Custom Milled Zirconia Implant Supporting an Ceramic Zirconia Restoration : A Clinical Report

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ABSTRACT

Dental implants constitute a well-established approach for replacement of lost teeth with titanium being the most favored material for implantation. However, titanium has its limitations in esthetically demanding cases and neither the form nor material of such implants has changed much over the past 40 years. Today, there is scientific evidence that zirconia dental implants osseointegrate well and offer many advantages over titanium implants. This report demonstrates the successful clinical use of a custom milled root analogue zirconia implant for single tooth replacement. A left maxillary first molar was removed, allowed to heal for four months and a custom-made, root-analogue, roughened zirconia was fabricated and placed. Subsequently it was restored with zirconia all ceramic crown. No complications occurred during the healing period. This successful case warrants further clinical research on zirconia custom milled implants in well controlled trials.

KEY WORDS

Copy milling, dental implants, zirconia, zirconia implant

INTRODUCTION

Treatment with fixed prostheses supported by endosseous implants has improved the quality of life of the edentulous patient.[1] Commercially pure titanium has been used for more than 30 years and is still the material of choice for dental intraosseous implants. Titanium dental implants with either smooth or roughened surfaces have shown high success rates in various indications.[2-4] Conventional and implant prosthodontics are undergoing a rapid metamorphosis. Historically, metal ceramic technologies have been the gold standard in both conventional and implant fixed prosthodontics; however, this is currently being challenged.[5] Developments in esthetic implant components, ceramic materials, computer-aided design/computer-aided manufacturing (CAD/CAM) technology, and increased sophistication in planning and surgical procedures have enabled the provision of more esthetic restorations. Currently, implant manufacturers offer a wide variety of components designed to manage esthetic demands.[6] Esthetic outcome of restorations supported by titanium implants might be compromised if the dark color of the implant shines through a thin peri-implant mucosa or if the implant head becomes visible following soft tissue recession. Furthermore, some authors see a potential health hazard in titanium particles or possible corrosive products.[7] Increased concentrations of titanium have been detected in tissues close to implant surfaces and in regional

lymph nodes.[8,9] Although the clinical relevance of these findings is not yet clear, an increasing number of patients are asking for metal-free treatment options. Tooth-colored ceramics were considered early as alternative implant materials but important biomechanical characteristics of ceramic implants such as fracture toughness were inferior to those of titanium.[7]

Partially stabilized zirconia, which is comparable to the highest values for oxide ceramics, has been introduced as a new ceramic implant material. This ceramic has more favorable mechanical properties than the fully stabilized zirconia. In addition, zirconia possesses high fracture resistance because of its energy-absorption property during martensitic transformation of tetragonal particles to monoclinic ones. Thus zirconia may act like steel, is biocompatible and possesses mechanical stability. Moreover, this material is highly radiopaque and easily cut for abutment preparation. Thus, partially stabilized zirconia is considered an attractive endosseous dental implant material.[10] The concept of replacing teeth with custom-made root analogue implants is not new. The oldest evidence of a dental implant dates back to around 550 BC.[11]

The goal of the approach used in this clinical report was to evaluate a novel approach to custom milled root-analogue dental implants. Zirconia was used as an alternative to titanium dental implant for its excellent biocompatibility, improved esthetic results by preventing dark discoloration of the gum and the display of titanium roots in case of gum recession, compressive strength, bending forces, fracture toughness and high electrical resistance.

CASE REPORT

A 23-year-old female patient presented with a missing mandibular left first molar due to decay. (Fig.1) Adjacent second molar had deep dental caries nearing pulp. So it was restored with temporary cement after indirect

Figure 1. Pre Operative View .

pulp capping. For the missing tooth, all the treatment probabilities were discussed and patient decided to go ahead with implant placement. However the patient was insistent on a metal free solution. Zirconia implant was an obvious choice owing to its mechanical and esthetic properties. Orthopantamogram(OPG) and Computed tomogram (CT) scan revealed adequate bone quantity and quality for placement of root analogue endosseous implant. An endopore titanium implant was chosen and an additional crown stump was designed and fabricated using light cure resin for later connection to the crown. The implant abutment assembly was then mounted on the mounting template and copy milling was carried out using Zirconia block. The custom milled Zirconia implant is then placed according to the standard guidelines for placing an endopore implant (Hi Tech Implant system). Crestal incision and two vertical incisions on adjacent teeth were used to expose the bone. Pilot drill was followed by the sequential drills for the osteotomy hole (Fig. 2). Custom milled zirconia implant was then placed and flaps sutured around the custom fabricated abutment (Fig. 3, 4). Immediate non functional loading was done using a temporary restoration fabricated on the abutment. Postoperative analgesics were prescribed on demand and antibiotic medication was given for four days 11. Patient was instructed to chew predominantly on the contralateral side and avoid hard food. At the control visit 10 days later a clinically healthy marginal area was present, and no postoperative pain or

Figure 2. Osteotomy Hole for Placing Implant.

Figure 3. Implant Tapped into Place.

Figure 4. Six Month Postoperative View.

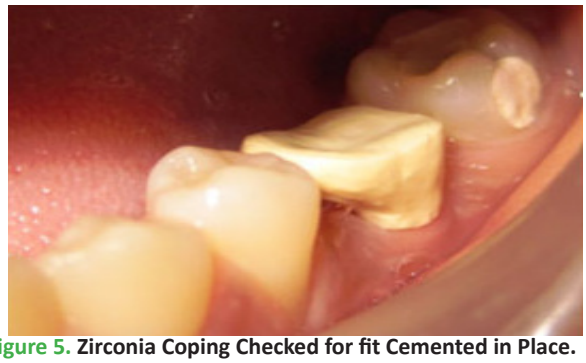

Figure 5. Zirconia Coping Checked for fit Cemented in Place.

Figure 6. Zironia All Ceeramic Restoration.

swelling was reported. There was no bleeding or wound infection. After four months all ceramic Zirconia crown was cemented in place (Fig. 5, 6). At twoyear follow up the patient presented with a stable implant, unchanged peri-implant marginal bone level as monitored by radiographs and soft-tissue parameters, and no bleeding on probing.

DISCUSSION

This clinical report describes successful dental root replacement with an individualized zirconia implant in a patient who chose rehabilitation with dental implant but insisted on metal free solution. During the past three decades, many different materials and shapes have been proposed for dentalimplants. It is generally accepted that implants should be made of stable, non-toxic, and bioactive materials, so that the surrounding tissues can form an interfacial bond with the implants.[12] Already, several zirconia implants have been introduced with proven efficacy in animal studies.[13,14] However long-term human trials to establish their clinical success are still missing.[7] Zirconia implants are considered an attractive endosseous dental implant material when considering the shortcomings of commercially pure titanium.[15] On the basis of the available data, osseointegration of Y-TZP implants might be comparable to that of titanium implants. Modifications of surfaces and microstructures have the potential to improve initial bone healing and resistance to removal torque, but existing data are few and do not involve commercially available implants.[7] This case, which is part of a larger ongoing clinical trial, demonstrates that placement of significantly modified, root-analogue, non-submerged zirconia implants yields excellent esthetic results superior to titanium implants.

CONCLUSION

In conclusion, this clinical report showed satisfactory osseointegration andgood soft and hard tissue biocompatibility of zirconia implants after a sufficient healing period. This may be applied to submerged and non submerged healing and could be the basis for an investigation of further healing periods with a higher number of implants.

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