

Implants surgery: Cardiovascular and Other organs and systems

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Abstract

An implant is a medical device manufactured to replace a missing biological structure, support a damaged biological structure, or enhance an existing biological structure. Medical implants are man-made devices, in contrast to a transplant, which is a transplanted biomedical tissue. The surface of implants that contact the body might be made of a biomedical material such as titanium, silicone, or apatite depending on what is the most functional. In some cases implants contain electronics, e.g. artificial pacemaker and cochlear implants. Some implants are bioactive, such as subcutaneous drug delivery devices in the form of implantable pills or drug-eluting stents.

Sensory and neurological implants are used for disorders affecting the major senses and the brain, as well as other neurological disorders. They are predominately used in the treatment of conditions such as cataract, glaucoma, keratoconus, and other visual impairments; otosclerosis and other hearing loss issues, as well as middle ear diseases such as otitis media; and neurological diseases such as epilepsy, Parkinson's disease, and treatment-resistant depression. Examples include the intraocular lens, intrastromal corneal ring segment, cochlear implant, tympanostomy tube, and neurostimulator.

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Introduction

A removable implant supported denture (also an implant supported over denture is a removable prosthesis which replaces teeth, using implants to improve support, retention and stability [1]. They are most commonly complete dentures (as opposed to partial), used to restore edentulous dental arches. The dental prosthesis can be disconnected from the implant abutments with finger pressure by the wearer. To enable this, the abutment is shaped as a small connector (a button, ball, bar or magnet) which can be connected to analogous adapters in the underside of the dental prosthesis. Dental implants are used in orthodontic patients to replace missing teeth (as above) or as a temporary anchorage device (TAD) to facilitate orthodontic movement by providing an additional anchorage point. For teeth to move, a force must be applied to them in the direction of the desired movement. The force stimulates cells in the periodontal ligament to cause bone remodelling, removing bone in the direction of travel of the tooth and adding it to the space created [2, 3].

In order to generate a force on a tooth, an anchor point (something that will not move) is needed. Since implants do not have a periodontal ligament, and bone remodelling will not be stimulated when tension is applied, they are ideal anchor points in orthodontics. Typically, implants designed for orthodontic movement are small and do not fully Osseo integrate, allowing easy removal following treatment. They are indicated when needing to shorten treatment time, or as an alternative to extra-oral anchorage. Mini-implants are frequently placed between the roots of teeth, but may also be sited in the roof of the mouth. They are then connected to a fixed brace to help move the teeth.

There is archeological evidence that humans have attempted to replace missing teeth with root form implants for thousands of years. Remains from ancient China (dating 4000 years ago) have carved bamboo pegs, tapped into the bone, to replace lost teeth, and 2000-year-old remains from ancient Egypt have similarly shaped pegs made of precious metals. Some Egyptian mummies were found to have transplanted human teeth, and in other instances, teeth made of ivory. Etruscans produced the first

pontics using single gold bands as early as 630 BC and perhaps earlier. Wilson Popenoe and his wife in 1931, at a site in Honduras dating back to 600 AD, found the lower mandible of a young Mayan woman, with three missing incisors replaced by pieces of sea shells, shaped to resemble teeth [4]. Bone growth around two of the implants, and the formation of calculus, indicates that they were functional as well as esthetic. The fragment is currently part of the Osteological Collection of the Peabody Museum of Archaeology and Ethnology at Harvard University. The early part of the 20th century saw a number of implants made of a variety of materials. One of the earliest successful implants was the Greenfield implant system of 1913 (also known as the Greenfield crib or basket). Greenfield's implant, an iridioplatinum implant attached to a gold crown, showed evidence of osseointegration and lasted for a number of years. The first use of titanium as an implantable material was by Bothe, Beaton and Davenport in 1940, who observed how close the bone grew to titanium screws, and the difficulty they had in extracting them. Bothe et al. were the first researchers to describe what would later be called osseointegration. In 1951, Gottlieb eventually implanted titanium rods in rabbits. Leventhal's positive results led him to believe that titanium represented the ideal metal for surgery [5].

Cardiovascular

Cardiovascular medical devices are implanted in cases where the heart, its valves, and the rest of the circulatory system are in disorder. They are used to treat conditions such as heart failure, cardiac arrhythmia, ventricular tachycardia, valvular heart disease, angina pectoris, and atherosclerosis. Examples include the artificial heart, artificial heart valve, implantable cardioverter-defibrillator, artificial cardiac pacemaker, and coronary stent. Orthopaedic implants help alleviate issues with the bones and joints of the body. They are used to treat bone fractures, osteoarthritis, scoliosis, spinal stenosis, and chronic pain. Examples include a wide variety of pins, rods, screws, and plates used to anchor fractured bones while they heal [6].

Metallic glasses based on magnesium with zinc and calcium addition are tested as the potential metallic biomaterials for biodegradable medical implants. Patient with orthopaedic implants sometimes need to be put under magnetic resonance imaging (MRI) machine for detailed musculoskeletal study. Therefore, concerns have been raised regarding the loosening and migration of implant, heating of the implant metal which could cause thermal damage to surrounding tissues, and distortion of the MRI scan that affects the imaging results. A study of orthopaedic implants in 2005 has shown that majority of the orthopaedic implants does not react with magnetic fields under the 1.0 Tesla MRI scanning machine with the exception of external fixator clamps. However, at 7.0 Tesla, several orthopaedic implants would show significant interaction with the MRI magnetic fields, such as heel and fibular implant [7].

Other types of organ dysfunction can occur in the systems of the body, including the gastrointestinal, respiratory, and urological systems. Implants are used in those and other locations to treat conditions such as gastroesophageal reflux disease, gastro paresis, respiratory failure, sleep apnea, urinary and fecal incontinence, and erectile dysfunction. Examples include the LINX, implantable

gastric stimulator, diaphragmatic/phrenic nerve stimulator, neurostimulator, surgical mesh, artificial urinary sphincter and penile implant [8].

Recovery

The prosthetic phase begins once the implant is well integrated (or has a reasonable assurance that it will integrate) and an abutment is in place to bring it through the mucosa. Even in the event of early loading (less than 3 months), many practitioners will place temporary teeth until osseointegration is confirmed. The prosthetic phase of restoring an implant requires an equal amount of technical expertise as the surgical because of the biomechanical considerations, especially when multiple teeth are to be restored. The dentist will work to restore the vertical dimension of occlusion, the esthetics of the smile, and the structural integrity of the teeth to evenly distribute the forces of the implants [9, 10]. Basic types

1. Root form implants; the most common type of implant indicated for all uses. Within the root form type of implant, there are roughly 18 variants, all made of titanium but with different shapes and surface textures. There is limited evidence showing that implants with relatively smooth surfaces are less prone to peri-implantitis than implants with rougher surfaces and no evidence showing that any particular type of dental implant has superior long-term success.
2. Zygoma implant; a long implant that can anchor to the cheek bone by passing through the maxillary sinus to retain a complete upper denture when bone is absent. While zygomatic implants offer a novel approach to severe bone loss in the upper jaw, it has not been shown to offer any advantage over bone grafting functionally although it may offer a less invasive option, depending on the size of the reconstruction required.
3. Small diameter implants are implants of low diameter with one-piece construction (implant and abutment) that are sometimes used for denture retention or orthodontic anchorage.

Conclusions

Endosseous implants are among the great achievements of reconstructive surgery, and thanks to them the sad situations of edentulism that mortified so many patients until only a few years ago are now disappearing. Unfortunately, in Italy - as elsewhere - far too many people are still unable to benefit fully from this technology, due to the paucity of scientific information and inadequate teaching of this treatment option. Today implantations are offered by almost all dental practices, but these services are often limited to a single method, due to misinformation about the better rehabilitation options offered by other techniques, which are deemed unsuitable because they were experimented in the more distant past (albeit with excellent results).

We must add another comment. In Italy and other countries there are renowned professionals who have successfully been placing thousands of implants considered to be "obsolete." Why don't research institutes offer these implantologists the chance

to teach and divulge their methods free of charge? We and a handful of other professionals are the only ones who, for years, have had the chance to teach on a university level, imparting everything we have deemed useful for enriching our students' stock of knowledge on implant dentistry. As a result, they can now choose the most effective - yet less advertised - techniques on a case-by-case basis.

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Conflict of Interest

None