Dental implants are commonly used these days for prosthetic rehabilitation of dental arches. A Many options exist to replace missing teeth but dental implants have become one of the most used biomaterial to replace one (or more) missing tooth over the last decades. Contemporary dental implants made with titanium have been proven safe and effective in large series of patients. Hence, in the present review, we aim to highlight some of the recent aspects of dental implants.

**Key words:** Advancements, Implants Prosthetic.

**ABSTRACT:**

Dental implants are commonly used these days for prosthetic rehabilitation of dental arches. Many options exist to replace missing teeth but dental implants have become one of the most used biomaterial to replace one (or more) missing tooth over the last decades. Contemporary dental implants made with titanium have been proven safe and effective in large series of patients. Hence, in the present review, we aim to highlight some of the recent aspects of dental implants.

**Corresponding Author:** Dr. Angana Pal, Post graduate student, Department of Prosthodontics, Crown / Bridge & Implantology, Maharana Pratap College of Dentistry & Research Centre, Gwalior, M.P, India


**INTRODUCTION**

Implants are often used as a treatment option for partially or totally edentulous patients. The success is directly related to the osseointegration process, and the use of standard implants allows a larger contact area with the bone tissue, which supports the osseointegration process. Tooth loss in the posterior jaws favors the resorption process of bone tissue, causing greater proximity to the inferior alveolar nerve and maxillary sinus, limiting the use of the implant. To overcome these problems, bone grafts or maxillary sinus lifting have been indicated to reestablish the height of restored bone tissue and allow for placement of standard implants. However, these techniques are associated with increased postoperative morbidity, higher costs, and higher risks of complications during patient rehabilitation. Thus, short implants are used, which are considered to be simpler and more effective for rehabilitating atrophic ridges later.1-3

**Anodization of the implant surface**

Anodization can produce micro or nano-textured rough surfaces. This causes an increase in the passivation layer of titanium oxide associated with pores. Coatings Several coating methods have been also proposed to modify the roughness and improve cell attachment. Hydroxyapatite can be deposed by plasma-spraying but the layer tends to delaminate, leading to implant failure in mid-term studies. These implants are nowadays abandoned. Similarly, implants were also encountered with coatings made of other orthophosphate calcium salts. Biomimetic calcium phosphate have also been electro-deposited or created by immersion in synthetic body fluids (gel-sol technique). Whatever the mechanisms used to induce a surface roughness, this favors fibronectin deposition, cell attachment and spreading as evidenced by in vitro and in vivo studies.4-6

**Corrosion in dental implants**

Pure titanium or titanium alloys, and to a lesser extent, zirconium, are metals that are often used in direct contact with host tissues. These metallic biomaterials are highly reactive, and on exposure to fluid media or air, quickly develop a layer of titanium dioxide (TiO2) or zirconium dioxide (ZrO2). This layer of dioxide forms a boundary at the interface between the biological medium and the metal structure, determining the degree of biocompatibility and the biological response of the implant. Corrosion is the deterioration a metal undergoes as a result of the surrounding medium (electrochemical attack), which causes the release of ions into the microenvironment. No metal or alloy is entirely inert in vivo. Corrosion phenomena at the interface are particularly important in the evolution of both dental and orthopedic implants and one of the possible causes of implant failure after initial success. In situ degradation of a metallic implant is undesirable because it alters the structural integrity of the implant. The issue of corrosion is not limited to a local problem because the particles produced as a result could migrate to distant sites, whose evolution would require further studies.7-10

**CURRENT IMPLANT DESIGN TRENDS**

**Finite element analysis**

Failure of implants is a relatively common problem, and there is a need of analysis of the abutments.39. FEA is becoming a common method in implant dentistry that allows engineers/scientists to study jawbone and implant properties, and bone-implant interface as well as to understand how to improve implant design in order to function within physiological acceptable limits. FEA consists on a computerized three-dimensional model that has been extensively used to predict the characteristics of stress distribution in bone surrounding implants, which are influenced by both the implant dimensions and the...
biomechanical bond formed between the bone and the implant.\textsuperscript{11, 12}

\textbf{Computer-aided design and computer-aided manufacturing technology}

Implants and abutment fabrication has and continues to undergo significant metamorphosis, and since nowadays, complicated shape implants and abutments are used, CAD/CAM techniques are being implemented. The advantages of the technique are accuracy and less time required for manufacturing the parts.\textsuperscript{13}

\textbf{Nanotechnology-based implants}

Nanotechnology approaches require novel ways of manipulating matter in the atomic scale. Currently, extensive research on techniques to produce nanotechnology-based implants is being investigated. Nanotechnology-based trends for dental implants consist on surface roughness modification at the nanoscale level to promote protein adsorption and cell adhesion, biomimetic calcium phosphate coatings, and the incorporation of growth factors for accelerating the bone healing process. In terms of surface modification at the grain boundaries level, one approach involves the physical method of compaction of nanoparticles of TiO\textsubscript{2} versus the compaction of micron-level particles to yield surfaces with nanoscale grain boundaries. Other interesting approach is the process of molecular self-assembled monolayers which are formed by the spontaneous positioning of molecules on the surface, exposing only the end-chain group(s) at the interface which can have osteoinductive or cell adhesive molecules.\textsuperscript{14, 15}

\textbf{Functionally graded materials}

As described by Mehrali et al. in 2013, the suitable design of porous bone with a porosity gradient from a dense, stiff external structure (the cortical bone) to a porous internal one (the cancellous bone), and with an adequate degree of interconnectivity exhibits that functional gradation is applied by biological adaptation. Therefore, functionally graded materials (FGMs) are gaining attention in dental implant applications.\textsuperscript{16}

\textbf{Success/failure of dental implants in diabetic patients}

Most of the studies observed slightly high percentage of early failure of implants in diabetics compared to late failure. Some reports indicated increased failure rate within first year of placement of implant. The published retrospective and prospective studies data, retrieved through various sources from 1994 to 2011, indicated that the success rate of dental implants in diabetic patients were in range of 85.5-100\% and were comparable to the non-diabetic patients. Most of the studies were of opinion that success rate in well/fairly controlled diabetics was either equal or insignificantly lower than normal individuals. Two studies, has taken chance to involve uncontrolled diabetic patients for dental implantation and observed encouraging results as early implant success was similar to non-diabetics. However, it is noteworthy that number of patients and implants placed (4 implants in 3 patients) in uncontrolled diabetics was quite low and all the patients selected were free of micro and macrovascular complications. Only two studies reported significantly high failure of implant in diabetic patients even when glucose level was adequately under control. One of these studies retrospectively included early, as well as late failures of implants over the period of 10 years but did not specify the glycemic control over that period. While other study, prospective in nature, observed significantly high early failures with probable reason that placement of multiple adjoining implants in diabetic patients increased the failure rates due to large wound, delayed healing and greater force posed over implants. Inadequate time (study period 90 days only) provided for osseointegration and regaining stability to implant in the study seems to be the cause of observing very high failure in diabetic patients.\textsuperscript{6-9}

\textbf{CONTRAINDICATIONS}

They are now well identified and classified. General contraindications are psychiatric disorders, severe cardiovascular troubles, hematological malignancies and ongoing therapeutic trials. A special attention is given to patients receiving intravenous amino-bisphosphonates for a malignant disease. Due to the high risk of inducing an osteonecrosis of the jaw, scientific societies and health agencies consider that dental implants are prohibited in these particular cases. However, bisphosphonate treatment for other metabolic bone disease such as osteoporosis is not a contraindication and recommendations should be carefully followed. Local contraindications are represented by an absent oral hygiene, a massive bone loss and occlusal disorders. Smoking is a discussed contraindication: it has been shown that a significantly higher percentage of implant failures may occur in smokers (particularly at the maxilla) but smoking do not preclude implant placement; smokers should be informed that they are more at risk for peri-implantitis.\textsuperscript{7-9}

\textbf{FUTURE TREND}

Despite conflicting reports regarding the effect of ceramic coatings and micro- and/or nano-topography on the osseointegration of dental implants, the prevailing philosophy is that they may significantly influence the bone growth and attachment to implant surfaces and ultimately improve the success of dental implants and the rapid return to function (i.e. mastication). There is an urgent need for more fundamental research in this area that would combine both in vitro and in vivo studies and ultimately lead to appropriate clinical application. In our desire to create the perfect implant designed with nanomaterials and bioinspired approaches, we must close key gaps in our basic knowledge and create a series of prototype dental implants with increasing functionality. We should start by recognizing the specific gaps in our present knowledge and then look broadly for advances that will enable us to bridge them. Specifically, we should seek to uncover the relationships linking composition and materials architecture at multiple length scales with
macroscopic mechanical behavior and the capability for osteogenesis. Eventually, these relationships must be tested and evaluated systematically in vivo and finally in clinical studies that maintain the same stringent analyses and outcome measures. Though fundamental interactions between biomaterials and surrounding tissues may be determined, a systematic approach must be established to confirm the relevance and consequence of these biologic responses. 3-5

CONCLUSION
Among various dental materials and their successful applications, a dental implant is a good example of the integrated system of science and technology involved in multiple disciplines including surface chemistry and physics, biomechanics, from macro-scale to nano-scale manufacturing technologies and surface engineering. Hence; it holds great future prospective in the field of prosthetic dentistry.

REFERENCES

Source of support: Nil
Conflict of interest: None declared
This work is licensed under CC BY: Creative Commons Attribution 3.0 License.