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CASE REPORT

Cold-welded Healing Cap: A Unique Implant Complication and its Management

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ABSTRACT

Biological and mechanical implant complications and failures are still present in clinical practice that frequently compromise oral function. Mechanical failures involving implant components are frustrating to a restorative dentist. Prudent knowledge of mechanical components and their functioning helps to achieve stable connections between implant-abutment/healing cap. Any misjudgement by the clinician can result in total fiasco of the procedure. Cold-welding of healing cap with implant collar is one such complication that occurred in this particular case and was managed by preparation of healing cap as conventional abutment using carbide burs.

Clinical relevance: An innovative method has been described to combat an unusual implant complication. Possible reasons for cold-welding and its management is described in this article.

Keywords: Cold-welding, Complication, Healing cap, Implants.

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INTRODUCTION

Dental implant surgery has become routine treatment in dentistry and is generally considered to be a safe surgical procedure. With high success rate of between 95 to 98% and low incidence of complications, these can provide both the patient and the dental team a relative incident free years of service.[1,2] Although implant survival rates are high, they do encounter complications involving the peri-implant soft tissue, bone and mechanical components. Most implant complications are due to technical problems like screw loosening, screw fracture, fracturing of veneering porcelain and framework fracture in implant-supported fixed partial dentures (FPDs).[1-5] Thorough understanding of the etiology and the frequency of these complications is lacking due to the failure of establishing standardized methods of data collection. Mechanical and technical complications play a major role in implant dentistry. They may lead to increased rates of repairs and remakes, and to a waste of time and financial resources, and may even affect the patient's quality of life. In this case report, one uncommon complication is presented and the possible solution executed.

CASE REPORT

A 38-year-old patient presented for an implant in the 36 area after a failed endodontic procedure. The tooth was removed using an atraumatic technique and the alveolus allowed healing for 10 weeks (Fig. 1). Intraoral periapical (IOPA) X-ray and orthopantomogram (OPG) of the patient were obtained after 10 weeks (Fig. 2). Bone mapping revealed bone width of 7 mm. Adin Swell implant measuring 5.0 × 13 mm was planned in the 36 area. The bone quality was corticocancellous and determined to be type II. The implant was placed at approximately 30 Ncm with primary stability achieved. A transmucosal healing cap was secured to the implant at 15 Ncm in the stage I surgery itself (Fig. 3). The healing cap helped to achieve precise apposition of the surrounding soft tissue with simultaneous shaping of the gingival funnel.[1,2] Patient was recalled after 8 weeks for the impression

Fig. 1: Preoperative view of the lower arch

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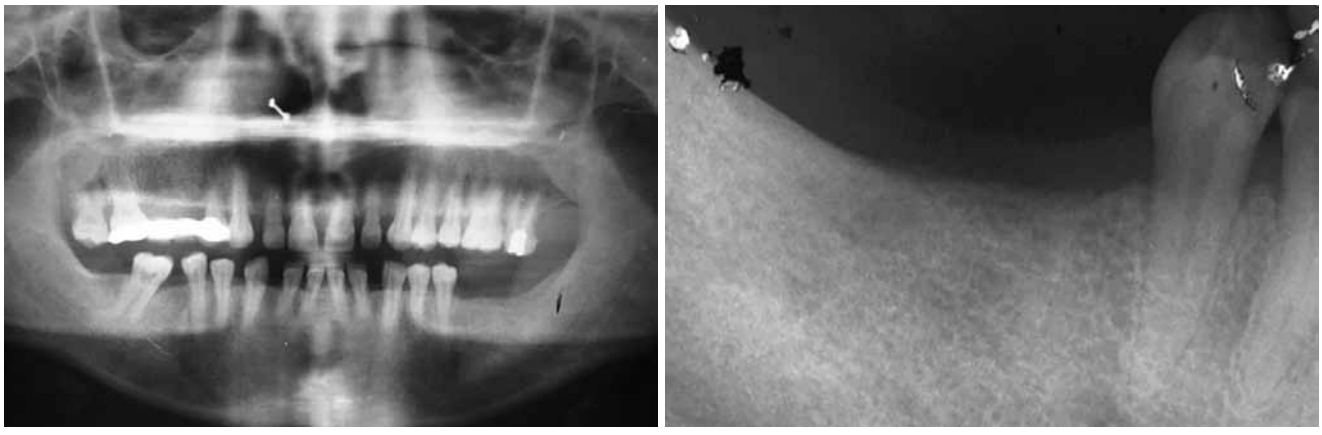

Fig. 2: Preoperative OPG and IOPA X-ray

Fig. 3: Stage I surgery

procedure. Repeated attempts to unscrew the healing cap failed. Patient was advised IOPA X-ray for implant and healing cap assessment (Fig. 4). A 35 Ncm torque was the maximum that was applied to unscrew the cap to prevent iatrogenic damage to screw crossthreads. Treatment plan included preparation of healing cap and placement of zirconia crown over it. Preparation of healing cap was completed with metal cutting carbide burs (SS White, Towbin Avenue, Lakewood, NJ). Margins were kept 0.5 mm supragingival for the longevity of the prosthesis (Fig. 5). Two proximal grooves were prepared on the mesial and distal region to give additional resistance and retention form to the preparation. Gingival retraction cord (≠1, Ultrapak, Ultradent, Knitted cord) impregnated with adrenaline was used before making impression with PVS impression material in custom tray (Fig. 6). Bite registration was completed with PVS bite registration material (Jet Bite Coltene, Whaledent). Impression along with bite record was sent to laboratory for zirconia crown fabrication (Fig. 7). Face bow transfer was done and casts articulated on Hanau H2 articulator (Fig. 8). Occlusion adjusted and zirconia crown (Zircad,Ivoclar) was cemented with Glass Ionomer Cement (GC Fuji II, Fig. 9).

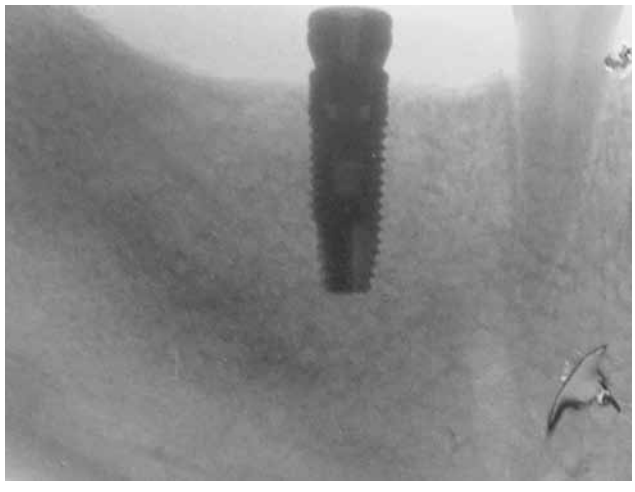

Fig. 4: Postoperative IOPA X-ray

DISCUSSION

Failures and complications with implant and abutment components as well as with materials of the prostheses result in frequent repairs and even remakes. Mechanical complications and fatigue of implant components is considered a sequel of biomechanical overload. The implant/abutment connection, by convention, is generally

Fig. 5: Preparation of healing cap with metal cutting carbide burs (SS White, Towbin Avenue, Lakewood, NJ)

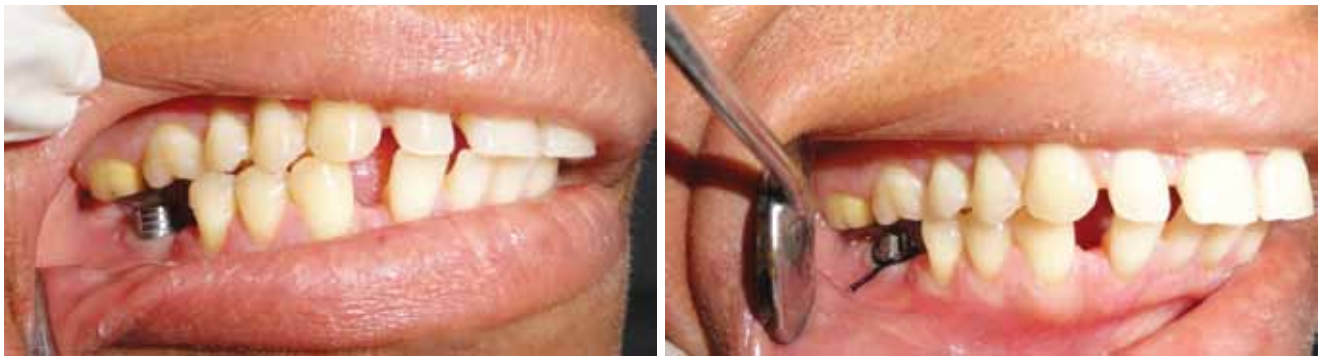

Fig. 6: Soft tissue retraction with gingival retraction cord (Ultrapak, Ultradent, Knitted cord)

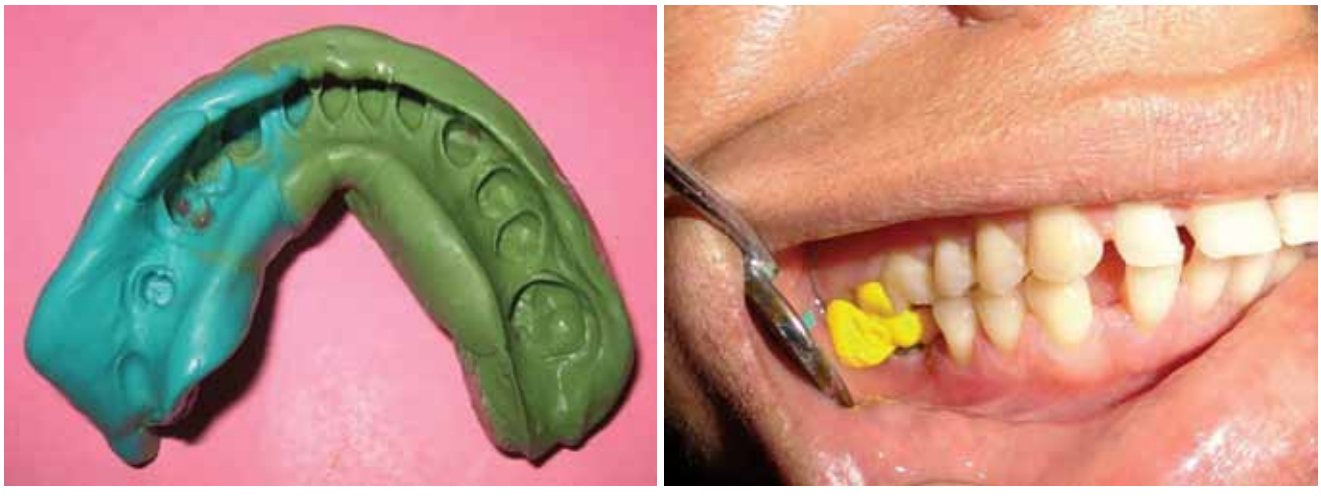

Fig. 7: Impression made in custom tray with single stage, double mix technique (combination of light and heavy PVS material)

described as an internal or external connection. These two implant-abutment connections can be distinguished by whether or not there exists an extension of a geometric figure above the body of the implant. In external connection implants, we observe a distinct projection external to the body of the implant.[1,2,6-8] The original Brånemark implants were external hex implants and were designed to restore a completely edentulous arch. They were not designed to serve as antirotation device.[9,10] When the implants were later placed in single-tooth or partially edentulous cases, the hex had to be used to prevent rotation of the abutment and the single crown. This external hex, which was only 0.7 mm in height, was not designed to withstand the forces directed on the crowns intraorally. Therefore, implant manufacturers had to compensate for this by changing the type of screw used (e.g. geometry, height, surface area), the precision of the fit over the hex, and the amount of torque used to secure the new screws. One of the first internally hexed implants were intended to distribute intraoral forces deeper within

Fig. 8: Articulated cast on Hanau H2 articulator

Fig. 9: Cementation of zirconia crown

the implant to protect the retention screw from excess loading, and to reduce the potential of microleakage, superior resistance to micro movement and loosening.[11-14]

The connection between the abutment/healing cap and the implant is termed as screw joint. The screw is a simple machine that has been used for centuries and follows the mechanics of a spiral ramp and is highly efficient. A 20 Ncm force on a screw is able to move two railroad cars if on a flat plane. Tightening of this the screw creates the tension in the screw necessary to retain the components together. This friction fit is necessary to preserve the integrity of two components. This pre-tightening has been referred to as preload. Preload is the initial load created by the application of a torque and causes elongation of the screw. Preload places the screw intention and leads to an overclamping force between the healing cap and the implant. The clamping forces on a metal-to-metal screw component are one of the more important considerations for long-term screw fixation. Large magnitudes of the preload have been seen to cause plastic deformation or permanent change in the material, at which point the screw is no-longer retrievable which is sometimes referred to as cold welding.[15] The suggested amount of torque for a preload should be 75% of the value to reach permanent deformation to provide a safety valve for the screw joint.

Cold welding is defined as an increase in loosening torque with respect to tightening torque and it has been suggested that this might occur and result in a lack of retrievability, which is inherent in the three-component system of the external hex design and can even be seen with internal hex design.[15] Sutter et al demonstrated that the loosening torque was 124% of the tightening torque at a clinically relevant level of 25 Ncm, which was presented in a favorable light, with reduced risk for loosening.[16] Norton et al concluded that for clinically relevant levels of tightening torque (20–40 Ncm), the loosening torque was approximately 80 to 85% for all units of Astra Tech and ITI Straumann implants tested, and cold welding did not occur. The only factor that influences resistance to loosening is the surface area of interface, whereby increased surface area will result in increased resistance to loosening and in rare instances can result in cold welding of components. This is most likely due to increased resting friction and stress generation between the implant and screw.[16]

As a general rule, the amount of torque suggested by manufacturers for healing cap range from 5 to 15 Ncm and a torque wrench is required to attain consistent torque value. Torque wrench provided by different companies is not completely accurate and components may corrode after autoclaving many times, which may increase the torque applied to the screw joint. This is one of the possible explanations that might have happened in this particular case. Therefore, autoclaving of hand torque wrenches in the open (broken) position is advocated.[17]

A logical solution in such a case was preparation of healing cap as conventional abutment and fabrication of crown over it.[17-21]

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