Piezosurgery — precise and safe new oral surgery technique

Piezosurgery is a new and modern bone surgery technique for periodontology and implantology. Piezosurgery has therapeutic features with several advantages over conventional surgical methods. The technology enables a micro-metric cut that is uniquely precise and secure, limiting tissue damage, especially to surrounding soft tissues. A selective cut is possible because of different ultrasonic frequencies, which only affects hard (mineralised) tissues, sparing fine anatomical structures. The intra-operative field remains almost free of blood. With piezo-electrical surgery techniques, bone harvesting (chips and blocks), crestal bone splitting, and sinus floor elevation can be performed easily and safely. Piezosurgery meets the high demands on the prosthetic finalisation of dental implants. Its precision allows excellent results and tissue conservation accelerates the healing process.

Piezo-electrical surgery is a relatively new surgical technique and offers considerable advantages over conventional methods of bone surgery. Based on adjustable, two-dimensional ultrasound oscillation, the technology offers tissue-specific cutting characteristics. With an operating frequency of 25–50 kHz, the device cuts hard tissues, while preserving sensitive soft tissues. Adjusting the working frequency settings and different tips, helps to adapt the system to different surgical techniques, such as dental extraction, bone grafting, osteogenic distraction, endodontic surgery, alveolar nerve decompression, and cyst removal. In particular, dental implants often require precise osteoplastical restoration, to guarantee proper positioning. Owing to its high accuracy (micrometric cut) and tissue-conserving properties (selective cut), Piezosurgery is the method of choice for critical implant site preparations.

Sinus floor elevation
Bone ridge splitting, harvesting techniques, and sinus elevation are particularly important techniques for implantologists. Sinus floor elevation is usually the most effective therapy for augmenting the atrophic posterior maxilla with bone mass. Perforation of the Schneiderian membrane is a risk with traditional procedures during preparation of the window or during the elevation stage. Piezosurgery can reduce this risk to a minimum. An intact membrane is a precondition for stabilising the graft. Different tips are therefore available for performing various surgical procedures, to achieve an optimal result. The selective cut makes it impossible to injure the membrane while preparing the window. In practice, the osteoplasty OT1 tip is recommended for the preparation of the window in case of a thin bone wall. In cases with thick bone, the osteoplasty OT1 tip is indicated for bone reduction, and the OT5 tip thereafter for bone cutting.

After elevation of the membrane 2 mm around the limits of the window, the Piezosurgery EL2 and EL3 elevation instruments are used. The hydraulic pressure of the elements applied via the cooling solution helps to dissect the membrane (Figs. 1–5).

Bone harvesting (chips and blocks)
Bone chips with a size of 500 µm (Fig. 6) are the perfect material for bone regeneration and show the best results. The chips serve as a guiding structure and thus facilitate bone regeneration. Piezosurgery is well suited for harvesting appropriate autogenous bone chips. Gently scratching along the surface of the bone, using osteoplasty OP1 to OP3 tips, can harvest sufficient bone chips.

Bone chips are not in any case the best material for bone regeneration. In horizontal or vertical augmentation procedures, bone chips show their limits. In these cases, bone blocks achieve better results. Classical donor areas for the blocks are the chin, linear oblique, and crista ilaca. The osteotomy has a disadvantage when using conventional procedures: the horizontal osteotomy needs a large area to be uncovered, to provide the clinician with good access to the operational site and to protect surrounding soft tissue. With Piezosurgery, this approach is easier, as the low operational amplitude of the tip requires only a small access area. The optimal cooling effect and the selective cut protect neighbouring soft tissues and ensure that no injury occurs (Figs. 7–8).

Bone splitting
For the placement of dental implants, the bone splitting technique can be used in cases in which there is sufficient...
bone height but insufficient bone width. In this case, Piezosurgery shows good results as well. With an osteotomy tip OT7, the bone can be separated non-traumatically (Figs. 10–12). An extension can be completed by the use of osteotomes. Piezosurgery lowers the risk of bone fractures and the bone becomes more elastic after extension. However, during bone splitting there is a risk of pressure trauma, especially in D1 bone. Therefore, Piezosurgery is also beneficial when used for preparations of dense mineralised bone.

Conclusion

With Piezosurgery, an innovative technique for dental surgery is available. It can be used as a concomitant procedure or, to some extent, to displace conventional techniques. It is especially useful for implant procedures, which demand precise actions and benefit from the high accuracy and tissue-preserving properties of this method.

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