Type of manuscript *– Review article*

Implant Screw Breakage: A Review Article

Vijay Ebenezer

Professor and Head of The Department, Department of Oral and Maxillofacial Surgery, Sree Balaji Dental College and Hospital, Pallikaranai, Chennai- 100, Tamilnadu, India

Abstract

Dental implants have revolutionized the treatment for edentulous and partially edentulous patients, and successful implant integration has been well documented for patients with those clinical conditions. With the high rate of implant success for edentulous individuals, the concept of osseointegrationhas become a predictable treatment modality[2]. Yet this cutting-edge treatment modality is not without its own set of adversities. Implant failures are as common as implant success. The types of implant failures are 1) loss of integration, 2) positional failures 3) soft tissue defects, and 4) biomechanical failures. In this article we come to the conclusion that the mechanical stability of the implant is a multi-factorial aspect.

Keywords *: Dental Implant, Screw Breakage, Fatigue, Biomechanical Failure*

Introduction

During the past few decades dental implants have come a long way from the implants used and studied by Dr. P. Brånemark in 1978. He was the 1st person to observe and thus describe the concept of osseointegration. Although the credit of 1st ever dental implant to be used in recorded history goes to the amazing Mayan civilization in 600AD, where they successfully used pieces of shell as replacement for mandibular teeth. Many more physicians, scientists and dentists have over the centuries helped to make dental implantology as it is today, a very reliable rehabilitation method for edentulous spaces in both the maxilla and mandible. Yet this modern method although so refined, has immense potential for failures as well. As many cases fail as the number of successful cases. Clinical observations have indicated that the major causes of implant failure are (a) deficient osseointegration, (b) complication of the neighboring soft tissues (peri-mucositis and periimplantitis) and (c) mechanical complications. Among the biomechanical problems, screw loosening, abutment rotation, and abutment fracture are the major issues[2]. We shall now go into more details about abutment fractures and the physical factors that resist as well as cause it.

Methodology

Pubmed database was searched for the keywords 'IMPLANTS BREAKAGE' "IMMEDIATE IMPLANTS", "FATE OF IMPLANTS" 141 articles were found.

Out of the 141 articles, the non dental articles were excluded to get 36 articles.

The duplicates were excluded to get 2 articles

These 4 articles were then reviewd and data for this Review Article was obtained.

DISCUSSION

Manyof the materials used to restore implants arederived from conventional restorative dentistry,forexample denture base resins. Completedenture wearers develop relatively littlebite force compared toforce generated withimplant supported restorations. Breakage is acommon failure of overdenture restorations(fig 1 & 2)[1].

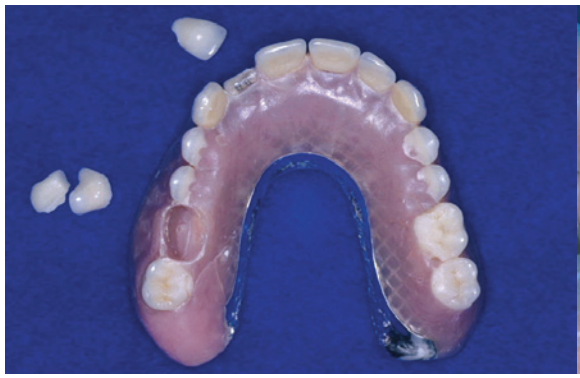

Fig 1: Teeth broken offan overdenture prosthesis[1]

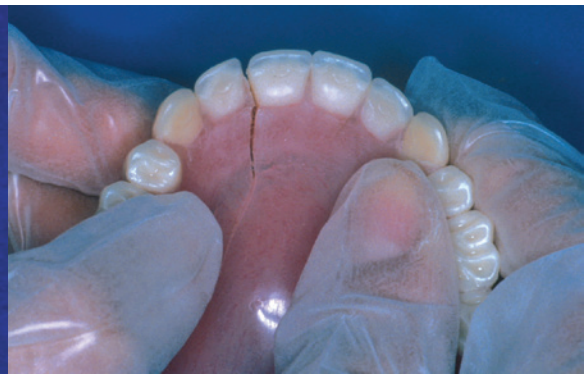

Fig 2: Fractured overdenturesare a common failure dueto increased forces and thinningof acrylic bases to accommodateimplant components and tissue bars[1]

Metal fatigue of restorative materials canalso lead to breakage — the rigid connection ofimplantsbone demands that attention ispaid to the size of connectors (Fig 3)[1]. Breakage of implants and implant componentscan also occuroften this is due to poortreatment planning and exposing implants toexcessive forces. The implant in Figures 4 and5 was treatment planned as a single implant inanincomplete dentition and a terminal tooth.The implant was connected to the tooth causingdecay onthe tooth, and eventually the implantto fracture under the load.

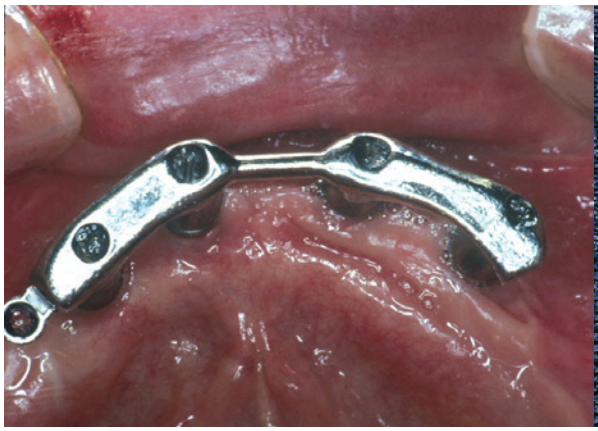

Fig 3: Intra-oral viewof fractured implant tissue bar. The cantilevered attachment hasfractured[1]

Fig 4: Implant restorationtogether with fractured implantcomponent[1]

In 2015, Sun-Young Lee, Sung-Jun Kim, Hyun-Wook An, *et al*from Institute of Science & Technology, Megagen Implant, Gyeongsan, Republic of KoreaDepartment of Periodontology, School of Dentistry, Kyungpook National University, Daegu, Republic of KoreaMIR Dental Hospital, Daegu, Republic of Koreadid a study on the effect on mechanical properties due to thread depth of various lengths of dental implants. They used Commercial Titanium implants of various lengths, diameters and thread depths and Solid rigid polyurethane blocks withuniformity as an alternative to human cancellousbone. The implants were tightened with a recommended torque of 30 Ncm using a digital torque meter.[3]The Titanium implants were tightened with the EZ Post containingthe hemispherical loading members were fixed with aspecimen holder that was made from brass and clamped inthe jig of a universal test machine[3]. After the static compressive strength tests, the Titanium implantswere examined macroscopically. The failure mode wasobserved to be deformation in the abutment and being tornhorizontally at the upper side of the Titanium implant.The threads in the Titanium implants with deeper threads did notshow breakage. Titanium implants with the samelength and inner diameter have a similar maximum compressivestrength. The mechanical strength is more relatedto the length and diameter than the thread depth. The failuremode wasobserved in the fixtures and abutments butnot the

threads. The thread depth did not have a majoreffect on the mechanical strength. Titanium implants with deeperthreads did not induce the breakage of threads applying themaximum compressive strength. Dental implants may fractureat load levels below the maximum compressive strengthof the implant/abutment complex. Thus, the maximum compressivestrength may suggest a standard point of acute overload.Mechanical failures of dental implants appear througha repeated loading process at low loads. The fatigue test isa general method used in the laboratory to mimic actualintraoral use. The fatigue limits of the dental implants withа diameter of 4.0 mm and thread depth of 0.6 mm (636 N)and those with a diameter of 4.0 mm and thread depth of0.35 mm (619 N) in the fatigue test on the basis of theInternational Organization for Standardization (ISO14801)were both more than 600 N. Thefatigue limit of the Ti implants with deeper threads is similarto that of Ti implants with shallow thread depth. The study indicated that the Ti implants with the deeper threadshave similar mechanical stability[3].

In 2009, Cleide Gisele RIBEIRO, Maria Luiza Cabral MAIA, Susanne S. SCHERRER, *et al* from Brazil conducted a study on the fatigue resistance of dental implants based on the design of abutment-implant interface. This studydemonstrated the superior fatigue resistance of external hex interface. There was no significantdifference between the conical and internal hexinterfaces. Probably, the quality of the surfacemachining of the flat-to-flat mating surfaces(mainly, the machining accuracy of the screw andthread) determined the superior resistance of theconnector; The mode and region of fracture inprosthetic screws observed in this study suggestedthat failure of these screws occurred by fatigue(presence of fatigue striations) and involved thethreaded part[2].

Conclusion

Thus, we can now see that the possibility of implant screw fracture is dependent on an array of various factors such as technique, material, design and the peri-implant environment as well. Since titanium implants are so very much biocompatible, they can be left as it is, without any complications, if a fracture does occur and it is not feasible to remove the fractured implant.

Ethical Clearance – Not required since it is a review article

Source of Funding – Nil

Conflict of Interest – Nil

References

[1] W. Chee and S. Jivraj.Failures in implant dentistry. BRITISH DENTAL JOURNAL FEB 10 2007: VOLUME 202 NO. 3

[2] Cleide Gisele RIBEIRO, Maria Luiza Cabral MAIA, Susanne S. SCHERRER, Antonio Carlos CARDOSO,H. W. Anselm WISKOTT. Resistance of three implant-abutment interfaces to fatigue testing. J Appl Oral Sci. OCTOBER 26 2010

[3] Sun-Young Lee1, Sung-Jun Kim, Hyun-Wook An, Hyun-Seung Kim, Dong-Guk Ha, Kyung-Ho Ryo1, Kwang-Bum Park. The effect of the thread depth on the mechanical properties of the dental implant. The Journal of Advanced Prosthodontics; 2015:7:115-21.

[4] Misch, Carl E. DDS, MDS ; Perel, Morton L. DDS, MScD ; Wang, Hom-Lay DDS, MScD ; Sammartino, GilbertoMD, DDS ; Galindo-Moreno, Pablo DDS, PhD ; Trisi, Paolo DDS ; Steigmann, Marius Dr. Med ; Rebaudi, AlbertoMD, DDS ; Palti, Ady DDS ; Pikos, Michael A. DDS ; Schwartz-Arad, D DMD, PhD ; Choukroun, Joseph MD ;Gutierrez-Perez, Jose-Luis MD, PhD, DDS ; Marenzi, Gaetano DMD, DDS ; Valavanis, Dimosthenis K. MD, DDS,DMD. Implant Success, Survival, and Failure: The International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference. Implant Dentistry. March 2008: Volume 17 - Issue 1 - p 5-15.