Supporting the osseointegration of ceramic implants

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In traditional oral surgery and implantology, the focus is on implant healing and on the local prerequisites for maintaining or building bone and soft tissue. But our prevailing perspective rarely transcends the oral cavity. Traditionally, we distinguish four potential mechanisms of bone formation: osteoinduction (growth factors), osteoconduction (bone replacement materials as "placeholders"), distraction osteogenesis and guided tissue regeneration (membranes, shell technique, etc.).[1]

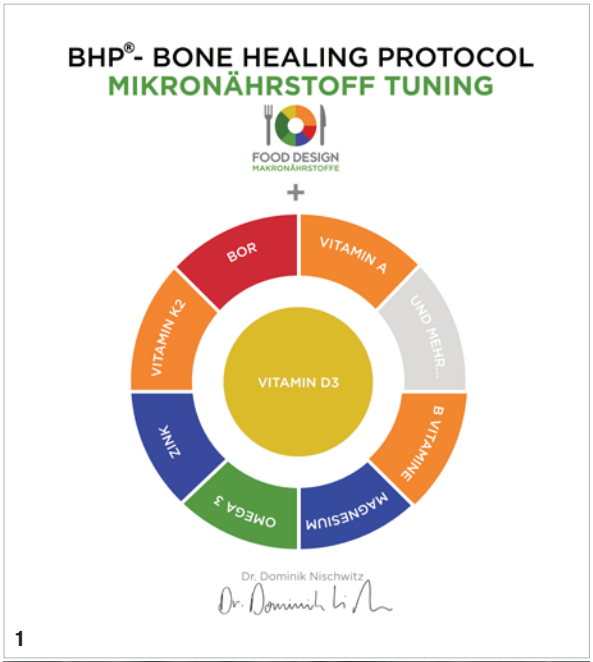
In biological dentistry, we draw on our experience and knowledge from functional medicine and nutritional science and employ targeted micronutrient therapies to support the systemic requirements ahead of planned surgery and for subsequent bone and tissue regeneration.

Local preconditions

Local preconditions for smart bone and soft-tissue regeneration include the decontamination of the surgical site (breath, saliva) and the activation of local growth factors (IGF-1, osteoblasts, plasma proteins, etc.) by drilling and by providing bleeding spots for bone stimulation, as well as the use of smart biomaterials such as platelet-rich fibrin (PRF) membranes to improve the extracellular matrix and optimise the bone and soft-tissue situation.

The use of microinvasive techniques such as piezosurgery, the use of ozone, navigated implant placement and improved imaging technologies (such as cone beam computed tomography, CBCT) have brought enormous advances in dental craftsmanship. The trend is clearly towards aesthetics and health. Far from remaining a taboo subject, ceramic implants are the future of oral implantology. Nevertheless, only about one per cent of surgeons insert ceramic implants. Based on his ten years of clinical experience (with over 4,000 ceramic implants placed), the author can safely assert that more surgical but especially systemic information is needed to achieve even better healing rates.

Ceramic implants heal without inflammation—but this is actually crux of the matter. Hardly any of us are truly familiar with the biochemistry of the entire human body.



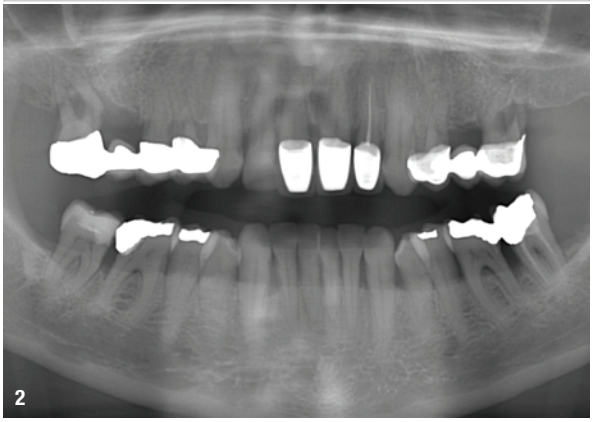


Fig. 1: Overview of the Bone Healing Protocol. – **Fig. 2:** Orthopantomograph taken prior to surgery.

In ceramic implantology, it is important to incorporate insights from functional medicine, nutrition and micronutrients in order to prepare the body for a "remodelling phase", and this is why much of our focus is on improving our patients' lifestyles. Both systemic preparation for the surgical intervention and a targeted follow-up are of the utmost importance.

Smart bone and soft-tissue management

Systemic preconditions: Surgical preparations and dietary changes. An improper diet with sugar, wheat, refined cooking oils, conventional dairy products ("Core Four disease agents")and other food intolerances promote the body's general tendency to develop inflammatory reactions and macro- and micronutrient deficiencies, meaning that insufficient proteins and amino acids, the fat-soluble A, D3, E and K vitamins, the water-soluble B and C vitamins, and minerals such as zinc and magnesium as well as healthy omega-3 and omega-6 fatty acids will be available for building and regenerating tissue and bone.[2] Our goal is to prepare patients for surgery as effectively as possible. The focus is on providing the right macronutrients and avoiding as many stressors as possible. The "Core Four disease agents" should be strictly avoided. More than one hundred years ago, Dr Weston Price researched different peoples all over the world. He documented his research in his book *Nutrition and Physical Degeneration*[3]: People who ate a species-appropriate diet were virtually immune to tooth decay. Their descendants, who had already been exposed to industrially processed foods, were already suffering from the typical signs of degeneration due to a lack of nutrients. The most important macronutrient for building tissue (bone, soft tissue, muscles, etc.) is protein.

Proteins and amino acids—life's building blocks

There are 20 proteinogenic amino acids, but only eight of them actually have to be ingested with the diet. These so-called essential amino acids are isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. The body is capable of building any protein from these eight amino acids—provided it has enough raw material available.

Numerous studies have demonstrated a link between inadequate bone formation, reduced bone density and delayed fracture healing on one hand and deficiencies in proteins and amino acids on the other. The older the patients, the more significant the correlation. Dayer et al. (2006), in an animal study, found that titanium implants osseointegrated less readily in protein-deficient rats (< 1 g/kg body weight).[4,5] The torque required to explant an implant from a rat's bone after six to eight weeks was around 43% lower in protein-deficient rats than in the animals with sufficient protein in their diet (= 1 g/kg body weight).[4] Hannan et al. found a clear association over four years between bone loss and insufficient animal protein in the diet, based on data from 391 women and 224 men participating in the Framingham Osteoporosis Study.[6] The greater the protein deficiency, the more pronounced the loss of bone mass at the femur and spine. No negative effect of excess protein on bone healing was observed.[6]

Fig. 3: Intra-oral situation prior to surgery. – **Fig. 4:** Preparing for implant placement. – **Figs. 5+6:** Status following delivery of the restoration.

Consequently, our main focus is on an adequate protein supply. Since no deficiency of macro- and micronutrients should be present in the acute regeneration phase, we recommend a daily protein intake of 1.5 to 2 g/kg body weight. To alkalize the body, a serving of vegetables is recommended with every meal. Healthy fats such as omega-3 and a variation of monounsaturated and polyunsaturated fatty acids should also be present. Collagen powders, essential amino acids, bone broths and protein shakes make it easier for patients to meet their daily pro-

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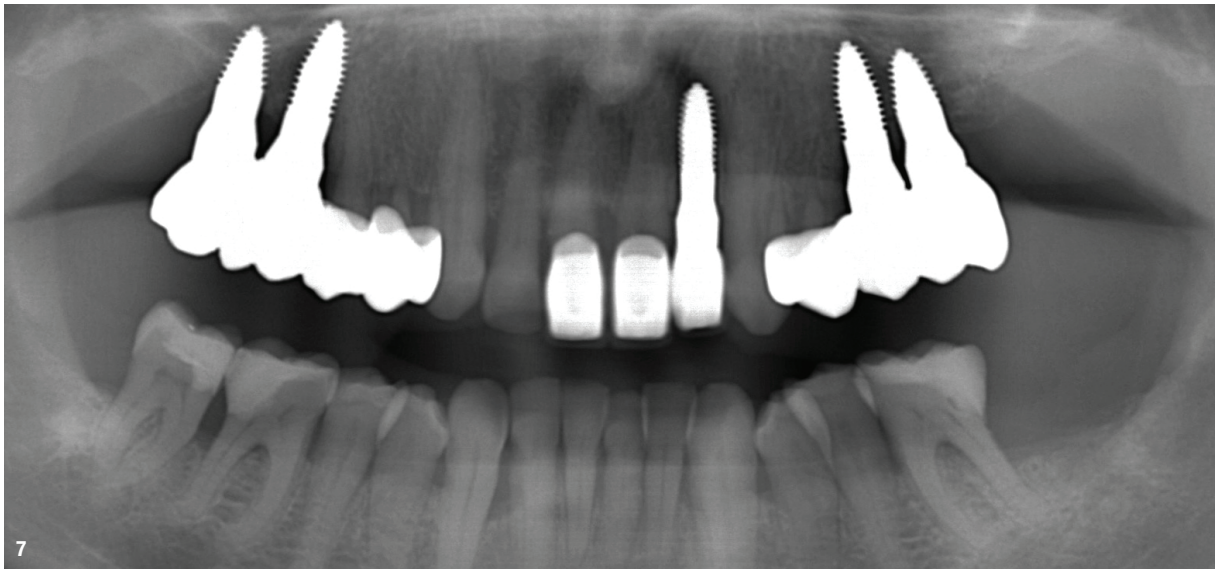

Fig. 7: Radiograph taken with the restoration in place.

tein requirements.[7–17] In our practice, systemic support for patients through targeted nutrition and supplying the appropriate nutrient supplements has become standard practice as a vital component of the surgery treatment.

Micronutrients

The foundation of the Bone Healing Protocol is high-dosage vitamin D3. Before surgery, we measure the patient's blood vitamin D3 levels. For optimal sustenance, we aim for a preoperative level of at least 60 ng/ml.[18] Numerous studies have shown that vitamin D3 is a critical factor in bone and tooth regeneration.[19–23] This vitamin activates two enzymes that are critical for bone mineralisation: osteocalcin (BGP) and matrix Gla protein (MGP). To prevent calcium from causing the calcification of arteries, these enzymes are activated by another important co-factor, vitamin K2 (MK-7).[24]

Another co-factor is magnesium, which is implicated in over 400 metabolic processes.[25] Zinc is involved both within the immune system and as a co-factor in the activation of the vitamin D3 receptor.[26] The trace element boron doubles the half-life of vitamin D3.[27] Since micronutrients work synergistically, there should be no shortage of B vitamins, vitamin C or digestive enzymes as well as omega-3 fatty acids in the postoperative period.

Conclusion

In addition to the precision of modern dental surgery, we integrate principles from functional medicine and nutrition. Our goal is to activate patients' innate healing capacities, support tissue and bone regeneration, and thereby significantly improve the integration success of ceramic implants.

The result: fewer complications, enhanced stability, and healthier, satisfied patients.

Yet, one of the greatest challenges in our specialty remains evident—biological dentistry currently lacks a universally recognised international standard.

To bridge this gap, the Institute of Biological Dentistry is pioneering a globally accepted quality framework: the Biodentistry Global Standard (BGS).

We are educating dentists worldwide under the Biodentistry 3.0 paradigm: a new era that harmonises advanced surgical techniques with functional medicine, positioning the dentist as a holistic healthcare expert of the future.

Literature

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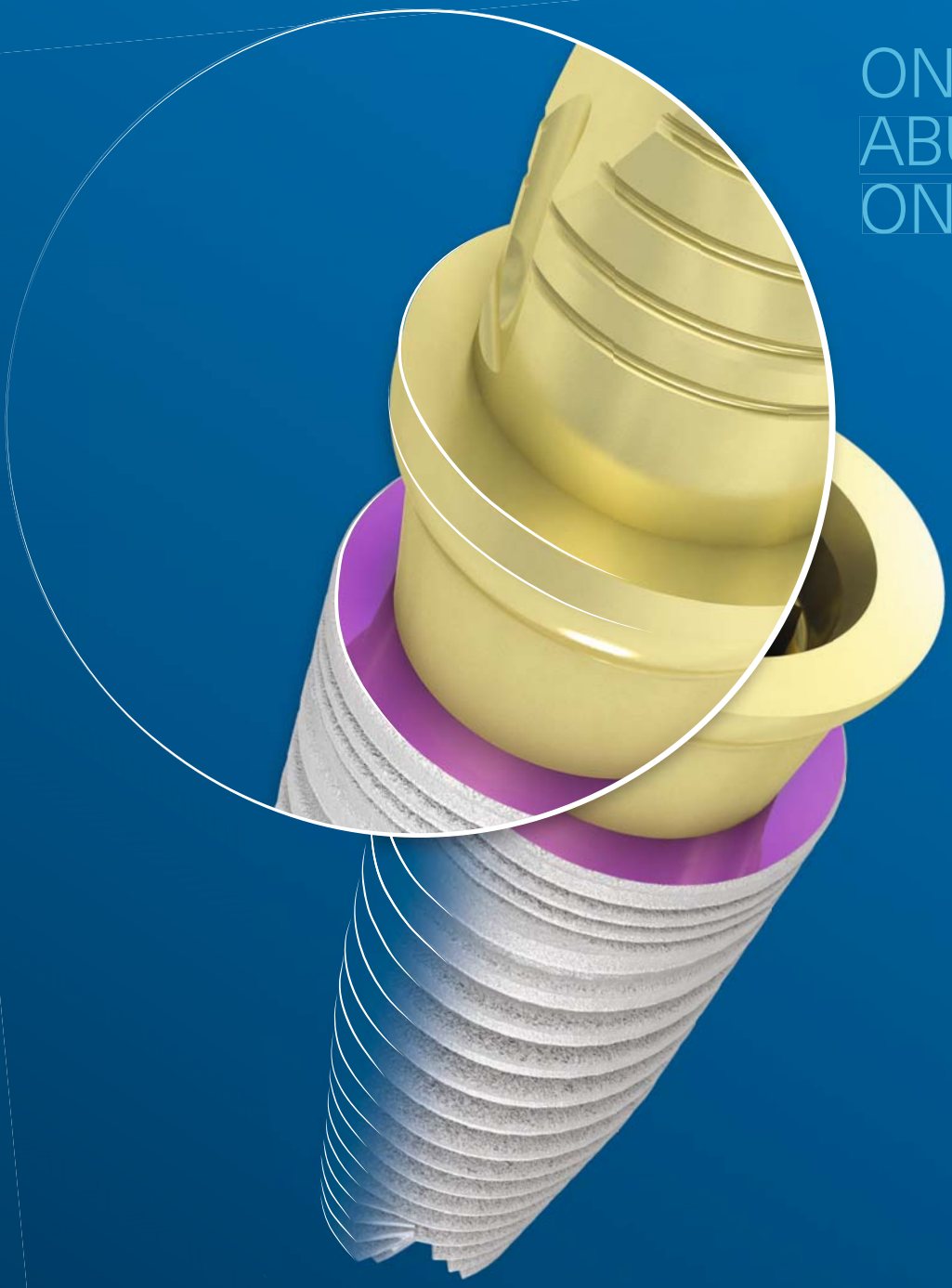

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