The Foundation of Knowledge

Statement of the International Implant Foundation (IF) concerning probing around basal implants (2003)

I. Probing as a diagnostic procedure around natural teeth and crestal implants.

Probing is one of the recognised diagnostic procedures for determining the depths of tooth pockets. For this reason, numerous examiners have also described depth probing as a diagnostic procedure in the area of crestal implants and have used it as an important criterion for evaluating the success of treatment.

The probing depth (pocket depth) is the distance between the edge of the gingiva and the depth to which a probe can be inserted at a given pressure. The relative attachment level is the distance between the deepest point in the pocket that can be reached with the probe and a defined point on the tooth. To determine the relative attachment level, the easily recognised cementoenamel junction is usually used as the upper reference point.

Probing around teeth aims to determine the clinically measurable attachment, which is considered to be a measure of periodontal health. In this context, one needs to bear in mind that the condition of the gingiva itself[ii], the probing force as well as examiner-dependent parameters[iii iv], type and shape of the probe as well as obstructions (crowns, calculus; macro-design of an implant, multiple abutments[v]) can decisively influence the result of measurement during probing. With periodontal probes, it is often not possible to determine the level of the actual bone. The reproducibility of probing is limited: one needs to allow for variations of +- 1 mm under clinical conditions. Probing is therefore popular for checking the function and condition of crestal implant bodies[1] because X-ray examination is only of limited diagnostic value owing to its being restricted to two dimensions and the time lag associated with it[vi], and because only significant destructions of hard tissues can be recognised on them[vii viii ix].

[1] The term crestal implant bodies includes implants where the main force transmission areas lie in the area of the vertical implant axis and that are inserted into the jaw from the direction of the alveolar crest. The term includes screw implants, cylindrical and conical implants as well as blade implants. Bicortical screws constitute a boundary case: this implant is indeed inserted from the direction of the crest, but owing to the design as well as the macro- and micro-structure it does not possess vertical force transmission areas. In terms of function, this implant therefore comes close to (also owing to the intended lateral and cortical support) representing a basal implant that is inserted via the crest.

The term normal biological width in the context of crestal implants describes the fact that there is first a connective-type tissue zone of approx. 1.5 - 2 mm above the bony attachment, above which lies a zone of epithelial contact measuring another 2- 2.5 mm. Probing in this area therefore has the aim of showing that only this desirable probing depth of no more than 3-4 mm is reached. In this context, the thread of screws and roughness at the implant surface influence the likelihood that a correct measurement is obtained[x]. For crestal implant bodies, there is varying information about the damage that may be caused by probing at the implant site. As with real teeth, the healing of probing injuries around these implants generally takes place within a fortnight[xi]. With crestal implants, probing should not be undertaken within three months of installing the abutment, to avoid disturbing the normal healing process. While depth probing is said not to cause any damage near healthy crestal implants[xii], microbiological studies have shown that pockets of a depth of more than 5 mm can potentially provide a protective biological environment for pathogenic germs[xiii xiv]. In the context of crestal implants, probing depths of 6 mm and more make an unfavourable treatment outcome more likely[xv].

Probing around crestal implants aims to measure the level of the bone that can still be considered to be attached. Owing to the resistance of tissues in the depth of the pocket, one may assume that for crestal implants it is never possible to probe the real level of the bone. In this context, Lang and Bragger state that inflammation of the marginal periodontium strongly influences the results of probing: around healthy implants it was possible to approach the effective bone boundary to approx. 0.8 mm by probing, while probing to a proximity of 0.2 mm was possible in an infected area[xvi]. Osteolytic pockets may be present for crestal implants in the infected transition area from bone to connective issue. At any rate, measurement errors are comparatively larger around implants than around teeth[xvii xviii].

One should also point out that overloading associated with vertical osteolysis (culminating in loosening of the implant) does not lead to deeper probing, as is found for plaque-associated bone fractures[xix]. This may be due to the fact that the inflammation reaction to overloading, which is non-bacterial, requires less space and is of lower intensity, with the result that probe penetration is more difficult.

Apart from the result of depth measurement, the tendency to bleed is used to evaluate periodontal health around teeth. Probing can therefore yield two results: if there is no bleeding, then periodontal health, i.e. stable conditions, is assumed. This experience cannot simply be transferred to implants: at the same probing force, bleeding occurs more frequently for „healthy“ implants than for healthy teeth in dentition with comparable oral health[xx xxi]. Different authors have obtained different results with respect to the relationship between bleeding and peri-implant collapse:

Natert et al.xxii and Salcett et alxxiii found no correlation between bleeding after probing and marginal bone loss. Smithloff and Fritz, on the other hand, show (for blade implants) that bleeding during probing and bone loss detected by means of X-rays are the most reliable parameters for detection of peri-implant collapse[xxiv].

Initial probing around an implant thus has some diagnostic value. If other parameters as indicators of disease are absent, they are of hardly any value however. Observation over a prolonged period is decisive, say every 3 – 6 months.

For crestal implants we can thus summarise as follows:

1. For probing to be of any value, a reliable and reproducible reference point on the implant or on the superstructure needs to be available.This point needs to be looked for every time probing is undertaken.
2. Probing is not expected to cause damage, as long as a probing depth of approx. 5 mm is not exceeded and as long as the surface of the implant is not irreversibly damaged or contaminated.
3. At the same probing force, deeper probing is possible near crestal implants than near teeth. This is due to the different structures of the peri-implant tissues. When the bone level is the identical, probes will penetrate more deeply under inflammatory peri-implant conditions than in the absence of inflammation.
4. Probing depth is one of several parameters that need to be considered when evaluating crestal implants.

II. Probing near lateral basal implants[2]

[2] Lateral basal implants belong to the group of lateral implants. They are laterally inserted into the basal jaw bone or into the alveolar bone by means of a T-shaped osteotomy. In the vertical part of the implant, BOI do not have force transmission areas.

All crestal implants share the feature that force transmission and attachment to the bone are only achieved along the vertical axis of the implant. This is the case for the sole reason that these implants lack further components, such as a force-transmitting disc. In contrast, very different circumstances exist for basal implants: depending on the structure of the surface, traditional osseointegration along the vertical implant axis is not intended, nor is it possible if the implant surface is completely smooth and lacks any structure. Basal implants possess resiliency (flexibility) by virtue of their design as well as nearly iso-elastic properties towards the bonexxv.

Several peculiarities preclude any transfer of the experience with crestal implants to the state of affairs with BOI:

- In contrast to crestal implants, basal implants do not exhibit systemic progressive bone loss. Missing vertical bone or a loss of vertical bone cannot be used as a parameter for determining the condition or prognosis of the implant. Even probing depths of more than 6 mm do not point to an unfavourable treatment outcome.

- With these implants, force transmission is effected via one or several base plates that are inserted into regions that tend to be protected against infection by virtue of being far removed from the mucosal penetration site in a bi- or multi-cortical manner. During insertion, the bone is opened by means of a lateral T-shaped osteotomy. In the lower jaw, the bone tends to quickly close the vertical and the horizontal osteotomy slit with bone. A smooth, continuous and mineralised subperiosteal bone connection can be expected in this region due to the load-induced strain after just a few months. The stimulus for bone regeneration thus comes from the jaw itself, which is subjected to massive torsion by virtue of its function. The same stress-related stimuli are not present to the same extent in the upper jaw. The bony osteotomy thus closes more slowly and mainly from the periosteum.

- For an examiner who hasn't carried out the implant insertion, the location of the vertical osteotomy cannot be determined following the surgery. As the implant can be inserted both laterally and obliquely and in the lower jaw both from the lingual and from the vestibular direction, and as the implant may also have been inserted longitudinally through the jaw, the vertical osteotomy can be anywhere in the jaw. Only the surgeon will know the insertion path. In addition, as one cannot expect osseo-adaptation in the area of the thread-bearing element, owing to flexion of the jaw or possible minimal play within the implant-prostesis-system, every probing carries the risk of - even for absolutely healthy implants - uncontrolled slipping off into the depths, which yields a non-reproduxible and diagnostically worthless incidental finding.

- When depth probing is carried out, the mechanically smoothed surface of the thread-bearing element of BOI is easily damaged and roughened. Rough surface regions promote subsequent accumulation of plaque. Due precisely to the design-related resiliency of BOI, one can thus pave the way for the establishment of an infection in deeper regions.

- It is well known from the crestal implantology literature that pathogenic germs can survive in niche areas from a pocket depth of approx. 5 mm. Especially when probing reaches the crestal plate of BOI, there is a risk that infections become established near the plate. They can spread horizontally along the plate and irreversibly disrupt the osseo-integration of the plates. Clinically, one can only gain control of this situation by removing the plate in question from the implant in a timely manner - i.e. before further penetration of the infection in the direction of lower plates - and cleaning the site thoroughly during a surgical intervention.

- If probing is undertaken in the upper jaw in the region of the sinus, there is always the danger of penetrating all the way into the sinus. This is because during probing the examiner is looking for a bony resistance, which is found rather rarely in the delicate bone structures in this region. While it not normally possible for an ascendant infection into the sinus to become established even under the most cramped conditions between oral cavity, BOI and maxillary sinus, clinical experience shows that probing as such may cause such infections. Apparently, penetrating probing deposits pathogenic germs directly into the maxillary sinus. In addition, deposition occurs along an unnatural pathway, against which there is no primary anatomical-structural line of defence.

- Even when clinically manifest sinusitis is already present, probing is futile: this is because the presence of the infection and its extent cannot be established by means of probing: this requires X-rays or a CT-scan. On the other hand, probing will result in an undesirable transplantation of bacteria and/or mixing of bacteria when the cause of the sinusitis was not in the region of the implant and when probing in search of bony support may injure soft-tissue anatomical structures.

- The course of „implantological collapse" for BOI differs substantially from the corresponding processes for crestal implants. The most frequent reasons for the loss of BOI are loss of osseo-adaptation in the region of the force-transmitting disc portions (e.g. as a result of osteolysis due to overloading) as well as fracture of the implants (most frequently as a result of loosening of the prosthetic constructions or as a result of osteolyses on implants that are integrated as part of the same implant-prosthesis-system elsewhere). Situations of overloading with osteolytic consequences at the force-transmitting discs of BOI cannot be diagnosed by means of depth probing. This requires X-ray and clinical examinations. Likewise, probing is not a reliable means for detecting fractures near BOI.

Summary

In general, any invasive medical procedure needs to be weighed up in terms of benefit and risk. Probing around teeth and implants must be considered invasive procedures. To justify probing, the obtainable measurement needs to be reproducible, on the one hand, and clinically meaningful, on the other. As there is always a risk of poorly controlled depth probing with BOI, and as the marginal bone level and the lateral bone adaptation in the region of the thread-bearing element are irrelevant for the prognosis of the implant at any rate, any probing around BOI presents a futile and potentially dangerous procedure that may harm the physical integrity of the patient. The potential damage associated with probing is completely disproportionate to the achievable diagnostic benefit.

Depth probing for evaluating the condition and prognosis of a basal implant rightly does not get mentioned in the Consensus on BOIxxvi. Recommendations from crestal implant literature cannot be transferred to BOI, as BOI possess different principles of function and integration.

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