DENTAL IMPLANTS AND THEIR SIGNIFICANCE TO THE BRASS PLAYER: PART II

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History of Implants

Osseointegrated implants are one of the fastest growing dental treatments today as a method of replacing lost or missing teeth. Modern osseointegrated implants have been available for 30 years. They can be used to replace a single tooth or an entire dentition. A modern implant is a titanium screw or cylinder surgically placed in the jawbone and is designed to transmit occlusal forces on prosthesis to the surrounding bone. Osseointegration is a biologic concept and refers to the mechanism of bone anchorage in which bone tissue and cells bond to the titanium surface of the implant. Success of osseointegration has been proven beyond a doubt. Prior to the discovery of this process, attempts to place non-integrated implants usually met with failure.

Osseointegration

Implants made of other materials such as stainless steel or porcelain or anything else besides titanium resulted in weak fibrous connective tissue engulfing the implant without actually bonding to it. Ancient civilizations attempted to use carved bone, ivory, or natural teeth extracted from poor people to provide replacements for the wealthy. All these methods invariably failed. A Swedish physician named Per-Inguar Branemark accidentally discovered the attachment mechanism when he noticed that titanium implanted into the bone caused the bone to adhere to the titanium with great tenacity. It was discovered that a period of undisturbed healing time was also required to allow the bone to fuse with the oxides of the implant surface. This same process is used routinely in orthopedics for the replacement of hips, knees, and other joints.

Types of Implants

There are many brands of implants today; however, all fall under the category of endosseous osseointegrated titanium implants. This refers to implants made of titanium placed within the bone for the purpose of bonding to the bone. In the past there were stainless steel blade implants which were placed in bone but failed to bond (osseointegrate) and eventually failed. Subperiosteal implants consisted of a non-osseointegrated framework that rested on the surface of the jaw. These implants usually led to infections and failure. Today’s implants are cylindrical or tapered cylinder in the shape of a tooth. Some are solid screws or have flat surfaces. Some have pure titanium surfaces or may have a coating of a bone-substitute material called hydroxyapatite, which may allow the in-growth of living bone and hence improve anchorage.

Diagnostic Considerations and Treatment Planning

Many factors play important roles in obtaining long lasting implant stability. These include factors related to the behavior and systemic health of patients, to the health of the implant recipient site, and amount and quality of the tissues at the recipient site, forces exerted onto the implant, skill of the surgeon and restorative dentist, and maintenance. Systemic factors include normal wound healing ability with absence of bleeding disorders, uncontrolled diabetes, compromised immune system, and rheumatoid arthritis. Smoking and poor oral hygiene factor into implant failure. Quality and quantity of bone in the recipient site are important considerations. Significant psychological or psychiatric problems can also preclude implant therapy.

Surgical Procedure

Prior to surgical placement of implants, a thorough clinical exam with radiographs is done. A treatment plan, both surgical and restorative, is devised. Surgical placement of implants is achieved by first making a small incision under local anesthesia. A cylindrical hole is made in the bone and an appropriately-sized implant is placed in the recipient site. The area is sutured together with the implant “buried” and allowed to heal (osseointegrate) for a period of 3 – 6 months. A temporary prosthesis can be worn during the healing period. The buried implants are uncovered after the 3 – 6 month period and an abutment or connecting piece is placed into the implant in order to prepare the implant for its final restoration; i.e., crown.

Restorative Options

The range of clinical applications involving dental implants is expanding. There is increasing use of implants as an alternative to conventional prosthodontics; i.e., bridges, full or partial removable dentures. Today’s dental practice includes restoration of the fully edentulous mouth, anterior or posterior
spaces, or replacement of a single tooth. For brass players, implants allow the possibility of a firm, non-removable dentition instead of a conventional removable full or partial denture. The advantage is especially significant for providing firm lip support to form the embouchure. For replacing a few teeth, a fixed bridge could be used as a reasonable alternative to implants. A traditional fixed bridge involves cutting down and shaping the patient's natural teeth to prepare them for crowns acting as abutments or "support beams" for the replacement teeth in between. The use of implants, if possible, is a superior option since they avoid involving adjacent natural teeth, are stronger, and look and feel like the patient's own teeth. Implants, however, may be more costly, are more of a time commitment, and at times are not always possible.

Another area of consideration is the subject of a temporary prosthesis used while the permanent one is being fabricated. In the case of traditional fixed bridgework, the temporary prosthesis is the same as the permanent except using different materials; i.e., acrylic temporary vs. porcelain-metal permanent. Therefore, temporization is not a problem in fixed prosthodontics for the brass player. An implant usually must remain buried under the gums during the 3 – 6 month healing process and therefore temporization becomes more complicated especially involving the front teeth. It is important that no pressure resulting in micro movement be placed on the implants at this time. Any micro movement could cause the implants to fail to osseointegrate. For a trombone or tuba player, where the rim of the mouthpiece contacts the mouth well above roots of the teeth, a simple temporary removable appliance or "flipper" may be used. For trumpet or horn players where pressure would be exerted directly on the implant area, a temporary bonded fixed bridge would be necessary to keep the rim of the mouthpiece from putting pressure against the implant area.

Biomechanics and Case Studies

An implant is a mechanical system designed to transmit occlusal forces (as well as transverse forces in the case of a brass player) onto prosthesis through an abutment and implant to the surrounding bone. The forces on prosthesis can be vertical, lateral, inclined, and torsional. It is important to note that these forces vary in intensity with location in the mouth and are often cyclical in action. Vertical forces tend to be larger in the posterior than the anterior regions. The maximum vertical biting force in humans was found by Van Eijden (1991) to approach 800N and Graf (1975) estimated the lateral forces to be around 20N. Furthermore, lateral components of inclined forces in the incisal region can be appreciable. How much force in the lateral and inclined direction can an implant tolerate is of particular importance to the brass player. The good news is that any brass player who has a sufficient amount of bone to place even the smallest implant may be a candidate.

According to the latest studies by Dr. Richard Sullivan of NobelBiocare, the largest implant manufacturer in the world, dental implants and abutments are bench tested to verify the strength of the design to exceed clinical conditions encountered. To meet strength requirements, the implants and associated abutments are tested to be able to withstand a force delivered by a weight that is 30 degrees offset to the long axis of the implant for 5 million cycles. The narrowest diameter implant, with 3.5 mm in diameter, is challenged with 290N, while the routinely used 4.3 mm diameter implant is challenged with 445N for 5 million cycles. Such forces are considered to represent a lifetime of function in a human. Based on recent experiments of trumpet biomechanics, Chesky reports that peak trumpet mouthpiece forces rarely exceed 100N.

The most important considerations in assessing the longevity of implants in brass players are the same as in any other patients: oral hygiene, smoking, teeth grinding, and overall medical health. Case studies have shown brass players to statistically have the same success rate as the rest of the population once the implants have integrated. The most vulnerable stage of implant treatment is the 3 – 6 month osseointegration stage before the implants are recovered. It is therefore very important that brass players seek a periodontist and a restorative dentist that understands their special needs in terms of exact placement of the implants and the restoration in order to keep the embouchure as it was previous to tooth loss.

Summary

Dental implants are an excellent treatment option for the brass player if cared for properly. Implants can last a lifetime and offer something that most closely approximates patients' natural teeth in terms of esthetics and function.

References


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