PHD THESIS – summery in english

# THE INFLUENCE OF BONE METABOLISM IN DENTAL IMPLANT THERAPY

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Dental implantology is a specialized field of dental medicine focused on the rehabilitation of patients who have experienced partial or complete tooth loss as a result of various etiological factors. Through the use of dental implants, modern implantology offers a predictable and long-term solution for restoring oral function and aesthetics. Dental implants are medical devices primarily manufactured from titanium, a material known for its high biocompatibility, and are designed to achieve stable anchorage within the alveolar bone while functioning as artificial dental roots that support prosthetic restorations.

Prior to the initiation of implant therapy, a comprehensive clinical and paraclinical evaluation of the patient is essential. This evaluation includes laboratory investigations, such as blood tests, as well as advanced imaging examinations, most notably cone-beam computed tomography. These diagnostic procedures provide crucial information regarding the patient's general health status, bone quantity and quality, and the anatomical characteristics of the implant site. Based on the assessment of biological parameters and bone support, an individualized surgical and prosthetic treatment plan is developed in order to optimize treatment outcomes.

The surgical placement of dental implants is generally performed under local anesthesia and follows a standardized clinical protocol. The procedure includes incision of the oral mucosa, elevation of the mucoperiosteal flap, preparation of the implant bed according to the manufacturer's guidelines, insertion of the implant into the alveolar bone, and closure of the surgical site by suturing. When properly indicated and executed, this therapeutic approach provides a durable, functional, and aesthetic solution for patients with edentulous spaces, contributing to the restoration of masticatory efficiency, phonation, and facial harmony.

Following implant insertion, a healing period is required to allow for osseointegration, a biological process characterized by the direct structural and functional connection between the implant surface and surrounding bone tissue. The duration of this phase varies depending on factors such as alveolar bone density, implant macrodesign, and the level of primary stability achieved at placement. Upon completion of successful osseointegration, the prosthetic phase of treatment is initiated, during which the definitive prosthetic restoration is fabricated and connected to the implant.

Dental implant therapy offers several advantages compared to conventional prosthetic solutions. These include the restoration of essential oral functions such as mastication and speech, preservation of adjacent teeth by eliminating the need for their preparation, prevention of progressive alveolar bone resorption, and improvement of the patient's quality of life and psychological well-being. Despite these benefits, the long-term success of implant treatment is influenced by multiple systemic and local factors, including the patient's general health condition, level of oral hygiene, and the absence of active infectious or inflammatory processes within the oral cavity.

In cases where radiological investigations reveal insufficient bone volume or unfavorable bone morphology—such as those resulting from traumatic extractions, advanced infections, trauma, or oncological conditions—bone augmentation procedures are required prior to implant placement. Bone tissue exhibits a remarkable regenerative capacity, particularly evident in fracture healing and alveolar bone regeneration. Although numerous synthetic and xenogeneic bone substitutes are currently available, autologous bone grafts remain the gold standard in bone augmentation procedures, especially when using Guided Bone Regeneration techniques. Autologous bone possesses osteogenic properties, promotes the release of growth factors, and provides a scaffold for neovascularization and osteoconduction.

One of the major risk factors affecting the long-term prognosis of dental implants is the presence of pathogenic bacterial microflora within the oral cavity. Periodontal pathogens associated with gingivitis and marginal periodontitis can colonize implant surfaces, leading to peri-implant inflammatory conditions such as peri-mucositis and peri-implantitis. If left untreated, these conditions may result in progressive peri-implant bone loss, implant mobility, and eventual implant failure. Therefore, regular follow-up visits and strict maintenance protocols are essential to ensure early diagnosis and management of potential complications.

This doctoral thesis was developed to support dentists and residents in dentoalveolar and maxillofacial surgery by providing a biologically oriented and multidisciplinary perspective on contemporary dental implantology. The research focuses on the influence of systemic biological parameters, including vitamin D levels and lipid profile components, as well as microbial factors involved in peri-implant pathology. Additionally, the

feasibility of using autologous ground dentin as a bone augmentation material for implant placement is explored.

**The primary objective** of the thesis was to conduct an observational study evaluating the clinical effectiveness of ground dentin used as an autologous bone substitute in sinus lift procedures performed in the posterior maxilla. **The second objective** aimed to investigate potential correlations between biological parameters and bone density during the interval between implant placement and prosthetic loading. **The third objective** focused on assessing whether bone resorption associated with periodontal disease is subsequently transmitted to the peri-implant bone surrounding dental implants. Through these research directions, the present thesis seeks to contribute to the optimization of implant treatment protocols and to enhance the predictability and long-term success of dental implant therapy.