# Osseointegration: A Connection Between Living Bone and Dental Implant

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## Editorial

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## DESCRIPTION

The direct structural and functional link between living bone and the surface of a load-bearing artificial implant is known as osseointegration. Osseointegration is now defined as "functional ankylosis," in which new bone grows directly on the implant surface and the implant maintains mechanical stability [1]. Medical bone and joint replacement techniques, as well as dental implants and amputee prosthetics, have all benefited from osseointegration. Osseointegration is a dynamic process in which the implant's features influence molecular and cellular function. While osseointegration has been observed with a variety of materials, term is most commonly used to describe bone tissue's reaction to titanium or titanium coated with calcium phosphate derivatives [2].

Previously, it was considered that titanium implants were held in place by mechanical stabilisation or interfacial bonding. Calcium phosphate coated implants, on the other hand, were assumed to be stabilised by chemical bonding. Both calcium phosphate-coated implants and titanium implants are now known to be chemically stabilised with bone, either by direct contact between calcium and titanium atoms or by attaching to a cement line-like layer at the implant/bone interface [3]. While there are some distinctions, osseointegration and bone fracture healing are both mediated by the same mechanisms.

Metallic, ceramic, and polymeric materials, particularly titanium, have been employed for osseointegrated dental implants. The connection between the bone and the implant does not have to be perfect to be called osseointegration, and the essential of osseointegration is determined by the durability of the fixation rather than the degree of contact in histologic terms [4]. In a nutshell, it's the process of achieving and maintaining clinically asymptomatic stiff attachment of alloplastic elements in bone throughout functional loading. Implant features

influence implant healing times and early stability. The motion of the screws against the bone, for example, provides strong initial mechanical stability to implants with a screw-root form design. Healing takes several weeks or months after the implant is placed before the implant is fully integrated into the surrounding bone. After a few weeks, the first signs of integration appear, followed by a more solid link over the next few months or years [5].
Implants with a plateau-root form (or screw-root form implants with a large enough space between the screw pitches) have a different peri-implant ossification mechanism. Plateau-root form implants, unlike screw-root form implants, demonstrate *de novo* bone development on the implant surface. Intramembranous-like healing is the sort of bone healing seen with plateau-root shape implants [6]. Though the osseointegrated interface grows more resistant to external shocks with time, continuous unfavourable stimuli and overload might destroy it, leading to implant failure. The absence of micromotion at the bone-implant interface was found to be crucial for effective osseointegration in research employing "Mini dental implants." Furthermore, it was discovered that above a certain level of micromotion, a fibrous encapsulation process rather than osseointegration occurred [7].

Even if there is no exterior impact, other issues may occur. Cement production is one concern. In most situations, the lack of cementum on the implant surface inhibits collagen fibres from adhering to the surface. This is usually the case because the area receiving the implant lacks cementum progenitor cells. When these cells are present, however, cement may develop on or around the implant surface, and a functional collagen attachment may adhere to it. A variety of procedures are employed to determine the degree of osseointegration and, as a result, the implant's stability [8]. Percussion analysis, in which a dental instrument is tapped against the implant carrier, is a common diagnostic method. The nature of the ringing that results is utilised to assess the implant's stability on a qualitative level. A non-integrated implant will produce a dull, low-pitched sound, but an integrated implant would produce a higher pitched "crystal" sound [9].

A reverse torque test, in which the implant carrier is unscrewed, is another option. The implant is stable if it fails to unscrew under reverse torque pressure. When an implant spins under pressure, it is considered a failure and must be removed. This approach has the danger of fracturing bone that is in the middle of the osseo integration process. It's also unreliable for measuring a bone's osseointegration capability, as studies have shown that a rotating implant can successfully integrate. Resonance Frequency Analysis is a non-invasive and increasingly used diagnostic tool. Vibrations in a short metal rod temporarily attached to the implant are induced using a resonance frequency analyzer device [10]. The probe analyses the resonance frequency of the rod as it vibrates and converts it into an Implant Stability Quotient (ISQ), which ranges from 1-100, with 100 signifying the highest level of stability. Values between 57 to 82 are generally regarded as steady, though each case must be evaluated on its own merits.

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