials [CCTs]) and 25 retrospective studies with a total of 2531 implants with a mean follow-up of 2.6 years.

3.3 | Consensus statements

3.3.1 | Consensus statements 1

The Type 1A protocol for replacement of a single tooth in the anterior maxilla (15–25 FDI) is predictable with high implant survival rates. This is based on studies with highly selective populations, with favourable patient and site-specific characteristics. When failures occur, the majority are within the first 6 months of implant placement. This statement is supported by 43 prospective (including data from 11 RCTs and 6 CCTs) and 25 retrospective studies.

3.3.2 | Consensus statements 2

Multiple patient and site-specific factors are relevant in the selection and completion of a Type 1A protocol for the replacement of a single tooth in the anterior maxilla (15–25 FDI). These include:

a) General factors:

- Medical status (63 studies)
- Periodontal disease (54 studies)
- Occlusal scheme (57 studies)
- Parafunction (26 studies)

b) Site-specific factors:

- Facial bone wall (60 studies)
- Endodontic infection (42 studies)
- Bone for anchorage (37 studies)
- Soft tissue quality (25 studies)
- Gingival margin position (22 studies)

c) Treatment factors:

- Mucoperiosteal flap (63 studies)
- Damage during tooth extraction (59 studies)
- Gap between the facial bone and implant (56 studies)
- Primary implant stability (42 studies)

3.3.3 | Consensus statements 3

The Type 1A protocol may not be able to be completed in all selected sites due to intra-operative procedural events mostly related to the extraction of the tooth or lack of primary implant stability. This statement is supported by 23 prospective studies (including data from 11 RCTs and 2 CCTs).

3.3.4 | Consensus statements 4

A chronic periapical infection associated with the tooth to be extracted is not a contraindication for the Type 1A protocol provided there is sufficient bone to achieve primary implant stability. This statement is supported by 29 prospective (including data from 9 RCTs and 3 CCTs) and 13 retrospective studies.

3.3.5 | Consensus statements 5

With regards to implant position, the presence of at least a 2 mm gap between the implant and the facial bone increases implant survival when the Type 1A protocol is utilized. This statement is supported by 13 prospective (including data from 5 RCTs and 2 CCTs) and 7 retrospective studies.

4 | SYSTEMATIC REVIEW PAPER 2

4.1 | Manuscript title

Clinical performance of immediately placed and immediately loaded single implants in the aesthetic zone. A systematic review and meta-analysis.

4.2 | Preamble

The following consensus statements are based on a systematic review that assessed the clinical performance of dental implants used according to the Type 1A (immediate implant placement and immediate restoration/loading) protocol for replacement of single teeth in the aesthetic zone (anterior maxilla 15–25 FDI).

The statements are based on up to 38 prospective (including 10 RCTs) and 25 retrospective studies with a follow-up of 12 and 96 months.

4.3 | Consensus statements

4.3.1 | Consensus statements 1

The Type 1A protocol, when utilized in the aesthetic zone, is a clinically viable treatment option. However surgical, technical and biological complications can occur. This statement is supported by 63 studies (10 randomized controlled trials, 28 prospective and 25 retrospective studies) with a follow-up ranging from 12 to 96 months. Surgical complications (mean per year 5.86%; 38 clinical studies) and technical (mean 3.27%; 25 clinical studies) and biological (mean 2.18%; 29 clinical studies) complications may occur.

4.3.2 | Consensus statements 2

For the Type 1A protocol, survival is not influenced by the type of implant (bone level vs. parallel walled vs. tapered design). This statement is supported by 63 studies (10 randomized controlled trials, 28 prospective and 25 retrospective studies) with a follow-up ranging from 12 to 96 months.

4.3.3 | Consensus statements 3

For the Type 1A protocol, there was an increase in PES when the space between the implant and the facial bone of the residual socket was grafted with autogenous bone or bone substitute. This statement is supported by 35 studies (7 randomized controlled trials, 12 prospective and 16 retrospective studies) with follow-up ranging from 12 to 96 months.

4.3.4 | Consensus statements 4

For the Type 1A protocol, the flapless approach provides good aesthetic outcomes (papilla height, PES and WES). This statement is supported by 11 clinical studies for papilla height, 31 clinical studies for PES and 16 clinical studies for WES.

4.3.5 | Consensus statements 5

For the Type 1A protocol, differences in survival are not influenced by type of retention (screw or cement retained) when focusing on the final restoration. This statement is supported by 29 clinical studies.

5 | CLINICAL RECOMMENDATIONS

The following clinical recommendations are based on the consensus statements from both systematic reviews.

5.1 | Preamble

The replacement of a single tooth in the anterior maxilla (15–25 FDI) with the Type 1A protocol is a complex procedure with high patient-centred benefits. It should be considered as the treatment

of choice when ideal conditions are present. Ideal site conditions include:

- Healthy adjacent teeth
- Intact facial bone
- No acute infection
- Ability to place the implant in the correct three-dimensional (3D) position for restoration
- Anticipated stability of the implant to allow immediate restoration

Multiple patient and site-related factors need to be considered for this treatment in order to achieve predictable long-term functional and aesthetic outcomes. If the criteria for the Type 1A protocol are not met, alternative treatment options must be considered.

Patients undergoing implant therapy should have no medical or psychological contraindications to complex oral surgical and restorative procedures. Patients should have realistic expectations about the final outcomes, be fully informed and have consented to undergo the Type 1A protocol.

1. **What clinical experience is recommended for the Type 1A protocol?**
   The Type 1A protocol is classified as a complex procedure (ITI SAC Classification, 2nd Edition, 2021) and should be performed by clinicians experienced in surgical and restorative implant procedures. These clinicians should have skills specific to tooth extraction and immediate implant placement, hard and soft tissue augmentation procedures and immediate loading/restoration of implants. A team approach is often needed.

   Dawson A, Martin WC, and Polido W. The SAC Classification in Implant Dentistry. 2nd Edition. Quintessence.

2. **How should a patient be clinically assessed for the Type 1A protocol?**
   A thorough clinical examination should be performed for the proper assessment of the patient and site. The patient should be assessed with the Esthetic Risk Assessment (ITI TG 10, SAC 2nd Edition) and risk assessment for immediate implant placement in single tooth sites (Hamilton et al. 2023, ITI TG 14) to determine the patient and site-specific risk factors for immediate implant placement.

3. **What radiographs are recommended to properly assess a site for the Type 1A protocol?**
   Radiographic assessment of the site and relevant surrounding tissues with a good-quality periapical radiograph and a cone-beam computed tomography (CBCT) scan is strongly recommended. The following radiographic criteria should be fulfilled:
   - An intact or minimally damaged facial bone plate
   - Sufficient bone available to provide primary stability in an ideal 3D position
   - Health of the adjacent teeth

4. **Is software planning recommended for the Type 1A protocol?**
   When a CBCT (digital volume) has been captured, the use of implant planning software is strongly recommended in order to evaluate the site and simulate the ideal 3D implant position. This allows the following to be analysed:
   - The tooth–alveolus axis relationship allows planning for optimal 3D restoration-driven implant placement.
   - The gap between the implant and the facial bone wall is at the level of the planned implant shoulder position.
   - Abutment options.

5. **What restorative preparation should there be prior to commencing treatment?**
   The prior fabrication and use of a traditional or computer-guided surgical template is highly recommended to achieve an optimal restoratively driven 3D implant position. A provisional crown, shell crown or matrix should be prepared prior to tooth extraction according to the desired method for fabrication of the planned immediate implant restoration. An alternative provisional prosthetic replacement of the tooth should be prepared and available in the event the treatment cannot be completed due to intra-operative events.

6. **How should the tooth be extracted when utilizing the Type 1A protocol?**
   A minimally traumatic tooth extraction with a flapless approach is recommended and all efforts should be made to preserve bone and soft tissue integrity. Special instrumentation may be required to achieve this goal. Debridement of the socket should be performed. The integrity of the socket walls should be confirmed following extraction.

7. **What should be done if the facial bone is compromised when the tooth is extracted?**
   If the facial bone is compromised during and following tooth extraction, the extent of the defect must be assessed. If a minor defect in the facial bone is present, the Type 1A protocol may still be considered. However, the risk of aesthetic complications is increased and additional adjunctive hard and soft

tissue regenerative procedures may be required. In larger defects, alternative treatment protocols to Type 1A must be considered.

8. **Can the Type 1A protocol be done in the presence of chronic periapical infection?**
   The Type 1A protocol can be selected for teeth presenting with chronic periapical infections. However, it is recommended that this is only considered when the following conditions exist:
   - Absence of a fistula
   - Infection can be completely debrided
   - There is sufficient bone remaining to provide primary implant stability

9. **How big should the facial gap be?**
   The facial gap should ideally be >2 mm in width at the level of the implant shoulder. However, this may not always be possible and ultimately needs to be considered in relation to the likely functional loading, implant diameter and the dimensions of the socket.

10. **What should be done when the facial bone or soft tissues are thin?**
    The following treatment can be considered:
    - In thin-tissue phenotype situations, or when facial bone is thin (less than 1 mm), the Type 1A protocol can still be considered. However, in addition to grafting of the gap, adjunctive soft tissue grafting may be required to compensate for anticipated post-extraction dimension changes. This will increase the complexity of the procedure and the risk of adverse outcomes.
    - Alternative implant placement and loading protocols may also be considered to reduce the risk.

11. **What steps should be taken for connection of the provisional crown to the implant?**
    Immediate placement of a provisional restoration is well documented. This can be performed according to previously published consensus statements. The following factors should be considered:
    - Screw retention is recommended.
    - Emergence profile should be appropriate (not over- or under-contoured).
    - Timeframe should be from implant placement to 1-week post placement.
    - A highly polished surface of the provisional is required.
    - The occlusion scheme should be without any eccentric contacts.
    - Light proximal contacts should be present.
    - The provisional restoration should be inserted and the retaining screw (abutment or prosthetic) torqued according to guidelines published by each manufacturer.

12. **What should be done if the Type 1A protocol cannot be completed at the time of surgery?**
    If the Type 1A protocol cannot be completed, the implant can be placed with simultaneous grafting and allowed to heal without loading the implant. If the implant cannot be placed, an early placement protocol can be considered. Alternatively, the socket may be grafted and followed by late implant placement.

5.2 | Patient perspectives

The following patient scenario, associated questions and answers were developed by Group 5, and are based on the consensus statements, clinical recommendations and expert opinion. The scenario forms the basis for questions that a patient may pose when being considered for the Type 1A protocol to replace a maxillary anterior tooth.

5.3 | Scenario

'My dentist told me that I have an infection located around the root of one of my front teeth. My dentist also told me that the tooth cannot be saved and needs to be extracted. My dentist mentioned that a dental implant with a crown could provide a long-term solution for replacement of this tooth'.

5.3.1 | Patient perspective 1: Can you remove the tooth and place a dental implant and crown at the same time?

We need to perform an examination of your mouth and make an assessment of important clinical aspects. We will need to take X-rays, which will most likely include a 3D scan known as a CBCT. If conditions are favourable, we can consider removing the tooth, placing the implant and a crown at the same time. This response is based on scientific evidence.

5.3.2 | Patient perspective 2: What could go wrong during the procedure?

Every effort is made to avoid complications and risks. Even so, unforeseen problems can arise during the procedure. Complications that occur during the procedure will most likely be related to one or more of the following three things:

- Complications resulting from the extraction (removal) of the tooth

- Inability to properly place a stable dental implant or place the implant in the ideal restoratively driven 3D position
- Inability to place a restoration (crown) on the dental implant at the same appointment, requiring an alternative option to be considered

This response is based on scientific evidence and expert opinion.

5.3.3 | Patient perspective 3: What could go wrong after the procedure?

Minor postoperative discomfort and swelling are expected and can usually be managed with over-the-counter medications. Postoperative complications are relatively rare but possible. Most postoperative complications can be related to one or more of the following four things:

- Postoperative pain and/or bleeding
- Postoperative infection
- Postoperative loosening and/or failure (loss) of the implant
- Undesirable aesthetic outcomes

This response is based on scientific evidence and expert opinion.

6 | RECOMMENDATIONS FOR FUTURE RESEARCH

Recommendation 1: Current studies report on outcomes for the Type 1A protocol used in highly controlled situations. It is recommended that future research report on the number of patients screened for inclusion, the number subsequently excluded and why. Survival, site-specific and aesthetic data from larger samples in less restricted populations should be gathered, with both practice and patient-centred clinical evaluation advisable.

Recommendation 2: Detailed reporting on treatments not able to be completed as a result of intra-operative variables (intention-to-treat analysis) should be undertaken. It is recommended that as a result of regional variations in the nature of soft tissues and the facial bone plate in the maxilla, reporting should differentiate between the premolars and the canine-to-canine region. Furthermore, future papers should identify immediate implant placement and/or immediate loading and/or type 1A protocols in the title and abstract to facilitate screening for future systematic reviews.

Recommendation 3: Future research should focus on outcomes, survival and success of procedures provided once failure and complications as a result of the Type 1A protocol are observed. Clinical and patient-centred outcomes should be reported.

Recommendation 4: The choice of augmentation materials used in conjunction with the Type 1A protocol has not been investigated adequately. Specifically, it is recommended that the choice of hard tissue graft material, in conjunction with the grafting of the space between the implant and facial bone (HDD – horizontal defect dimension) be investigated specifically with regard to long-term clinical and aesthetic outcomes.

Recommendation 5: The choice of soft tissue grafting procedures and materials used in conjunction with the Type 1A protocol has not adequately investigated, specifically when these procedures are indicated and when they should be utilized in conjunction with hard tissue augmentation options. Site-specific indication for use, along with long-term clinical and aesthetic outcomes, should be evaluated.

AUTHOR CONTRIBUTIONS

Dean Morton: Writing—original draft; conceptualization; supervision; writing—review & editing. **Daniel Wismeijer:** Conceptualization; supervision; writing—original draft; writing—review & editing. **Stephen Chen:** Writing—review & editing; writing—original draft; supervision; conceptualization. **Adam Hamilton:** Conceptualization; writing—original draft; writing—review & editing. **Julia Wittneben:** Conceptualization; writing—original draft; writing—review & editing. **Paolo Casentini:** Conceptualization; writing—original draft; writing—review & editing. **Luiz Gonzaga:** Conceptualization; writing—original draft; writing—review & editing. **Rafael Lazarin:** Conceptualization; writing—original draft; writing—review & editing. **William Martin:** Conceptualization; writing—original draft; writing—review & editing. **Pedro Molinero-Mourelle:** Conceptualization; writing—review & editing; writing—original draft. **Barbara Obermailer:** Conceptualization; writing—review & editing; writing—original draft. **Waldemar D. Polido:** Conceptualization; writing—review & editing; writing—original draft. **Ali Tahmaseb:** Conceptualization; writing—review & editing; writing—original draft. **Daniel Thoma:** Conceptualization; writing—review & editing; writing—original draft. **Anja Zembic:** Writing—review & editing; conceptualization; writing—original draft.

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CONFLICT OF INTEREST STATEMENT

All authors and participants in Group 5 declared no conflicts regarding the content of the Seventh ITI Consensus Conference or subsequent articles developed from the proceedings.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

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