ten years of primary stability ...

... and immediate loading with Xive

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The immediate loading treatment option, particularly in the atrophied jaw and where there is reduced bone quality, is inseparably associated with the primary stability of the inserted implants. The basis for this is the macro design of the implant systems and the bone-specific preparation of the implant site. Because of the properties of the Xive implant system, both requirements can be fulfilled and transgingivally healing implants can also achieve a long-lasting osseointegration under functional load.

In contrast to secondary stability due to contact osteogenesis, primary stability is not so very dependent on biological factors, but, to a higher degree, on the design, particularly the macrodesign, of the implant, the insertion torque, the preparation technique and the quality of the local bone. An implant may be regarded as adequately primarily stable for functional immediate loading if a torque of more than 35 Ncm is reached on insertion. Otherwise, due to the micromovements of the implant due to an excessive load, there is the risk of fibrous encapsulation and even the failure of the osseointegration. This limit is specified as over 100 µm. Micromovements between 50 and 100 µm are considered critical. Values below this do not affect the osseointegration process and may even have a beneficial effect. Placed implants with adequate primary stability and splinted by an immediate temporary denture can therefore be immediately loaded. Here, the functional loading conforms to the criteria for immediate restoration.

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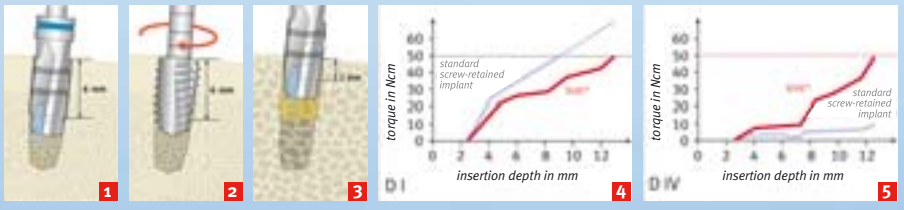


1 *The preparation depth of the crestal preparation in D I to D III bone is six millimeters.*
2 *The tap is also used in particularly dense bone.*
3 *The preparation depth of the crestal preparation in D IV bone is two millimeters.*
4 *Torque stabilization by Xive (red) in D I bone quality; the plateau formation ensures an atraumatic insertion.*
5 *Torque stabilization by Xive (red) in D IV bone quality due to internal condensation*

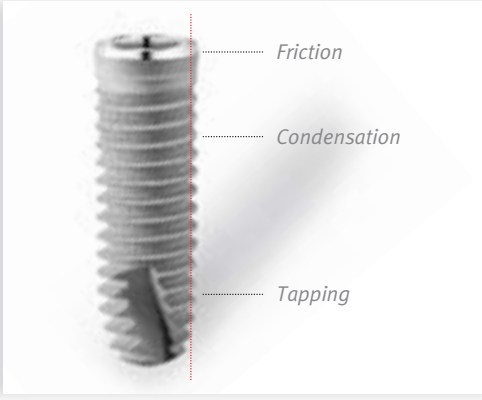
1_Schematic representation of crestal preparation using the Xive twist drill crestal and the tap
2_The implant design with the synchronized thread geometry of the Xive implants in combination with an appropriate preparation technique results in the condensation of the cancellous bone, without compromising the cortical bone too severely.
3a, 3b_The thread geometry in detail: Condensing larger core diameter in the crestal segment (3a) and additional small extension over and above the maximal implant diameter at the implant collar (3b)

BONE-SPECIFIC PREPARATION PROTOCOL

The preparation of the implant site appropriate to the bone – particularly in a soft bone structure – is a basic prerequisite for achieving the desired primary stability. The classification of the bone quality according to Lekholm and Zarb into class D I to D IV can be viewed as a standard. In the maxilla, class D III and D IV, a medium-hard to soft bone with wide-meshed cancellous bone, low density and thin cortical bone, are generally available. The mandible, on the other hand, is characterized, as a rule, by a class D I and D II bone quality, a more cortical, medium-hard to hard, very dense bone.

If there is the risk of bone trauma in cortical bone, then in cancellous bone there is the risk of a lack of primary stability. If the implant site is prepared for the desired implant diameter in accordance with the drilling protocol, then the preparation is generally crestal, adjusted to the available bony structure preparation of the cortical bone, using the crestal Xive twist drill. This may be dispensed with in exceptional cases where there is a D IV bone quality. A too intense compression of the cortical bone is avoided by expanding the cavity crestally, since the ablation of the substance only takes place in the upper third of the implant site. Due to the depth of this final crestal drilling, adapted to the bone quality, and optional use of the tap, the degree of bone condensation and hence the torque for the implant placement can be specifically defined. Hence, as a rule, the necessary primary stability can be achieved with the Xive implant in all bone qualities, without excessively loading or even traumatizing the cortical bone in the process (Fig. 1). In our investigation to assess the primary stability of Xive implants by measuring the insertion torque using various grafting techniques, we were able to analyze the values of 191 implants.

It becomes apparent that there is a correlation between the various grafting tech-niques and low bone density. The bone condensing thread design of the Xive implant used and targeted implant site preparation in accordance to the bone density, however, enables a high primary stability to be achieved by the torques attained – regardless of whether a grafting procedure has been performed or not.



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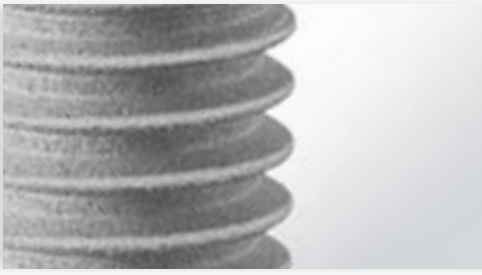

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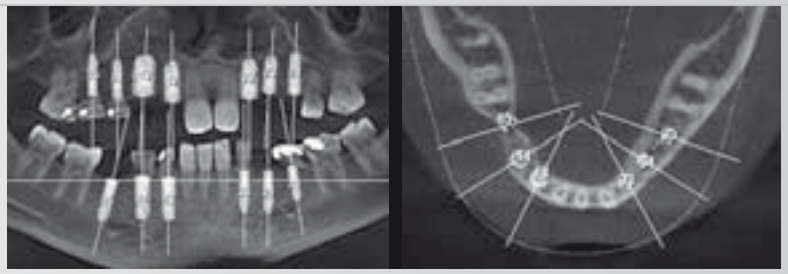
4a_



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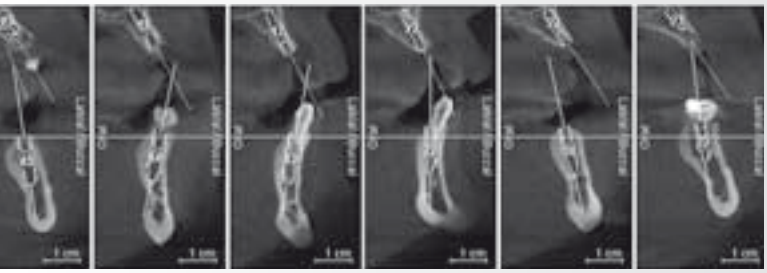

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Clinical case

4a_A patient with multiple agenesis had both a varying bone quality and a varying bone volume. Both require implants that, owing to their design, facilitate a high primary stability.
4b and 4c_The virtual planning of the implant treatment makes it clear that, due to the agenesis, various surgical techniques to build up the hard tissues and soft tissue management will be necessary.
4d_Pilot hole and preparation for bone splitting in region 14, 13, and 12 with simultaneous sinus floor elevation via lateral access in region 15
4e_Bone splitting following crestal osteotomy in region 13 with the Xive BoneCondenser
4f_Mechanical insertion of the Xive implants with high primary stability in the region of the sinus floor elevation

CONDENSING IMPLANT DESIGN

The thread geometry of the implant is significant for condensing the surrounding peri-implant bone. The friction in the bone is dependent on the depth of the thread. Hence, a rather narrow thread profile with a deep thread is recommended for the cancellous bone, while a flatter thread with a correspondingly low cutting resistance is suitable for the cortical bone. Otherwise, pressure necrosis could be caused in the cortical bone due to excessive compression and no adequate primary stability will be achieved in the cancellous bone. Therefore, a synchronized thread geometry for the crestal and apical bone region, adjusted to these requirements, was developed for the Xive implant system (Fig. 2). The thread design produces a condensation of the surrounding peri-implant bone, even as early as the placement in the region of the cancellous bone. This internal condensation is the key to a high primary stability, even where there is a soft or re-duced bone quality. By contrast, the condensing effect of the thread in the region of the cortical bone structure is deliberately minimized due to the flat thread geometry. Taking the bone-specific preparation into account, the extended crestal section of the Xive implants gently compresses the peri-implant bone here while being screwed in (Fig. 3a and 3b). The insertion in the cortical bone is safe and atraumatic due to the apically self-tapping thread. Even where there is extended caudalization of the maxillary sinus – particularly in class D IV bone – an adequate primary stability can be achieved, thanks to the condensation thread. This enables grafting procedure and implant placement. Where bone splitting is performed, the tapered apical thread allows a good stabilization in the local bone. The flat condensation thread, in turn, avoids traumatizing the expanded bone. Avoiding grafting procedures entirely or being able to perform these simultaneously with the implant placement because their complexity is reduced considerably means markedly less stress for the patient and the practitioner, as well as a noticeable simpli-

fication and reduction of the treatment process. Due to the non-rotationally symmetrical shape of the extraction socket and the low density of the alveolar cortical bone, in an immediate implant placement there are two limiting factors for a high primary stability, which can be compensated by using implants of the appropriate length and diameter, provided the preparation technique is guided by the bone quality in order to achieve an adequate primary stability.

CONCLUSION

Even in cancellous bone, the high primary stability due to the preparation technique, adjusted to the bone quality of the respective patient, in combination with Xive as the suitable implant system, creates numerous treatment options: single- or two-stage treatment, immediate or late implant placement, with or without immediate restoration (Fig. 4a to 4l). As a result, not only the processes in the practice and in the laboratory are optimized; above all, thanks to the therapeutic option of immediate loading, patient morbidity is reduced and patient acceptance and consent for implantological treatment increases accordingly. ■

Literature on request from the authors

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4g_Manual control using the ratchet to release the maximal torque, in order to release tension peaks, particularly in the crestal region
4h_Preparation of the implant site in region 35, 34, and 33; the tap is also used, in order to prevent a too intense compression in the cortical bone.
4i_Postoperative OPG; combined subgingival and transgingival healing mode in the immediate implants

4j_Preparation for impression making with TransferCaps attached
4k_Radiographic image of the restoration; the stability of the implants allows paired splinting and a cantilever in region 22 in the maxilla, in order to ensure the interimplant distances.
4l_Clinical situation of the restoration fifteen months postoperatively with keratinized and irritation-free gingiva and broadly harmoniously formed peri-implant soft tissues

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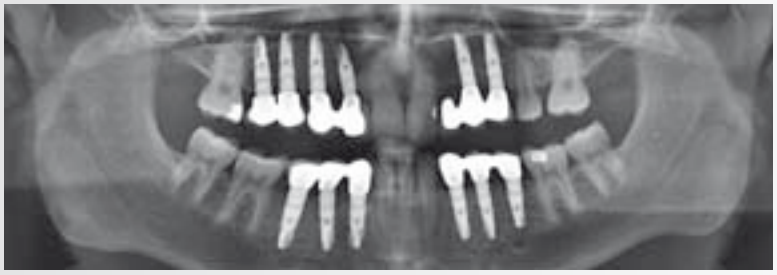

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