



Avoiding Implant Malpositioning

9th European Consensus Conference (EuCC) 2014 in Cologne
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Consensus Paper/Guideline
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1 Theoretical methodology

Objective

The purpose of this Consensus Paper/Guideline is to offer recommendations for clinicians engaging in implant dentistry, helping them avoid potential complications caused by incorrect positioning of implants.

Preface

This Consensus Paper/Guideline is restricted to the parameters of the healed natural host ridge and should the recommended implant position not be attained bone augmentation will be required.

The Consensus Paper/Guideline is also restricted to “bone-level” implants.

The recommendations are considered with patient safety as well as long term implant survival the priority.

All statements contained in this Consensus Paper/Guideline are meant to serve as guidance only. The patient’s individual situation must be taken into account; it dictates all further measures and may justify deviations from the pronouncements made in this Consensus Paper/Guideline.

Background

Prevalence of the clinical problem, therapeutic uncertainty, avoidance of complications.

The correct positioning of implants is an issue of high clinical relevance. Exactly under which conditions the choice of an implant position can still be deemed justifiable remains unclear. There is uncertainty regarding the appropriate therapeutic approach for correcting malpositioned implants. Preimplantological treatment planning and its proper therapeutic implementation serve to avoid complications.

On the issue of malpositioned implants

There are different modes of implant malpositioning:

1. The implant is not located where it should be located according to the preimplantological treatment plan. From the planning point of view, this certainly constitutes malpositioning. From the patient’s point, however, the position in question may be preferable because it is associated with fewer surgical interventions.
2. The implant is located at a position where it cannot be restored. This definitely constitutes malpositioning.
3. The implant is located at a position where it can be restored, possibly with certain major reservations. Here it must be decided whether the resulting restoration can be tolerated or whether the implant position must be corrected.



Definition for the purposes of this Consensus Paper/Guideline

An implant is considered malpositioned if it cannot be restored prosthetically or if restoring it would result in obvious and considerable drawbacks in terms of prosthetic function and/or aesthetics. If an implant deviates from its ideal position, tolerances must be taken into account in the assessment and in the treatment process. As a rule, there is no single and exclusive implant position that is “right”.

Literature search

The Cochrane Library, EMBASE, DIMDI and Medline literature databases were used to conduct the search. The search strategy included selected search terms such as *vertical positioning of dental implants, horizontal positioning of dental implants, inter-implant distances, tooth-to-implant distance, distances of dental implants and neighbouring structures, implant failure, implants and biomechanical failure, distribution of implants*. The studies returned by the search were screened by reading the abstracts. Studies found to be irrelevant to the subject were identified and excluded on this basis. All articles that were found to be (potentially) relevant were obtained in full-text form. Few if any randomized controlled trials or other systematic clinical studies were available on the subject.

Procedure for developing the Guideline/Consensus Conference

A preliminary version for deliberation (authored by the Department of Craniomaxillofacial and Plastic Surgery of the University of Cologne) was made available to the members of the working group on the day of the Consensus Conference. The Consensus Conference was organized in five steps:

- Reviewing the preliminary draft
- Collecting alternative proposals
- Voting on recommendations and levels of recommendation
- Discussing non-consensual issues
- Final voting

2 Theoretical considerations on avoiding implant malpositioning

2.1 Causes

In addition to damaging adjacent structures, malpositioned implants may adversely influence the aesthetics, function and structural integration of implant-supported restorations.

Causes frequently cited in connection with implant malpositioning include (Porter, 2005):

- Improper or inadequate/inappropriate diagnostics and treatment planning.
- General surgical and/or prosthetic errors.
- Inexperience/inexpertness on the part of the oral implantologist.
- Lack of coordination between the prosthodontist and oral surgeon.



2.2 Correction of malpositioned implants

Possible **therapeutic consequences** include (depending on the degree of malpositioning):

- Removal of the affected implant.
- By current standards (cf. the DGZMK's criteria for implant success), the simple non-use of an existing dental implant can be recommended only in exceptional cases, e.g. when there is an additional risk of damage to adjacent structures when removing implants close to a nerve or to roots of adjacent teeth.
- Surgical corrections often described in the current literature (e.g. segmental osteotomies, see below) appear possible from a medical perspective and are recommended in individual cases. But since they imply the surgical management of complications following elective surgery, these procedures require a meticulous assessment of possible additional complications and the chances of success. Complete and comprehensive patient information is mandatory.
- A prosthetic approach to the management of complications will depend on the circumstances of the case and on the degree of malpositioning. Prosthetic options such as angulated abutments are usually not considered problematic. The replacement of missing tissue by prosthetic materials can be difficult in the case of fixed dentures and will strongly depend on the specific case, while the replacement of tissue by removable dentures generally appears unproblematic, provided adequate oral hygiene is maintained.

2.3 Prevalence

Malpositioning has been reported in the literature as occurring in less than 1% of cases (Goodacre, 2003). It should be noted, however, that only malpositioning on a larger scale (with therapeutic consequences) may have been included in the relevant considerations.

The literature also suggests that the (mandibular) anterior region, and in particular single-tooth replacements in single-tooth or extended edentulous spaces, present the greatest challenges with regard to the correct three-dimensional positioning of implants.

In this context, appropriate indications and pre-implantation diagnostics are of particular importance. The results of the 2011 EuCC, the **Cologne ABC Risk Score**, were also considered.

At the time of that Consensus Conference, no randomized/controlled trials had been extant, and the available studies were primarily retrospective in nature (at the IIb/III levels of evidence) so that the guideline's grade of recommendation was B ("should"-type recommendation).



It might be useful that (in addition) the distances were given relative to the first indentation made to indicate the position of the future implant cavity, as herein may lie the origins of implant malpositioning. In comparable literature reports, distances are usually measured relative to the implant neck, which already represents the final position of the implant at the end of the procedure, when correction options no longer exist. Distances given to the first indentation are related to “standard” implant diameter of 4 mm. Implant diameter has to be considered for the individual situation.

3 Three-dimensional orientation of the implant

3.1 Distances in the mesiodistal plane

When preparing implant cavities for standard implants (with a diameter of approximately 4 mm), the indentations for the respective implants must be at least 7 mm apart (= minimum inter-implant distance of 3 mm). The indentation must keep a distance of at least 3.5–4 mm to any adjacent tooth (= minimum distance to adjacent natural teeth of 1.5–2 mm). New techniques and implant designs (e.g. platform switching) may change these recommendations in future.

3.2 Distances in the orofacial plane

The indentation made at the beginning of the implant procedure should be located about 2–3 mm from a line connecting the labial surfaces (for a standard implant diameter of 4 mm), so that the implant neck will stay within this boundary. By looping some floss or suture material around the teeth delineating the gap or positioning a suitable ruler or similar, this boundary can be visualized during the procedure. The neck of the implant should not exceed this line.

3.3 Distances in the coronapical plane

Aesthetic zone: The crestal border of the surface, intended for osseointegration, should be placed at a level 3–4 mm below the intended coronal soft tissue margin.

Non-aesthetic zone: The crestal border of the surface, intended for osseointegration, should be placed at or below bone level.

3.4 Inclination of implant

Inclination/angulation of implant should be positioned preferably in the most upright position within the bone parameters.



4 Distances from adjacent structures

Recommendations for the prevention of damage to adjacent structures (minimum distances are also valid for 3D diagnostics):

- A preimplantological assessment of distances and adequate safety margins during surgery are necessary and may be ensured by 3D-based surgical procedures.
- If basic diagnostics (x-rays, casts, clinical examinations) have demonstrated a significant proximity to adjacent structures, 3D diagnostics should at least be considered.
- Safety distance of at least 2 mm from the mandibular canal.
- Safety distance of 3–5 mm anterior to the mental foramen.
- Safety distance at least 1 mm from the roots of adjacent teeth – in narrow spaces or in root convergence, x-rays from various angles are recommended.
- Exceeding on the anatomical structures of the maxillary sinus, the nasal floor or subsections of the jaw *without additional surgical precautions* (such as sinus-floor elevation) is not recommended.

5 Prevention of indication-related malpositioning (taking into account the prosthetic objective)

Single-tooth replacement (Ia/Ib)

Also for biomechanical reasons (related to the individual case), high crown to implant length and width ratio and implant positions outside the centre of the future prosthetic crown should be avoided (no off-axis loading).

In general:

Adequate prosthetic treatment planning and its correct execution may lower the possibility of malpositioning of implants.

Cologne, 1 March 2014

Professor Dr Dr Joachim E. Zöller
Vice President



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