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Case Report»

Dental implant treatment using cortical bone or corticalized bone areas.

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Typical contents in ID

- **Evidence Reports** summarize the latest «Hot Topics» from relevant journals putting similar studies «side-by-side». This unique presentation of studies allows you to compare and contrast the patient populations, the treatment interventions, and the quality of the scientific methods. The «evidence-based bottom line» is presented with an overall summary statement at the beginning. Clinical notes by implantologists with special expertise on the topic complete the Evidence Report by providing their expert clinical opinion. **ID** is an implantology publication that provides attention to detail in balancing science with clinical opinion in such a clear, concise, and visually-friendly presentation.

- **Literature Analyses** provide you with an in-depth look at the research on a given topic. A «Literature Analysis» is a critical review of the literature on the epidemiology, treatment methods, and prognosis for implant-related topics or conditions. Literature Analyses are broader than «Evidence Reports» and are written to serve as a reference tool for implantologists to help them make decisions regarding how to manage patients, to assist them in evaluating needs for future research, and to use the material for future presentations.

- **Critical Appraisals** summarize the findings from important papers used for clinical decision making or marketing by implant companies. In addition to the summary, the study's methods and clinical conclusions are critically reviewed in an effort to challenge the implantology community into not accepting everything that is published, while fostering alternative explanations and ideas.

- **Case reports** give implantologists the opportunity to publish on unique patients using innovative or alternative methods for treating challenging patient conditions.

- **Research in Context** is a helpful «what is» section to consult if you've ever read a study and asked «what is a p-value» or any other research method question. It assists clinicians with the critical evaluation of the literature by briefly describing relevant aspects of research methods and statistical analysis that may bias results and lead to erroneous conclusions.

Editorial

Funding for implants

Dental implantology takes place in a field between medical/surgical interventions and cosmetics.
In some European countries like **in Germany**, treatment providers have tried hard to position dental implantology in the field of medicine in order to get funding from the health insurers. This opened a large field of discussions, regulations and enormous amounts of money and time were spent for these useless efforts to take money out of the community`s pocket. One working minute at the chair is associated in Germany with more than 30 seconds of paperwork. This is ineffective.

In France, for many years, treatment providers were sick of arguing with health insurers and they positioned dental implantology clearly in the cosmetic field. Therefore patients had to pay out of their own pockets for the treatment and the implantologist did not argue with clerks of the insurance at all. They were right away able to direct treatment towards the patients needs, regardless of "regulations". With the economic crisis developing, some treatments are moved back into the field of public funding.
In Switzerland the placement of two implants in the area between the mental nerves plus a full denture fixed thereon is covered by a state insurance but not necessarily by the health insurance. The state insurance pays only for those patient`s, who can prove that they can`t afford this "simple treatment". Thus two implants for the secure fixation of the lower denture are considered the minimum amount of treatment, the minimum quality of life, which every citizen in Switzerland should be able to get. All other implants are not covered and the question whether the treatment is a completely medical one may be left open.

In Germany a young man is suitable for serving in the German Army even with severe oral malfunctions, deformations and abnormalities, missing teeth, etc., as long he is able to maintain his body-weight in comparison to his body-height within a broad limit.

In the Swiss medical system, on the other hand, dental treatments are not covered (except cases where the problem is based on congenital defect`s etc.), and the rejection of the coverage is made on grounds of the assumption, that teeth-loss or decay is always based on the patient`s own fault (lack of cleaning, lack of maintenance). The Swiss dental association fights strongly for keeping dentistry outside of any state-ruled insurance.

In Russian speaking countries the treatments provided by the state are restricted to the lowest possible standard, but they include crowns and bridges. Implants are not available in this basis. The reason is, that educated treatment providers who are knowledgeable about implant, simply will not even think of doing this kind of work inside state premises. Patients receive some minimal treatment in state clinics (consider this as a "patient catcher"), and they are then referred to the

private office (often run by the same treatment provider) for the implant treatment.

Since patients can eat and live with soft tissue born dentures or even without teeth at all, the question, whether or not dental implantology should be covered by insurances at all must be raised strongly.

There are good arguments for categorizing dental implantology into the field of cosmetics and there are arguments against it. The fact that the treatmant provider by law has to be a licensed dentist or surgeon alone, will not justify the strict classification as a medical invention. Note that liposuction and botox-applications (just to name two examples) are carried out by physicians and yet everyone will understand, that the major issue of those treatments is a cosmetic one in most of the cases.

Cosmetic interventions and medical interventions differ though with regard to the informed consent, with regard to patient information and decision making, and regarding electivity. Furthermore medical interventions can`t take place without medical indications, whereas cosmetic interventions can.

It seems that all efforts of state organizations to claim that the states will provide good and affordable dentistry are in vain. The reality shows, that the patients have to provide his/her own money for reasonable treatments, especially for dental implants. This is clearly an advantage, as this payment is usually connected with the patient taking good (or at least better) care of the incorporated work-pieces, if he/she himself/herself had to pay for it. We should strive to continue working for real, patient derived money, as long as it is available and has a value.

Munich, December 2010

Prof. Dr. Stefan Ihde

1. Introduction

At the onset of dental implantology a variety of implant designs was proposed and used. Later industry focused on producing bullet-type of implants and influenced the universities to "research" and teach into this direction. This finally influenced the thinking of the treatment providers to an extent, that many of them are unable to follow or understand a different way of thinking.

Dental implantology and orthopedic surgery were developing independently, without a fruitful exchange of ideas and experiences. Therefore the use of cortical bone was never advocated in the dental field, and the mainstream in dental implantology is until today still in doubt about the possibilities of immediate loading protocols and the usage of cortical bone and corticalized bone. The option of corticalizing spongious bone through compression screws on the other hand is to our knowledge not used in the field of orthopedic surgery.

Basal implantology closed this gap and introduced proven concepts of orthopedic surgery into our dental field. Basal implantology is a new category with new, broad indications and almost no limitations. Basal implants broadens the spectrum of implantology, without necessarily competing with traditional concepts. The technology allows to treat virtually every case immediately, safely and effectively. This also increases the productivity of the dental office dramatically.

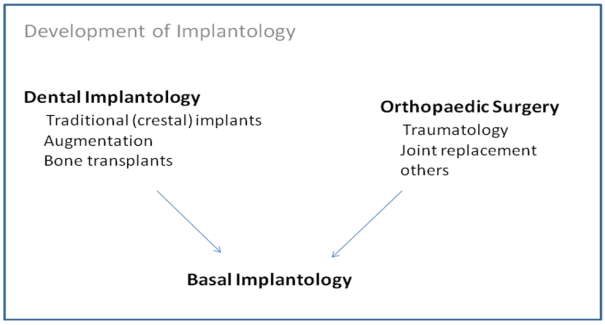

Fig. 1: While in some areas of this world even the traditional dental implantology is still fighting for this acknowledgement, the category has divided up in other areas. Basal implantology is based both on the dental knowledge(regarding prosthetics and function) as well as on proven surgical principles and concepts of the orthopaedic surgery. As a rule never bone augmentations are used to provide anchorage for basal implants. Instead optimum use of the available bone is made.

As per definition, basal implants consist of one or several base-plates or macro-retentive (retentive) threads, which are connected to a vertical implant part (or shaft), the latter holding an abutment (one piece designs) or an internal or an external thread for abutment connection (two piece designs). Lateral basal implants (e.g. commercial brands like Diskimplant®, BOI®, TOI®) are inserted from the lateral aspects of the jaw bone and anchored strictly trans-osseously in cortical bone structures. Basal implants transmit loads primarily (and initially only) into the cortical bone areas, and they do not necessarily have to be osseo-integrated (primarily or at

all) in spongious bone or empty areas (like the maxillary sinus). Basal screw implants are considered from a functional point of view as basal implants, because they are anchored in basal cortical bone regions in the cortical opposite to the alveolar crest. They provide no surface enlarging for load transmission in the vertical implant parts and they provide no 3D-compression. All basal implants belong to the group of osseo-integrated implants. Some basal implants provide in addition the possibility to be in part or only used as a sub-periosteal implant designs.

Basal implantology avoids bone augmentation. In selected cases augmentations are nevertheless performed to increase the volume for aesthetical reasons, even in combination with basal implants. However: augmentations are today never necessary for the sake of creating bone to fixate the implant.

2. Description of the devices

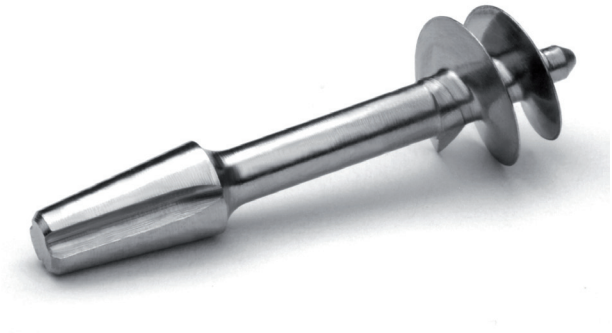

Fig. 2: Basal screw implant (BCS®, GBC®) 7mmd, 17mml: Load transmission takes place through the cortically anchored screw threads

Fig. 3: Basal Implant with a base-plate of 9 x 16 mm and a shaft height of 6 mm (BOI® BAST 9/16, or TOI®). The base-plate of this BOI®-design may be turned after the inserting the implant. This way high primary stability is gained. The serrated flat end of the implant interlocks in the vestibular cortical. These designs are turned inside the bone after they have been fully inserted.

Fig. 4: Compression screw implants (KOS®, GCS®) are not considered to be basal implants. They nevertheless allow immediate loading, because the surrounding bone is compressed during the insertion of the implant. The bone thereby corticalizes (becomes more dense, while the osteonal bone structures are damaged), remodeling is delayed, and the compressed peri-implant bone cannot be the origin of the remodeling process. However these bone areas can be still the target of the remodeling.

At the first glimpse the devices displayed in Figures 2 and 3 seem to have nothing to do with each other. In practical use however, they are absolutely identical regarding the purpose of the design: Both implants are designed to create cortical anchorage in the cortical. BOI®-implants utilize the lateral corticals of the jaw bone, while BCS®-implants with large threads utilize the basal cortical and the lateral corticals.

"Other than conventional implants, basal implants use macro-retentive elements of their design to allow immediate loading. They are anchored purely in native cortical bone."

According to the traditional thinking in dental implantology it is assumed that implants become osseo-integrated, and that this process is somehow connected or supported by the properties of the surface of the implants. When using basal implants or the KOS® system, we are utilizing cortical bone areas and as soon as the implant gains direct contact to highly mineralized cortical or corticalized bone it can be considered as functionally already osseo-integrated. This gives us the opportunity and the justification for an immediate load protocol.

Although they are skelettonized, basal implants provide exactly what is needed by the dentists to satisfy the needs of the patient:

Stable intra-oral abutments, through cortical anchorage

- The transition area between the infection-free basal bone area and the mouth serves as a safety-distance.
- A thin mucosal penetration area as a prophylactic means against peri-implantitis.
- A cementing or screw-on abutment, or a screw connection for safely connecting prosthetics
- A polished surface for the prevention of infections (just as orthopaedic implant screws and devices)

Traditional crestal implantology no doubt offers optimal ways of restorative treatment in situations where the implants can be inserted without delay and with no need for adjuvant procedures. Unfortunately, a great many patients do not meet these criteria. This is particularly true of the posterior segments of the maxilla and mandible. Whenever oral conditions are less than ideal for crestal implants, the advantages of the basal approach are obvious:

- Low degree of invasiveness (no augmentation, distraction or transplantation)
- A one-step procedure
- Simple repair in case of problems or implant exchange
- Combination with crestal implants and even with teeth (in selected cases)
- Simple laboratory technique
- Extremely high success rates

- If screwable designs are used, in most cases a flapless procedure is sufficient. This way placing implants has mutated to an extreme non-invasive procedure.

Disadvantages of the basal implant systems include:

- The stock-keeping requirements in the daily practice are slightly greater than in crestal implantology, i.e. it will always be necessary to keep an assortment of implant types handy to avoid extensive planning. Of course, extensive (3D-) pre-operative planning is an alternative for keeping stock, however keeping a stock is cheaper.

- The technique of lateral basal implants poses substantial challenges, for instructors and users alike, as far as the surgical and prosthetic treatment stages and the substantial knowledge requirements in the fields of biomechanics and bone physiology are concerned. An outline of the necessary knowledge is found in the textbook "Immediate loading" which is available from the International Implant Foundation.

From a business perspective, however, these disadvantages turn out to be advantages after all, since mastering the learning curve will give dentists a comfortable edge over any competitors in the field of implantology.
It has been discussed that the devices shown here do not allow the creation of aesthetical solutions, because the dentist cannot deliver an emerging profile. It is true, that KOS®, BCS® and BOI® implants do not provide an emerging profile and the good reasons for this have been mentioned. In fact, good aesthetics may be reached without an emerging profile, and the results are long-lasting.

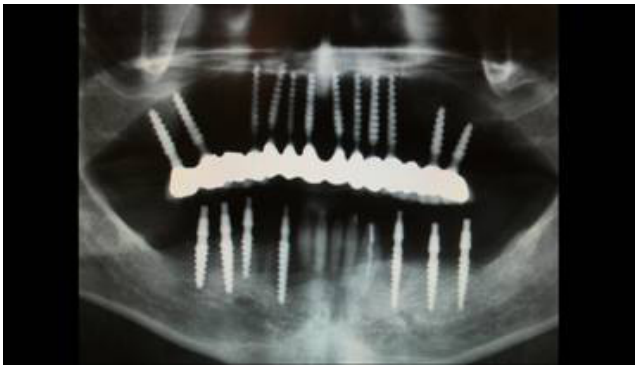

Fig. 5a:

Fig. 5 b

Fig. 5a and 5b: Compression screw implants were seated in the mandible and in the maxilla. Although the implant-heads are only max. 3.45mm in diameter, an extremely satisfying and durable clinical result (The upper jaw is shown 12 years postoperatively) is possible.

3. The Treatment plan

Basal implants (BOI®, BCS®) may be used as support for bridges. In some indication their use as single tooth implants is possible. In general we recommend to use in healed bone areas a KOS® implant instead of basal implants. The reason is, that the KOS® implant with its roughened surface shows better resistance against rotation.

For segments and full bridges we prefer basal implants, because they are easier to use and the risk of infection is smaller. BCS® and BOI® are suited for placement into extraction sockets. Actually the preferred way of treatment is to insert the implant right after the extraction and not to wait for the "healing" of the socket.

The rationale behind this is, that the socket walls undergo remodelling after the extraction. This remodelling weakens the bone structures for a long period (up to two years) and the weakened bone provides less resistance for the implant under immediate load conditions.

For full bridges the area of the canines and of the 2nd molars is equipped with implants. Additional implant between these "strategic areas" can help to secure the treatment success in immediate loading protocols. In the maxilla the last implant is typically a tubero-pterygoid screw. BCS® implants are well suitable for this purpose. The distal mandible is typically treated with a BAST-implant (Fig.3). For canunes either long BCS® or triple-BOI® implants are suitable.

Fig. 6

Fig. 6: Technical abutments at the side of a full bridge in a case with extremely strong resorbtion. The masticatory surfaces are created ideally, because they are the pathways for a bilateral and balanced mastication. Note that the base-plates are much wider than the vertical part of the implant, and this results in a direct support of the masticatory surfaces. All occlusal contact points and all functional surfaces are located within the supporting polygon marked by the base- plates of the implants.

Fig. 7.: The upper jaw is equipped with 8 KOS® screw implants and two STC tubero-pterygoid screws. The usage of angulated KOS®A 25o right in front of the sinus allows reduction of the otherwise wide span from the anterior implants to the tubero-pterygoid screw. Note that this bridge is cemented on the KOS® implants and screw-connected to the distal SCT-implants. Avoiding the sinus and nevertheless reducing the span of the bridges is one of the key strategies in basal osseointegration.

Fig. 7

We tend to use basal implants with only one disk-plate in the distal mandible and prefer to put no implants at the premolar positions for full bridges, to ensure that the elasticity of the mandible is not overly reduced and that no fulcrum is created in the middle of the horizontal part of this bone. Triple- and double-disk BOI® implants can be used to good effect along the anterior block of the mandible.

When considering a tooth as part of a larger bridge, it should be considered that overall masticatory forces will increase. In general the maxilla should be treated with 8-10 implants: "Never underequip the maxilla! (citation from: Prof. Dr. Gerard Scortecci)"

Which jaw should be restored first?

Concerning the issue as to which jaw should be restored first, we have developed the following approach in our clinic: if implant treatment is needed in both jaws, both jaws should be treated simultaneously. Sometimes patients do not agree to this treatment, i.e. because they have not full trust in implants or because they cannot afford treatment in both jaws right away. In these cases the mandible should be treated first. There are several reasons for this decision:

- Complete dentures are not retained nearly as well in the mandible as in the maxilla. Therefore, the need to provide treatment is typically greater in the mandible.

- In many cases, additional implant treatment in the maxilla turns out to be redundant once a fixed restoration has been inserted in the mandible. The patients adapt easier to an upper full denture.

- The morphological changes in the mandible are often substantial, particularly in the wake of adjustments performed to re-establish a normal masticatory pattern. Simultaneous placement of implants in the maxilla and mandible carries a high risk of overloading the newly inserted implants in the maxilla. Relative elevation of the distal implants is especially liable to inflict damage to maxilla. Conditions are more favourable once the functional adaptation after implant placement in the mandible have been largely completed.

Note however, that the mandible alone may only be treated, if the maxilla offers a satisfactory opposing dentition, aligned to the plane of Kamper, and correct curves of Spee and Wilson. If the mandible is restored against an unsuitable maxillary dentition, various problems may arise and often in combination of the treatment of the upper jaw with implants, a new fabrication of the lower bridge (free of charge) is required. Should, in these cases, problems with the lower bridge and implants arise before the upper jaw

has received implants, the patient may lose trust in the procedure and deny the treatment in the upper jaw.

Clinical experience shows that the ability to eat increases after inserting a mandibular restoration supported by implants. Chewing function was significantly improved once these restorations were in place. In patients on a limited budget, a cost-benefit analysis will therefore definitely argue in favour of providing an implant-based solution in the mandible rather than the maxilla. This strategy will be effective in the majority of patients and will often render additional treatment of the maxilla redundant (See: Lee A.J.C., Albrektsson T, Brånemark P.I. (eds.): Clinical Application of Biomaterials. John Wiley & Sons Ltd.). Thereby the approach is very cost-effective.

We feel that this view needs to be put into perspective, as considerable progress has been made with implant treatment in the maxilla since 1982. With today's BOI® and BCS® technology, implant-supported fixed restorations have become just as affordable, successful and simple to realize in the maxilla as they have been in the mandible for quite a time.
If a complete denture is present in the maxilla, the necessary (mostly distal) elevation of the occlusal plane towards Kamper's plane can be performed more readily than in the presence of a fixed restoration or of elongated natural teeth. Trying to save money on this aspect of treatment will be counter-productive in the long term.

Treating only one jaw is not recommended in cases where:

- in the opposite jaw teeth from 6 -6 are not present and cannot be restored without implants. An unequal arch length in the non treated jaw will lead in most cases to a unilateral pattern of chewing. This leads inevitably to an unequal distribution of bone mineralisation and subsequently to problems on the tension side.

- unilateral or anterior chewing patterns prevail and cannot be eliminated on the existing dentition.

- the bite must be raised in both jaws in order to adjust the vertical dimension.

- the plane of bite cannot be aligned to the plane of Kamper: this is very often the case in class II subdivision 2 cases. After elongation of both frontal segments and tooth loss in the distal mandible those patients present a plane of bite which is significantly too much caudally in the distal jaws. If this is to be corrected, usually

- all lower front teeth have to be extracted and the extraction of the canines must be considered

- a vertical reduction of the bone between the mental nerves often has to be performed (the necessary reduction is 0.3 – 1 cm)

- the vertical dimension must be raised, and elongated upper molars and pre-molars must either be shortened or extracted.

- It is recommended to raise the bite in one step and even to raise it slightly more than initially necessary. This will allow a slight reduction of the vertical dimension during the adjustment phase, without creating an overly strong engagement of the front teeth. To avoid this, the front teeth must have enough free space at all times.

Single tooth restorations on basal implants

Replacing single teeth with basal implants is a good option for the trained implantologist. It requires good intra-operative vision and planning, because once the horizontal slots have been performed, the position of the slots cannot be changed. Therefore starting at the correct height is vital. Except for the replacement of first upper molars, and lower 2nd molars all positions are suitable for single BOI implant placement. Whenever a healing time is acceptable or required, the internal system (IDO, IDDO, IDDDO) may be used. The head of those implants are partly submerged and placement of a healing screw is required as the following two case reports show. The beauty of this procedure is that implantologists trained on screws are well able to do the prosthetical work on IDO implants and they only have to learn the slightly different insertion technique.

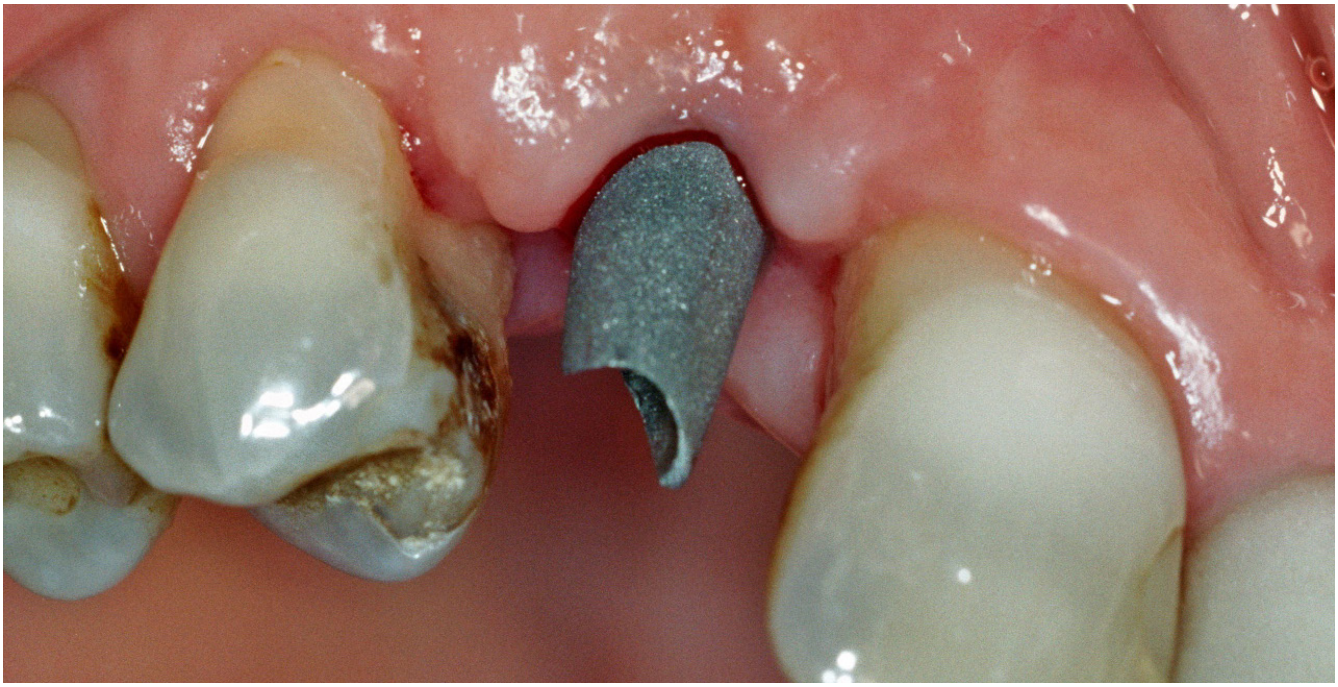

Fig. 8: An individual abutment was casted (Co CrMo) and is tried in.

Fig. 9.: Perfect integration of the basal implant with visual corticalization of the bone adjacent to the base plates. The grafted area seems to be connected to the native bone. The distance between the bone and the crown-to-implant connection is approximately 1.5 mm. This case was treated using the early reopening technique (ERT, see below)

Fig. 10.: The decision to create a lateral (12) rather than a canine was taken in close communication with the patient. No request for improvement of the soft tissue situation.

4. Handling KOS® and BCS®-implants

4.1. The flapless approach

Whenever the horizontal bone supply (width) is adequate, the flapless insertion technique should be used. Avoiding a flap helps preserve the bony flow of nutrients unchanged and avoids the occurrence of a regional acceleratory phenomenon (RAP). Therefore the available spongeous bone remains constant after implant placement.

Experienced surgeons manage to place KOS and BCS implants even into very narrow ridges without creating a flap. In fact, a flapless approach is always worth trying. The morphology of the alveolar crest may be explored bi-digitally or with the help of the injection needle.

The osteotomy in the upper jaw may be prepared or carried out with the help of the handgrip, the adapter, and the thin yellow pathfinder drill (BCD 1). Only if the bone becomes very hard, the blue contra-angle may be used to gain an osteotomy in an adequate length.

Whenever it is possible, the osteotomy also for KOS implants in the upper jaw should reach the opposite cortical and penetrate it slightly. The implant placed therafter should also reach this cortical. As a rule, roughened implants (KOS®, KOS®B, KOS®A, KOS®E, KOS®EB) may penetrate the cortical towards the nose or the maxillary sinus approximately 1 mm without creating a problem. BCS may penetrate into any depth or even transverse the sinus to reach a stable cortical areal. The reasons for this are that BCS® implants are completely polished and for this reason they are not prone to bacterial colonisation. Furthermore they have a thin mucosal penetration diameter.

When planning the osteotomy take into consideration, that in many cases the densitiy of the bone around the osteotomy is different at different sides. As soon as a compression screw or a BCS® is placed into a cavity smaller than the threads, the screw will be forced into the direction of the weaker bone areal. This may lead to a change of inclination of the implant or to a complete displacement. Since the bone in the upper jaw is denser on the palatinal side, the displacement is usually into the vestibular direction and often we have to assume that the vestibular cortical is fractured under the periost. This fracture resembles a Greenstick-fracture and it heals uneventfully.

Whereas we can and should compress the spongeous bone to increase the stability in the maxilla, we do not have this possibility in the lower jaw. Therefore the osteotomy in the lower jaw must be prepared almost to the size of the core of the implant or slightly bigger, because even the thick-necked KOS® implant (2.8mmd at the neck) would fracture as soon as forces of more than 80 Ncm are exerted.

In this context I would like to mention, that the idea of the “pressure osteolysis” does not refer to conical compression screw implants. The so called “pressure osteolysis” created “during implant insertion” has been described in connection with cylindrical implants, however scientific proof for its existence is missing, and it is assumed to occur only at the apex of implants. (As it is not possible to differentiate between “pressure osteolysis” and the result of a residual infection, many cases of “rest-ostitis”

may have been misdiagnosed).

In conical implants high insertion torques concentrate on the flat or rounded apex area, whereas pressure distributes evenly over the whole vertical implant area in conical implants and not in the apex of the implants. This pressure distribution is effective. Furthermore spongeous bone becomes condensed whenever compression screw implants are inserted. The process of condensing is described as corticalization. During this corticalization the flow through the osteons is cut off, osteons are destroyed and compressed and they can no longer be the source of osteonal remodelling but only the target of osteons travelling from unaffected bone areals. Since this takes more time (depending on the distance from the point of the initiation of a secondary osteon to the implant surface), the time-span for carrying out prosthetical work on KOS implants is increased. Nevertheless is has to be mentioned here again, that immediate splinting (and thereby loading) is still the safest way of handling KOS and BCS implants.

New designs of BCS® implants are available with diameters of 5.5 mm, 7 mm, 9 mm, and 12 mm. The implants feature very sharp and cutting threads. To place these implants after a pre-drilling of 2 – 2.5mmd often only requires a considerable amount of axial pressure. This pressure is exerted with the hand which is not turning the ratchet. Note that theses implants may alter their direction of insertion, if the corticals which they touch are of an unequal mineralization.

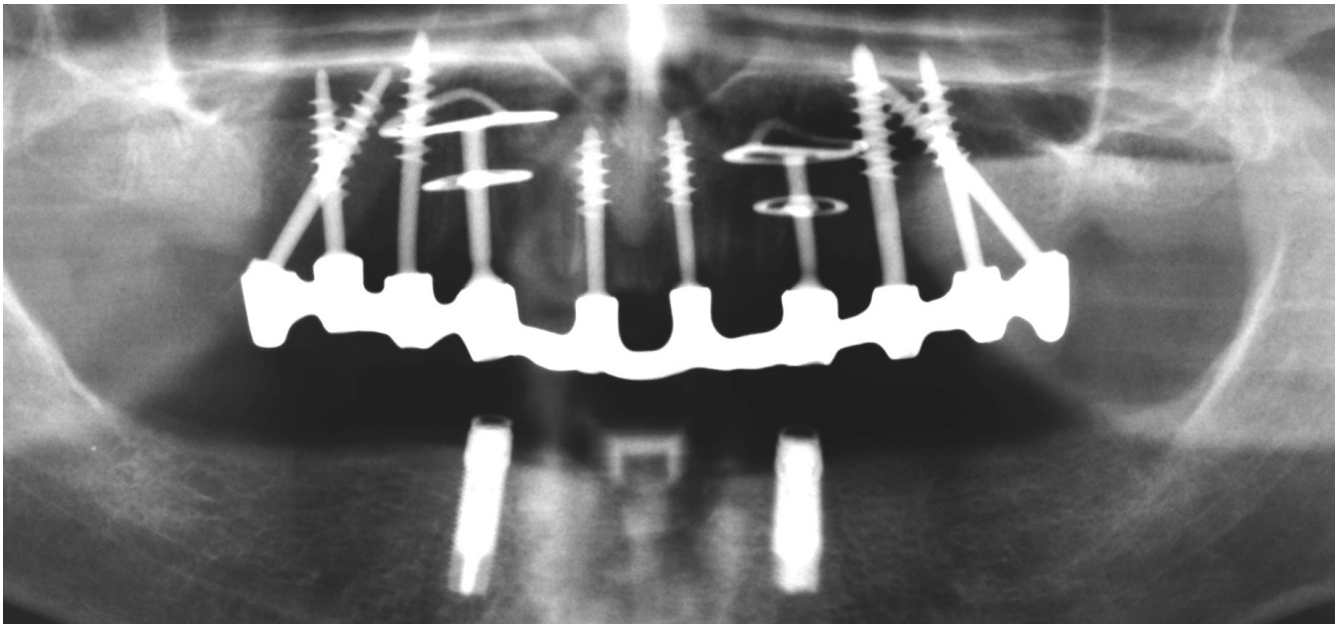

Fig. 11: Implants may touch or bypass one another inside the bone without creating any problem. The requirement for inter-implant distance is smaller, if the implants provide a thin diameter and if they are polished.

For KOS® implants the drill sequence has to be regarded especially in the lower jaw. In the upper jaw the bone may be so soft, that a wide implant may be placed right after the initial pilot drill (the yellow DOS1) was used to the full length.

For flapless insertions the oral mucosa is completely disinfected with Betadine or a similar agent. The insertion is planned according to radiographs, mostly by panoramic overview pictures. From this picture information about the start of the insertion is taken, the length of the implant is determined, and the question, whether or not an opposite cortical should be penetrated is answered.

Digital or bi-digital inspection will then help to explore the site in the mouth. Special care must be taken, not to slip off the ridge or to penetrate the cortical in lingual or palatal direction. Undercuts on the lingual aspect of the mandible are explored also. Although cortical engagement is for KOS® implants not as essential as it is for BCS® implants (KOS® implants gain stability by resting in compressed bone with strongly reduced possibility to initiate remodelling), it nevertheless is an advantage to position the apex of the KOS® implant into cortical bone.

4.2 Insertion with open flap technique

If the surgeon is uncertain about the bone morphology and fails to fixate the implant into the bone, the preparation of a flap is indicated.

a.) Slim crestal flaps are an option in many cases:

In a strictly crestal approach the top of the crest is uncovered, but the flap remains attached to the alveolar bone on both sides. Under this relatively good vision often the secure preparation and the insertion of a thin KOS® implant (e.g. 3.0 or 3.2 mm) becomes possible in thin ridges. The small flap is then sutured around the implants.

b.) The full flap technique should uncover the whole alveolar bone at least from one side. The flap preparation is done para-crestally: usually the cut is performed on the palatinal side, but again strictly perpendicular to the bone surface. These flaps offer the opportunity to punch th+e flap and hang the flap over the implant heads after a flap lengthening procedure (Wassmund-Procedure). Therefore the flap should not only allow the insetion of the implant, it should also allow closing over extractions and a sound suturing. It is advisable to create rather large flaps, because the patients will have less pain if the flaps are large. The possibility of intra-operative changes of the treatment plan must be taken into account: in some cases placing a lateral implant instead of a BCS is necessary and in those cases a larger flap is definitely an advantage. When suturing after extractions, note that the frontal area and areas over base-

plates should be closed first, because it is easier to generate tissue in the distal maxilla (through a flap lengthening procedure than in the front. Closing tightly over base-plates is necessary in order to preserve the blood clot for woven bone formation.

c.) The exploration flap is used, if the crestal width of the bone is sufficient for implant insertion, but endangered structures or parts of basal implants have to be passed by in secure distance. A typical example for this exploration flap is a small cut crestally to the mental nerve followed by the careful preparation of the nerve-bundle. Under full vision of the nerve bundle the implant may be inserted near the nerve, without opening a full flap. The exploration flap is sutured slightly and the sutures may be taken out on the day after surgery.

4.3. Coping with non-parallel bone supply

When using KOS® implants there are 4 good options to overcome the problem of non- parallel implants and divergent insertion directions:

- Using angulated KOS®A implants is a good option in healed bone areas and if the implant is being splinted to other implants. KOS®A is contra-indicated for single tooth replacement.
- KOS®B provides the possibility of bending. The neck of the implant is 1.8mm in diameter only, and bends of about 15 degrees are possible. KOS B implants must be used in connection with other implants in larger bridges. Usage as a single implant is strictly contra-indicated.
- Finally, both KOS® and BCS® implants may be equipped with "angulation-adapters" These adapters are slipped over the abutments and cemented with strong, permanent cements (e.g. Fuji, Fusion, Panavia or similar). Both the surface of the abutment and the inner surface of the adapter must be roughened with a coarse diamond before the cementation takes place. After the cementation the over-projecting top of the abutment is ground down to the adapter surface.

4.5. Lateral basal implants

After preparing a full thickness flap, the vertical and the horizontal osteotomies are prepared. After this the implant is inserted with gentle tapping and the flap is closed. The impression is taken typically right after the operation.

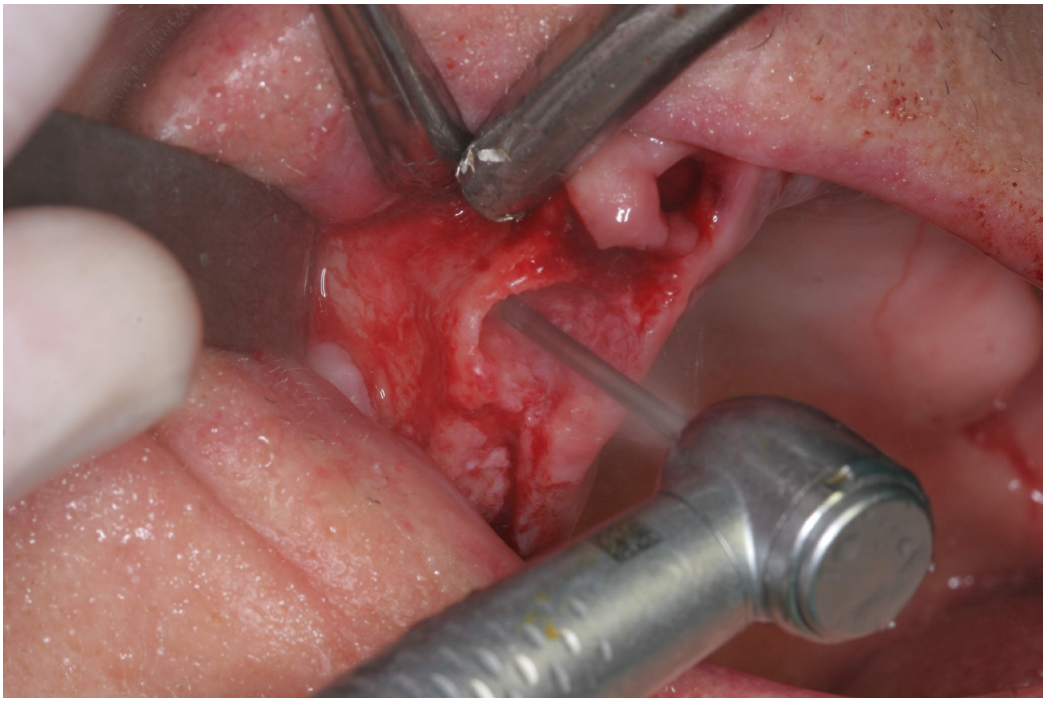

Fig. 12a

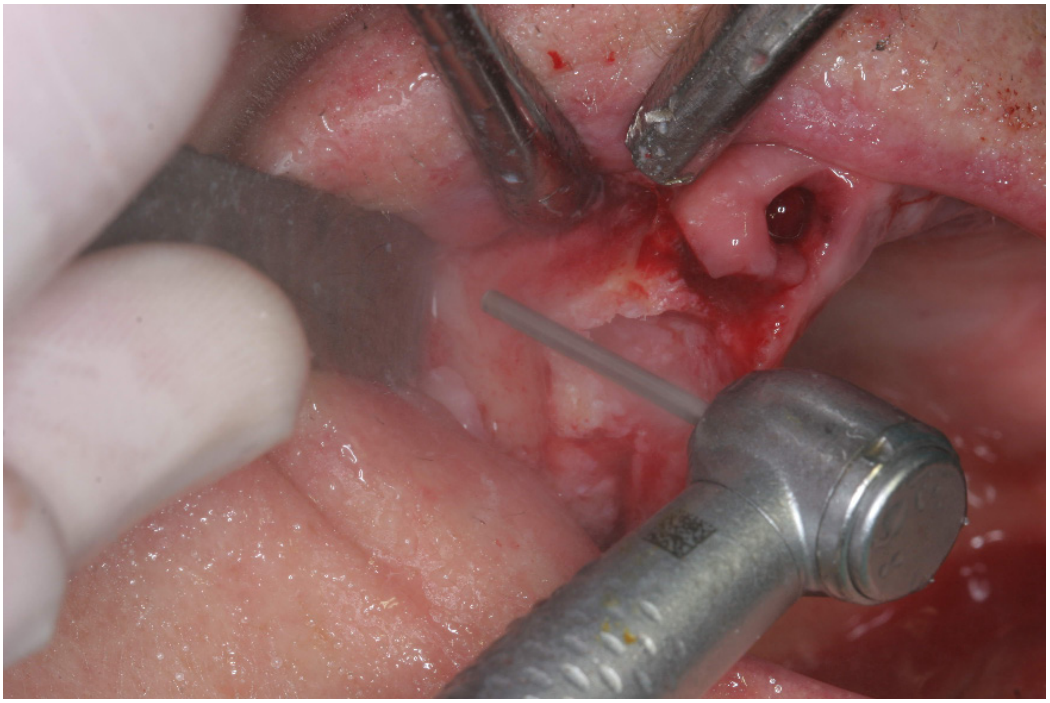

Fig. 12b

Fig. 12c

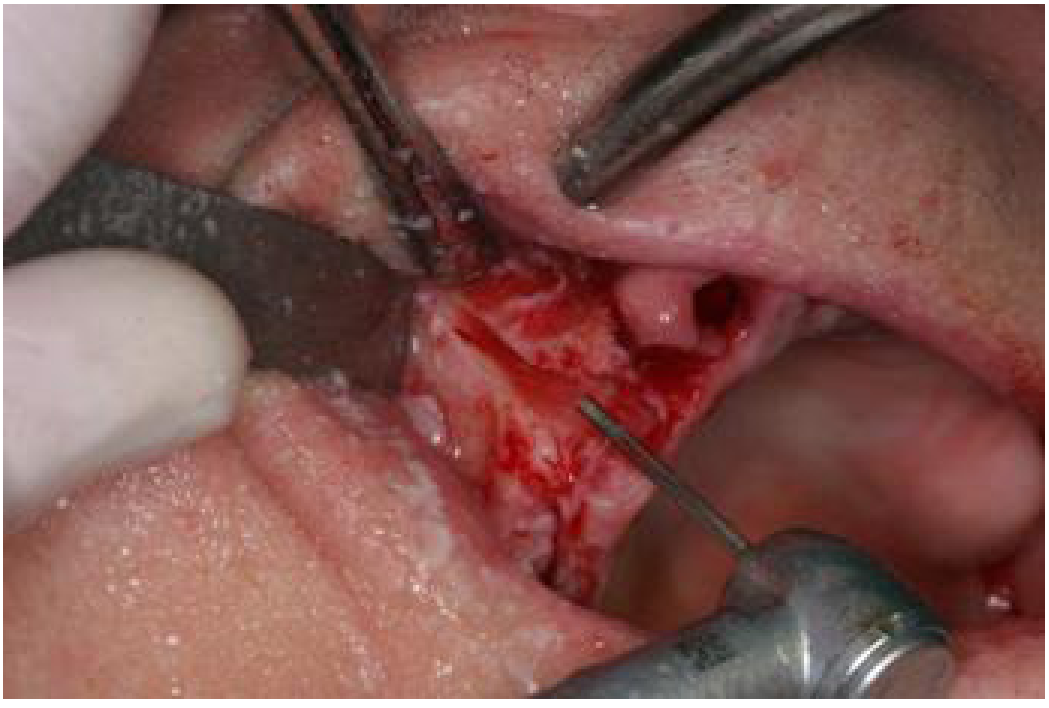

Fig. 12d

Fig. 12e

Fig. 12f

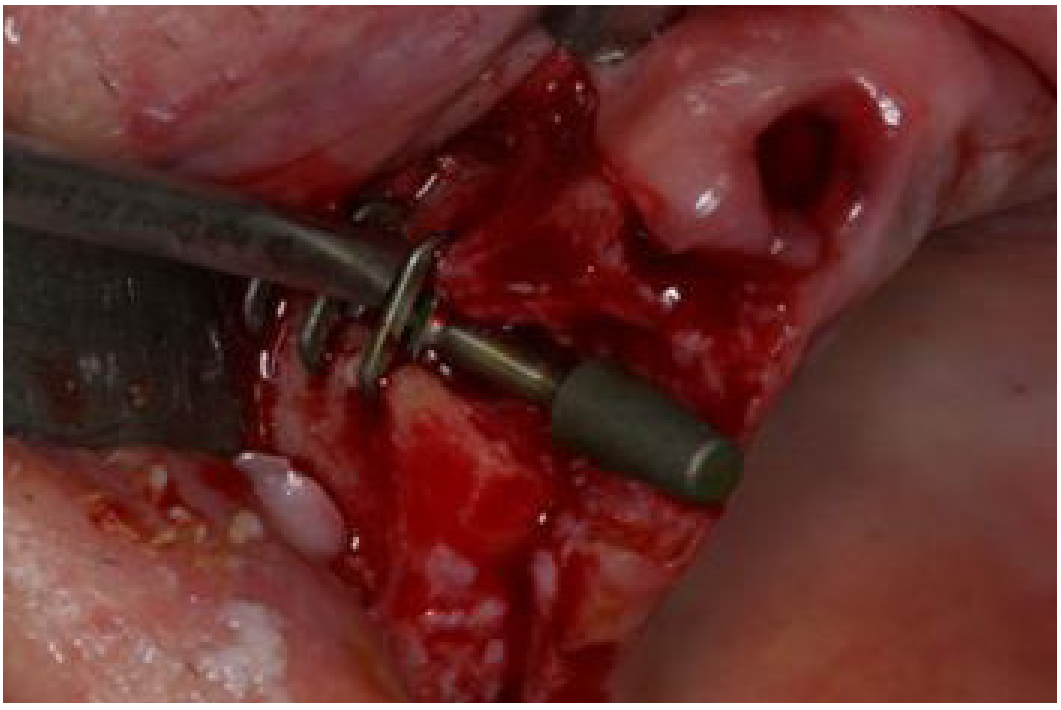

Fig. 12f

Figs. 12a-g: After the tooth 13 had been extracted, the socket is cleaned from soft tissue remnants (Fig. 12.a). Then the over-projecting vestibular part of the bony extraction socket is reduced (Figs. 12.b, c) and the vertical slot is prepared (Fig.12.d). With the triple-cutter the horizontal slots are prepared (Figs. 12. e,.f.). The implant is tapped in completely (Figs. 12 g.). Since after extractions often a V-shaped vertical slot is left on the vestibular side of the alveolar crest, the soft tissue might invaginate into the slot and competitively prevent (woven) bone formation. This can be avoided by moving down larger parts of the flap towards the head of the implant,- a procedure which can be compared to a coronal repositioning flap in the periodontal field. The sutures are always used as matrace or double sutures (3.0 silk being the preferred material) and those sutures should be left in 5 – 7 days to allow the stabilization of the soft tissues in the new position. If considerable amounts of soft tissues are moved towards the head of the implant, a nice aesthetic appearance is easier to achieve.

Conclusion

Basal implants utilize cortical bone areas. They are inserted in a bi-cortical (trans-osseous) way. Because the stable and resorption-resistant cortical bone is used, procedures are possible in an immediate load protocol.

Compression screws are used as single tooth implant and preferably in healed bone areas, i.e. not in sockets. The rationale of compressing the bone is the increase of mineralisation and the prevention of remodelling originating nearby the endosseous implant surface.

As basal implants are considered elastic implants, they may be combined with natural teeth. The treatment provider should keep in mind however, that dental implants have on average a higher life expectation than the involved teeth. Hence constructions should be planned in a way, that teeth which fail early can be removed without endangering the overall construction.

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