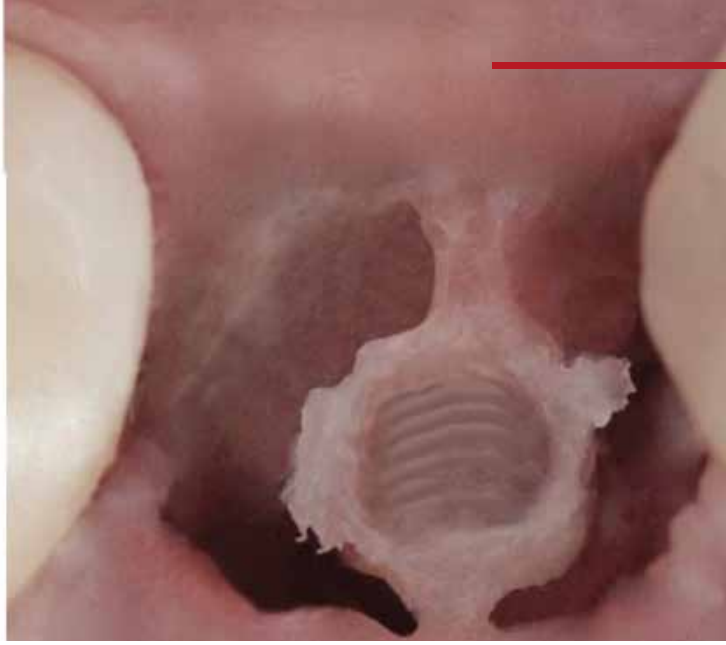


DETERMINING IMPLANT LENGTHS AND DIAMETERS

Thorough planning is the foundation for long-term success in implant placement. Influenced by developments over the past decades – particularly with regard to the design of various implant systems and the associated surgical techniques – the approach to determining implant lengths and diameters has also evolved. The impact on the pre-implant planning phase is outlined and explained below by Prof. Dr. Armin Nedjat using the MIMI®-technique (Minimally Invasive Medical Implantation Method) and the corresponding Champions implants.

Historically, starting with Brånemark in 1965 – who placed implants in the lower jaw only interforaminally – the goal used to be to insert the longest possible implants, maintaining a "safety distance" of 2 mm from important anatomical neighboring structures in both the lower and upper jaws **(Fig. 1 and 2)**. Today, planning for preoperative length estimation has become significantly simpler compared to past decades.

Regardless of available space, I have been placing delayed implants with a length of "just" 8 mm for about 10 years, and even as short as 6 mm when necessary **(Fig. 3)**. This approach is supported by the evaluation of 13,438 placed Champions (R)Evolution® implants in a 10-year study (2012 to 2022), which showed the same treatment success rate in 96.5 % of cases, without peri-implantitis, regardless of implant length.

Reasons for the change in implant length determination

In principle, there are three basic requirements or main criteria that inserted implants must meet and that implantologists should fulfill: the implant must allow for prosthetic restoration, achieve primary stability between 20 and 60 Ncm, and be surrounded at least buccally by 1 mm of keratinized gingiva.

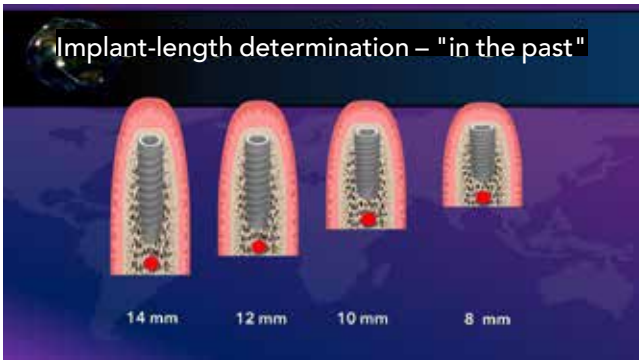


Fig. 1: In the past, implants were planned to be as long as possible using an OPTG. For example, if 16 mm of space was available, a 14 mm-long implant was placed; if there were 10 mm of space, an 8 mm-long implant was chosen.

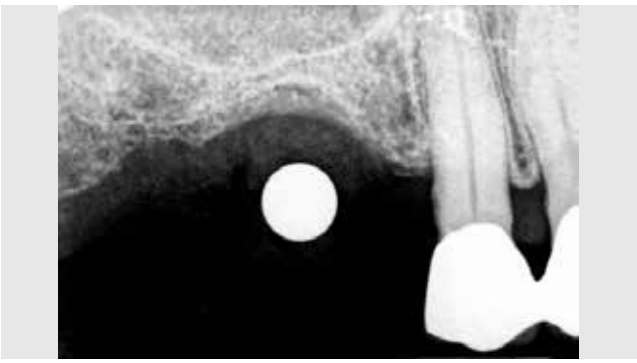


Fig. 2: To determine the available space, 5 mm-diameter lead balls were also used, fixed with a viscous bite registration material or with a thermoformed foil placed directly over the surgical area.

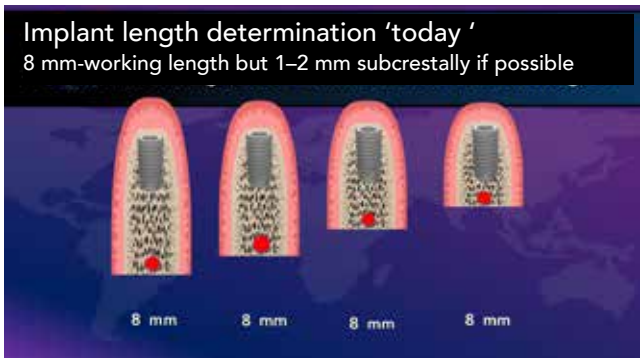


Fig. 3: Regardless of the remaining bone height (20 or 10 mm), implants with a length of 8 mm (or even just 6 mm) are now long since scientifically accepted as standard and, in some implant systems, show long-term results equivalent to those of longer implants.

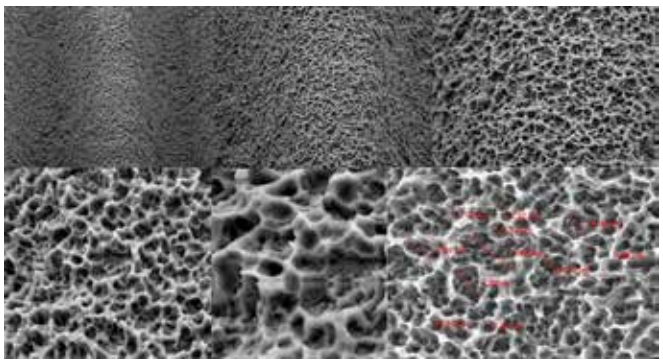
The key features of the Champions (R)Evolution implant include its crestal micro-thread, the bacteria-proof internal cone of 9.5°, and a Shuttle that combines multiple functions in one – serving as the insertion tool, the surgical cover screw, and the healing abutment. This allows the implant to be inserted 1 to 2 mm subcrestally without the disadvantages of bone-level implants. In hard D1/D2 bone, a crestal widening using a drill that is 0.5 mm larger is recommended, and primary stability between 20 and 60 Ncm is primarily achieved through the spongiosa. As a result, no significant forces act on the crestal bone level, which helps prevent crater-shaped bone resorption during the healing phase.
Of course, in the modern MIMI-method (Minimally Invasive Medical Implantation Method), no mucoperiosteal flaps should be raised, and a reopening of the gingiva (gum) ("re-entry") should be avoided.
The aim is to preserve the periosteum and the "gingival width" intact to maintain the nutrient bone pump via the healthy periosteum over the long term. This is important, as any flap raising may increase the risk of peri-implantitis.

"Finishing" of modern implant systems is recommended **(Fig. 4)**. Through blasting and triple etching, the "smooth" titanium surface develops both large and small lacunae, increasing the overall surface area by a factor of 50. As a result, the BIC (Bone-Implant Contact) increases significantly – for example, an 8 mm-long Champions (R)Evolution implant with a diameter of 3.5 mm achieves a surface area equivalent to that of a 32 mm- long non-finished implant with a diameter of 4.5 mm.

Another argument for the 8 mm standard implant length is the lingual mylohyoid fossa in the posterior lower jaw. If an axis-correct and optimal prosthetic implant position (with a straight Abutment) is intended, there is often only 10 mm of "space" available there **(yellow parenthesis, Fig. 5)**. To insert longer implants, you would necessarily have to prepare the cavity and insert the implant in a more buccally directed manner.
Though more from a business management perspective than a scientific one, a smaller "implant inventory" in the respective practice is also relevant. With around 1,500 implants inserted annually, we use the 8 mm- implant length in 85% of cases—ideally 1 to 2 mm subcrestally—so that the Shuttle of the Champions (R)Evolution implant (with a gingival height of, e.g., 2 mm) ends equi- or slightly subgingivally. As a result, the entire implantation, including infiltration anesthesia and X-ray check-up, takes only about 25 minutes.

Planning the implant diameter

First, two basic rules should be mentioned: In principle, for titanium two-piece implant systems, a diameter of "only" 3.5 mm can be recommended. The only exception is the replacement of a single molar, where a diameter of 4.0 mm should be used in both jaws. Even if a sagittal bone availability of 7 mm is visible in the cone beam



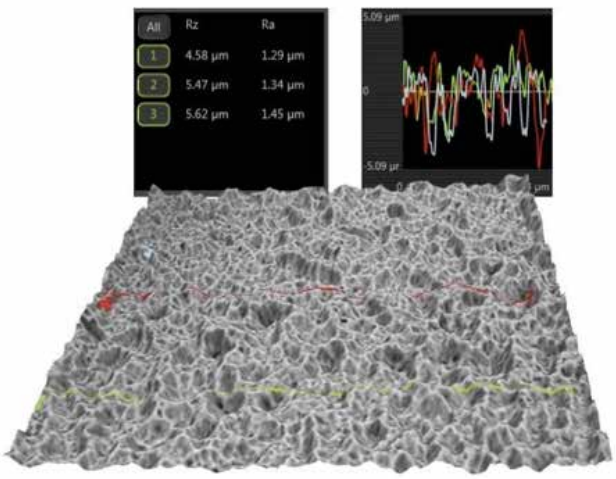


Fig. 4: Various finishing processes during manufacturing may lead to surface impurities, even in sterile-packaged implants. The CleanImplant Foundation has taken up this issue: since 2022, it has annually certified the Champions (R)Evolution (Made in Germany) with excellent, clean, and sterilized surfaces, based on intensive laboratory analyses and "blind purchases" from different dental clinics.

(CBCT) scan, 3.5- and 4.0 mm-diameters are always the first choice—provided bone density allows for it (keyword: "primary stability").
In the lateral distal posterior upper jaw or with (delayed) immediate implants, however, we no longer rely on the anatomy of the bone (e.g., using a preoperative cone beam) but on so-called bone Condensers. I personally introduced these into Dentistry in 2008, having originated from orthopedic surgery. They are "miniature versions" of the one- and two-piece Champions implants, with small diameter increments, used for bone condensation. In just a few minutes, soft D4 bone can be transformed into D3, and then into a more stable D2 bone, thus increasing the density of D3 and D4 and the grip of the implant by condensing the drilling walls. This "osseous metamorphosis" is safe, successful, and easy to perform **(Fig. 6)**.

After the pilot cavity is made with a Conical Triangular Drill, only Condensers with increasing diameters are used in softer bone (starting from the distal upper 1st premolar). For instance, if the blue HP-Condenser with a diameter of 4.3 mm reaches the required primary stability (20 Ncm; adjusted to the "OUT" position-release setting) at 30 rpm and 30 Ncm torque, a Champions (R)Evolution implant with a 4.5 mm diameter is selected **(Fig. 7)**. CA-Condensers run extremely "smoothly" and can also be used for the "Internal Direct Sinus Lift" (IDS).

Conclusion

A cone beam scan requires a medically justified indication and should never be performed routinely for planning purposes alone, due to the still significant radiation exposure for patients. The selection of implant lengths and diameters has become much simpler in the past two decades. It is recommended to record the length of the extracted root whenever possible and measure the length on the X-ray. This allows for a simple estimation of the bone volume using a basic rule of three **(Fig. 8)**.

In the case of delayed implantation, we have had good experience with shorter implants of a standard length

Fig. 5: In the posterior mandible, even in the mylohyoid fossa, an ideal prosthetic implant position can be achieved using shorter implants.

Fig. 6: The Champions-Implants Condensers with HP (handpiece) – connection are available in increasing diameters. Thanks to their smooth and lever-free operation, optimal preparation of the implant cavity can easily be achieved even in narrow bifurcations.

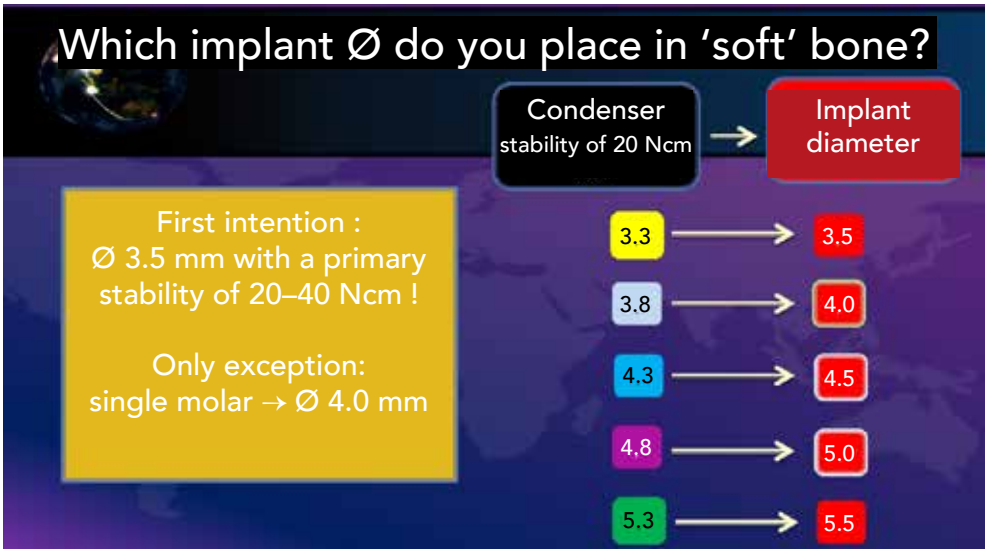


Fig. 7: Soft bone is prepared exclusively using "condensing" Condensers. As soon as primary stability of 20 Ncm is achieved with one of the Condensers, an implant with a slightly larger diameter than that Condenser can be inserted.

Fig. 8: Tip: The best measurement reference is the extracted tooth itself and the corresponding X-ray. Be sure to document the root length in the patient file before the tooth is immediately "biorecycled" using the Smart Grinder technique and returned to the socket to prevent alveolar collapse. This way, you'll know which implant length to use from week 8 post-extraction if you're not placing the implant immediately.

QR-Codes of two explanatory videos: one about determining the implant diameter and one showing the surgery of an Internal Direct Sinus Lift (IDS).

HP-Condensers and "Osseous Metamorphosis" (OMM)

Live surgery of an IDS (Internal Direct Sinus Lift) with simultaneous implantation

of 8 mm, ideally placed 1 to 2 mm subcrestally with "crestal relief" in D1/D2 bone without raising a muco-periosteal flap, using the CNIP-MIMI technique. In "soft" bone (as a rule distal, upper region teeth sites 5 to 7), in all immediate implantations, and in MIMI-II (distraction in narrow ridges), the HP-Condensers are used at approximately 30 rpm and 30 Ncm. In these cases, the preoperative anatomy does not determine the implant diameter in "soft" bone, but rather the bone density achieved through HP-Condensers, with the goal of inserting implants at a primary stability of 20 to 60 Ncm.

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