LETTER TO EDITOR

IMPLANT MOVEMENT

Dear Editor

Implant and the restoration in the oral cavity are subjected to numerous forces of varying duration and type that are so complex that it is hard to replicate. This is one of the various reasons that are presented for the failure of breakage of implants that perform well in the lab but fail when they're placed at the clinical stage.[1] Biomechanics is concerned with the physical behavior of biological structures as well as the relationship between biologic and regenerative systems. Forces are passed directly from an implant and natural tooth to the bone during restoration, and this should be considered in the biomechanics of dental implants. Under all the enlisted factors that are associated with the clinical performance of the implant, micromovement of the implant via force to transfer to the bone has been highlighted. The issue of implant micromotion has become increasingly important with the introduction of innovative treatment approaches such as early and quick loading of dental implants[2], with implants being repaired early in the healing phase.

The minimal displacement of an implant body relative to the surrounding tissue, which cannot be recognized with the naked eye is known as micromovement of the implant. According to Perona et al. Macromobility (more than 0.5 mm) can be seen with the naked eye, indicating osseointegration failure even in the absence of additional signs or symptoms and micromobility (between 0.1and 0.5 mm) is difficult to detect with the naked eye and requires the use of specialized instruments such as resonance frequency analysis (RFA, Osstell®). It's also known as the 'distance the implant moves when subjected to a 1 N lateral load at 10 mm above bone level.[3] Clinically, dental implant micromobility (less than 0.1 mm) cannot be determined .[4] Micromovement at the developing bone-implant interface results in the production of fibrous tissue around the implant rather than bone. Micromotion is referred to as fretting when the mobility amplitude is smaller than 100 µm. Fretting is a type of wear that occurs when two materials are in touch while being loaded. In material science, there are four types of fretting patterns that are commonly observed which are tangential fretting/reciprocal fretting, radial fretting, fretting in a torsional direction and dual motion fretting (any of the aforementioned in combination).
Except for torsional fretting, all are seen in dental implantology. Various types of fretting in dental implants include when an occlusal force is applied to an implant, the following occurs at the implant's body, tangential fretting can be seen. Radial fretting is visible at the implant's apex.[4]. When a 90° lateral force is applied to an implant the following happens at the apex of the implant, tangential fretting can be seen, radial fretting can be noticed in the implant's body. A mixture of tangential and radial fretting can be visible in the apex and body of the implant when an oblique force is applied.[5]
Micromotion of dental implants can disrupt the osseointegration process. In a study conducted by werner et al various contact types between implant and bone were simulated using three distinct types of virtual biomechanical models, and implant deformation, bone deformation, and stress at the implant-bone interface were measured under an axial load of 200 N, which mimics a common biting force. A symmetric loading situation of the bone was documented without friction between implant and bone, with maximal loading and displacement at the apex of the implant.[6]

The type of loading that occurs, the type of implant-bone interface that is present, the length and diameter of the implant, implant geometry and surface texture, and the quality and quantity of the surrounding bone are all factors that affect stress and strain transmission [7] Only by comprehending the most important of these aspects can solutions for implant stabilization be devised. A closer examination at implant deformation, bone deformation, and stress or strain at the implant-bone interface is required to determine how implant mobility, also known as micromotion, relative motion, micromovement, and so on, affects bone response.[8] In this study, the effect of friction phenomena and implant design (cylindrical versus threaded) on stress distribution and implant displacement could be established within the scope of this study. The insertion of threads to a cylindrically shaped implant, as well as the introduction of friction between the implant and the bone, resulted in a reduction of implant displacement under a 200 N axial stress.

This has been demonstrated that the healing status of newly inserted and osseointegrated implants influences the incidence of micromotion events along the implant bone contact. Micromotion remained constant for a soft implant bone contact, indicating early phases of osseointegration, independent of the region studied. The addition of a friction coefficient between the implant and the bone, which simulated mature bone reflecting an osseointegrated implant, drastically modified the distribution of micromotion along the implant bone contact. A decrease in micromotion was seen, in addition to generally lower levels of micromotion as compared to a newly implanted implant. The quantity of micromotion reduced as the implant approached its apex.

Conclusion

It should be noted that micromotion will play an important role in the stability of the implant prosthesis and could lead to certain failures if osseointegration does not fully take place. Hence this micromotion should be accounted for to prevent deleterious events from taking place.

Acknowledgement

The author would thank all the participants for their valuable support and thank the dental institutions for the support

Conflict of interest

All the authors declare no conflict of interest

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How To Cite This Article: Gopika. Implant Movement. Int J Prostho Rehabil 2021; 2: 1:8-9.

Received: 25-03-21; Accepted: 27-04-21; Web Published: 24-06-21