Editorial

Weight of the Implant-superstructure and Stresses in the Bone

One of the characteristic features of the field of the implant dentistry is a constant development in the implant-biomaterials that are improving the rate and quality of the osseointegration. However, the complexity of the nature of the masticatory loading is one of the key determinants in the success of the implant restorations. More and more research is concentrating on how the masticatory loading can be modified to provide favorable stresses transferred to the implant-superstructure, implant-body and the supporting bone. Hence, different framework and veneering materials to fabricate the implant-superstructure are constantly being developed. Though the structural durability and biocompatibility are important qualities of these biomaterials, 'weight' of the superstructure is one of the key elements that can directly affects the stress level developed in the bone. More the weight of the implant-superstructure, more are the stresses developed in the bone under same masticatory loading conditions. Weight of the superstructure can be altered by changing the density of the framework and veneering materials. Different framework materials are tried to fabricate the superstructure like Co-Cr alloys, Ni-Cr alloys, Ti alloys, zirconia, fiber reinforced composites. Veneering materials like porcelain, composite resins, and acrylic resin are usually used for implant superstructure. Different material has different density and hence effectively different weight for the same volume.

Most of the studies highlighting the modulus of elasticity of the materials used to fabricate the superstructure that also plays an important role in stress distribution in the superstructure as well as in the bone.[1-3] Meric et al evaluated stresses developed in the bone with the three-dimensional finite element method (3D FEM) analysis. They used three 3-unit implant-supported fixed partial denture (FPD) composed of a metal framework and porcelain veneer with or without a cantilevered extension and an FPD composed of a fiber-reinforced composite framework and a particulate composite veneer without a cantilevered extension. Under vertical, oblique, and horizontal forces applied to the prostheses in the models, the lowest stresses in the bone were observed with the model containing fiber-reinforced composite framework and a particulate composite veneer. Ciftci and Canay studied stress distribution on the metal framework of the implant-supported fixed prosthesis using different veneering materials like porcelain, heat-polymerized poly (methyl methacrylate) resin, microfilled composite resin, and glass-modified composite resin. They concluded that in comparison to porcelain, more stresses are borne by the acrylic resin-veneered metal framework under static loading. Juodzbalys et al analyzed and compared the resultant stresses in the superstructures and in the supporting bone by the dynamic and static occlusal loading on one unit fixed, implant-supported prostheses veneered with porcelain and with composite resin material with a 3D FEM analysis. They concluded that the composite resin material has more advantageous stress distribution than porcelain, which reduces impact force under dynamic load up to a 6.5%. All these research are highlighting the effect of material modulus of elasticity definitely played the role in stress distribution inside the superstructure as well as in the supporting bone.

The research indicating the influence of the weight of these materials of the substructure on the stresses developed in the bone is still missing. There is a need of more biomechanical and clinical research of superstructure materials to evaluate and develop favorable stress pattern in the bone.

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