Biological and osseointegration capabilities of a zirconia implant

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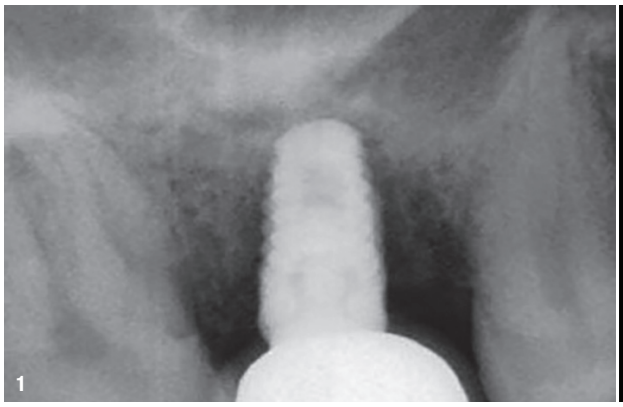
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Introduction

Extraction of tooth is carried out for numerous reasons, including caries, fractures, periodontal problems, prosthetic purposes, orthodontic, and widespread external or internal root resorption. Root resorption (pathological) has a multifactorial etiology, although many aspects remain unclear, and can lead to loss of tooth structure. The use of dental implants is a reliable treatment option for replacing missing or hopeless teeth, and the satisfactory and predictable outcomes reported by several implant research studies have supported the huge development and standardisation of oral implantology.

According to the available data, the current success rate of dental implants is around 94–95% in the maxillary area and 97–98% in the mandibular area after a ten-year follow up period.[1] However, the rising demand for usage of dental implants is associated with a growing need for long term and predictable results, and despite having excellent success rates, complications/failures may occur because of biomechanical and biological complications. Peri-implantitis is a biological complication and is still a topic of concern.

Peri-implantitis is a pathological condition that occurs in the tissues around dental implants and is characterised by inflammation of the peri-implant connective tissue and progressive loss of the supporting bone. In clinical situation, peri-implantitis sites exhibit signs of inflammation and, in particular, increased probing depths and/or recession of the mucosal margin, bleeding on probing and/or suppuration, and radiographic bone loss. According to Jan Derks, the prevalence of peri-implant mucositis


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and peri-implantitis ranged from 19 to 65% and from 1 to 47%, respectively. Meta analyses estimated weighted mean prevalence of peri-implant mucositis and peri-implantitis of 43% and 22%, respectively.[2] The problem with this pathology remains the lack of information on etiological factors and standardisation of the utilised diagnostic criteria.

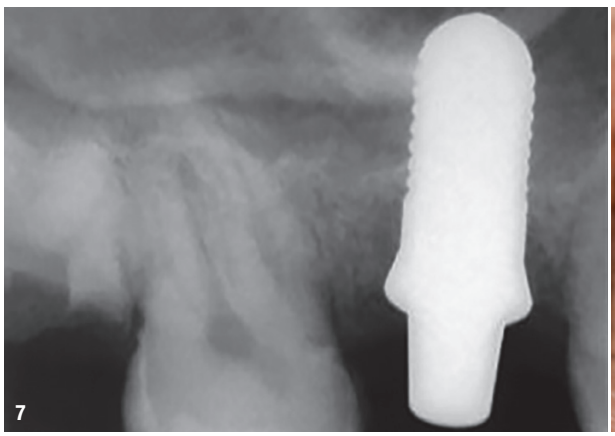
Titanium implants after interacting with intra-oral conditions, undergo tribocorrosion and release titanium particles into the surrounding gingivae. This release of ions can contribute to the subsequent inflammation around titanium dental implants. The degradation products in the form of microparticles or ions may infiltrate the peri-implant tissue and peri-implant bacterial plaque and trigger an inflammatory response, resulting in bone resorption, suggesting a possible pathogenesis of peri-implantitis.[3–7] Furthermore, the studies have shown that allergic responses and hypersensitivity to metal are not uncommon findings; in fact, delayed onset T cell mediated metal hypersensitivity is reported in 12–17% of the general population.[8–10]

The increasing incidence of peri-implant mucositis and peri-implantitis affects both the short- and long-term survival rates of titanium implants and their success. Therefore, using an alternative material, zirconium dioxide, has been increasingly popular and successful. Among the new generation of ceramics in the dentistry field, zirconia ceramics presents outstanding aesthetic characteristics, a low propensity of plaque adhesion around the implant surface, excellent biocompatibility, and good osseointegration, muco-integration and biomechanics. In addition, zirconia ceramics have characteristics similar to those of titanium implants and are frequently used in implant prosthetics.[11–14] This case report describes how a failed titanium implant in the maxillary posterior was successfully replaced with a zirconia implant that became biologically integrated.

Case presentation

A 40-year-old male patient presented to us after having received a titanium dental implant at another private practice ten months before presenting to our office. He presented with a loose titanium implant (position #16) in the maxilla.

The patient reported no history of tobacco smoking or alcoholism. The last dental check-up visit had taken place about six months before. No previous history of periodontitis was detected. At clinical evaluation, the peri-implant mucosa appeared swollen and red, and probing revealed bleeding and a probing depth of 4 mm buccally and 4 mm lingually. There was slight mobility. The radiographic image showed radiolucency around the cervical region around the implant with a diameter of 4.25 mm (Fig. 1). A diagnosis of peri-implantitis was supposed, and after discussion with the patient, the implant was removed (Figs. 2 & 3)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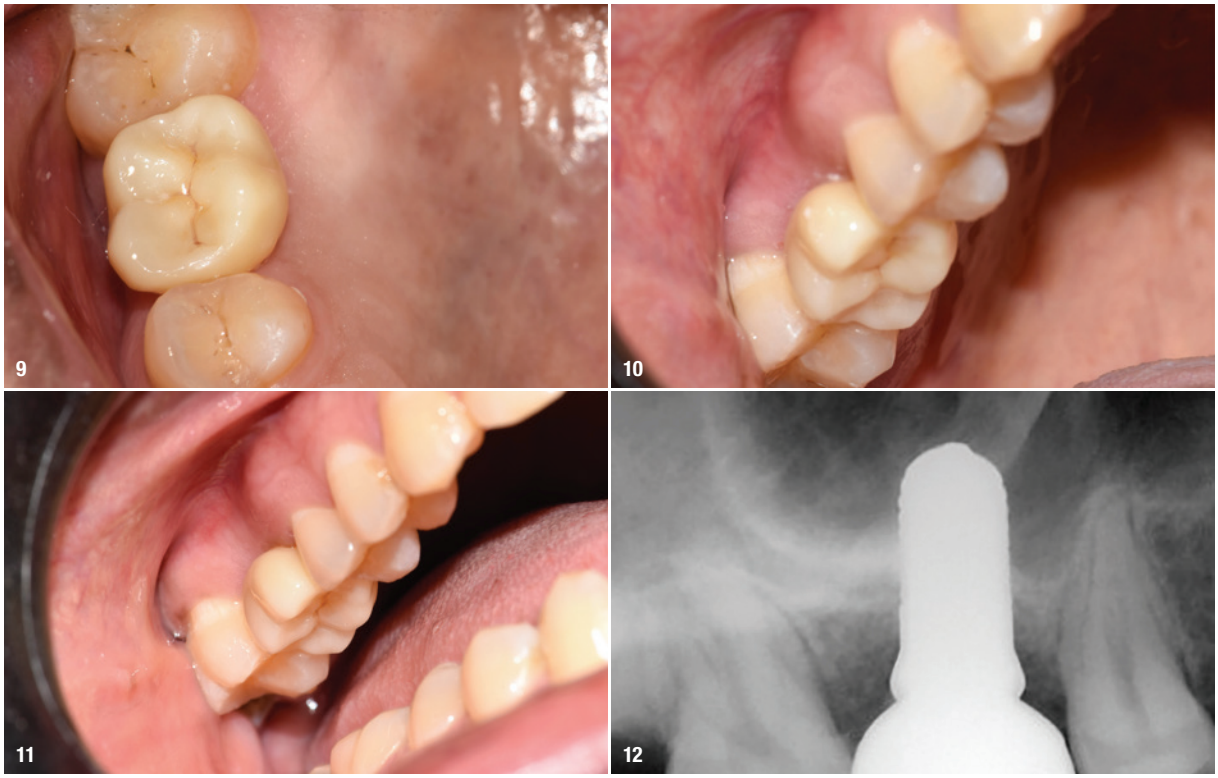

and the socket was debrided using diode laser therapy.

After 12 weeks, a one-piece zirconia implant (ZiBone, COHO Biomedical Technology) was inserted following the company's protocol (Figs. 4–7). A zirconia implant was chosen for better biological integration. Furthermore, the patient had requested a metal-free option, since there was a possibility of a metal allergy.

The fixture was loaded with a metal-free zirconia crown after 16 weeks (Figs. 8 & 9). During the follow-up period, the patient did not report any symptoms of peri-implantitis or other problems, and the clinical and radiographic examination showed the success of the metal-free implant prosthetic restoration. In particular, the peri-implant tissue appeared healthy (Figs. 10 & 11), and the radiograph confirmed the absence of marginal bone loss around the implant and no sign of bone resorption (Fig. 12).

Discussion

In the above case, the zirconia dental implant seemed to have integrated well without any signs of marginal bone loss and established excellent soft tissue healing. A ceramic dental implant has some benefits over titanium: although the survival and success rates of zirconia and titanium dental implants are quite comparable, some research studies have stated that a zirconia dental implant is more biocompatible compared with titanium, as the latter releases corrosion products around the implant site. The characteristics of their enhanced biocompatibility, along with good osseointegration and success rates, make zirconia implants clear candidates for use in clinical implant dentistry. However, further investigations on titanium release and its connections with peri-implantitis, hypersensitivity and bone resorption are recommended.

about the author

Dr Saurabh Gupta graduated from Manipal College of Dental Sciences in India with a BDS and holds a master's degree in oral and maxillofacial surgery from Rajiv Gandhi University of Health Sciences in Bangalore in India. He is an international and national lecturer and a board member and Education Director of the International Academy of Ceramic Implantology. He is a member of the Zirconia Implant Research Group, which aims to orient and lead research in the field of metal-free implantology. He founded and directs WhiteZ Dental in Bangalore.

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