*Dental Traumatology 2004; 20: 169–171*
*Printed in Denmark. All rights reserved*



DENTAL TRAUMATOLOGY

Case Report

# Trauma to anterior implants

Stuebinger S, Hodel Y, Filippi A. Trauma to anterior implants. Dent Traumatol 2004; 20: 169–171. © Blackwell Munksgaard, 2004.

Abstract – The replacement of anterior teeth with an implant-supported restoration is recognized as an efficient and successful treatment. One of the rare complications that can occur with dental implants is the fracture of either the implant or the superstructure because of biomechanical overload or occlusal force. In contrast to the permanent dentition, there is limited information about how osseointegrated implants or the periimplantary bone behave after dental trauma. This article presents a case of trauma to anterior implants and illustrates the effects to the titanium screw and the surrounding tissue.

**Stefan Stuebinger, Yvonne Hodel, Andreas Filippi**

Department of Oral Surgery, Oral Radiology and Oral Medicine, University of Basle, Basle, Switzerland

Key words: dental trauma; implant; fixation screw

Priv.-Doz. Dr Andreas Filippi, Department of Oral Surgery, Oral Radiology and Oral Medicine, University of Basle, Hebelstr. 3, CH-4056 Basle, Switzerland
Tel.: +41 61 267 2609
Fax: +41 61 267 2607
e-mail: andreas.filippi@unibas.ch

Accepted 4 September, 2003

In dental traumatology, an acute injury represents an emergency, which mostly requires prompt and competent diagnosis and therapy. This not only reduces pain and the likelihood of late sequelae but, possibly, also improves the prognosis for the injured tooth (1), in which the intensity, direction and localization of the force vector impacting the tooth and periodontal ligament play a decisive part (2). The bone quality of the alveolar process also influences the individual effects of the injury (3). In case of sufficient resilience and deformability of the surrounding alveolar process, i.e. predominantly in elastic infantile bones with substantial amounts of cancellous tissue, loosening or dislocation of teeth primarily occurs (4). This is connected with more or less extensive injuries of the periodontal ligament and pulp. It may result in pulp necrosis, possibly with subsequent infection-related root resorption (5). The pulp, in general, reacts more susceptibly to trauma than to the peridontium (6).

If, however, the alveolar process shows no or only little deformation potential, the kinetic energy impacting the dental hard tissue mostly results in a fracture of the tooth. Here, the adjacent alveolar bone only fractures under a larger force impact. Such bone injuries can range anywhere from the loss of the vestibular bone wall through to extensive fractures of the alveolar process, with entire bone fragments breaking off (7).

Based on these fundamental principles of dental traumatology, the question arises how dental implants, their supraconstruction and periimplantary bones react to accidental force impact. The individually possible course and the pertaining range of problems are to be shown by this case report in an exemplary fashion.

## Case report

Three years after an implant placement of the maxillary central incisors (Frialit II, Friatec, Mannheim, Germany; diameter, 4.5 mm; length, 13 mm), a 55-year-old man presented to our clinic with an anterior tooth trauma after a fall. The clinical examination did not show anything extraorally except for a slight abrasion at the upper lip and the tip of the nose. Intraorally, the crown on the maxillary left implant showed some obvious splintering of the ceramic layer (Fig. 1). Both implants had not been loosened; the

*Fig. 1.* Fracture of the crown (ceramic layer) on implant 21.

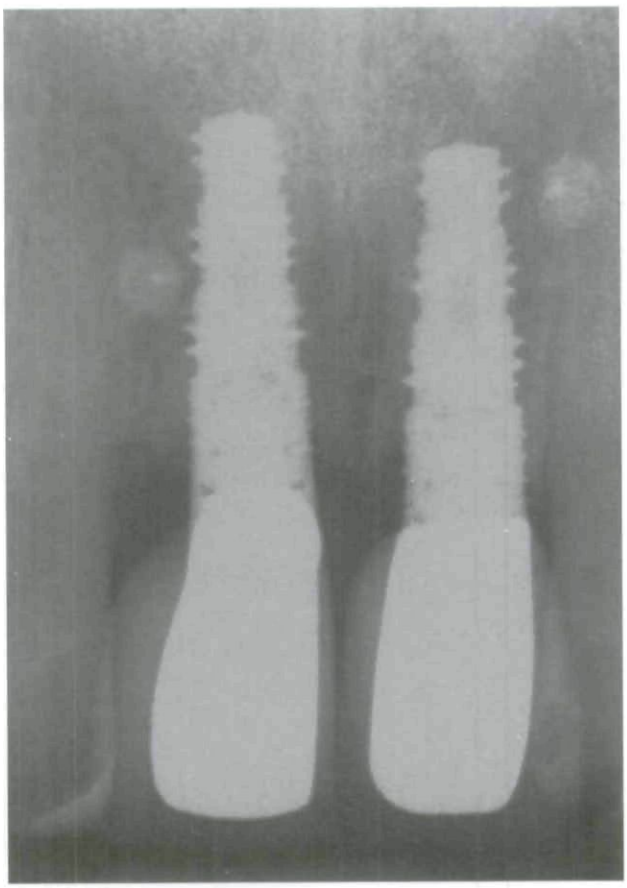

*Fig. 2.* Periapical radiograph of the implants 11 and 21: trauma-related pathological changes are not visible.

Periotest® values (Gulden, Bensheim, Germany) averaged −4 for the upper right maxillary incisor implant and −1 for the upper left maxillary incisor implant and had not changed as compared with the values of the last annual check-up (Fig. 2). The patient had the subjective feeling that upper left maxillary crown had tilted in palatal direction, which was clinically visible (Fig. 3). The vital neighbouring teeth did not show any changes resulting from the accident.

*Fig. 3.* Palatal tilted crown on implant 21 (occlusal view).

*Fig. 4.* Bend of the fixation screw on implant 21 (bottom) in comparison to a new fixation screw (top).

The implant crown upper left maxillary and superconstruction were removed. The fixation screw of implant upper left maxillary was clearly bent (Fig. 4). This explained the palatal tilt of the crown.

## Discussion

The physiological repair and regeneration mechanisms after dental trauma are partially well researched and described in international literature (8, 9). The same is also true for the numerous possibilities of therapy. This includes implantology for the replacement of teeth lost after the completion of jaw growth, which has been practised successfully for more than 20 years. Despite long-standing implantological experience, one does not exactly know to date how osseointegrated implants or the periimplantary bone behave after dental trauma. In the scientific literature, one finds very little information, which does not permit any general conclusions. In individual cases, it is reported that a fracture of the alveolar process or the jaw may occur in case of excessive exertion of force during implantation (10); however, this is not comparable with the energy potential, which builds up in case of external traumatic violence to the implant. Furthermore, it is reported that – in case of false or excessive functional load on hollow cylinder implants or slender extension implants connected with horizontal and vertical bone loss – a fracture of the thin coronal implant walls may occur if the apical part of the implant is still osseointegrated (11, 12). In the past, ceramic implants were, by far, more susceptible to fractures than the relatively stable titanium implants because of their lower shearing and bending resistance, which is because of material properties. There are three essential reasons for the fracture of implants: manufacturing faults in the implant design, incongruence between implant and prosthetic supraconstruction and physiological and/or biomechanical strain (13). Some case reports provide evidence for that (14, 15).

The question is, thus, whether the implant or the surrounding tissue reacts primarily after a trauma. Furthermore, it still has not been clarified whether – analogously to the fracture of teeth – deformation will primarily occur in an implant fracture because of the elasticity module. Of course, it would also be worth considering to what extent the implant shape (cone, cylinder, screw) (16) or the implant surface (TPS, SLA, machined) (17,18) play a part in such cases.

Human bones are mechanically much less resistant than titanium (19). Analogously to the conditions with artificial hip joints, one must, thus, assume that a load beyond the normal physiological range does not result in a fracture of the implant but in strong tension peaks within the bone, failure of the intraosseous connecting forces and, ultimately, in a fracture. It remains unclear whether the dentoalveolar bone rather breaks monocortically or whether entire bone segments break out together with the implant. Scientific studies, case reports or long-term observations after implant traumas are not found in current literature. We would, thus, request that cases documented in a similar fashion be published.

## References


1. Andreasen JO, Andreasen FM. Examination and diagnosis of dental injuries. In: Andreasen JO, Andreasen FM, editors. Textbook and color atlas of traumatic injuries to the teeth. Copenhagen: Munksgaard; 1994. p. 196–217.
2. Andreasen JO. Etiology and pathogenesis of traumatic dental injuries. A clinical study of 1298 cases. Scand J Dent Res 1970;78:339–42.
3. Lehman ML. Bending strength of human dentin. J Dent Res 1971;50:691.
4. Andreasen JO, Ravn JJ. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. Int J Oral Surg 1972;1:235–9.
5. Oikarinen K, Gundlach KKH, Pfeifer G. Late complications of luxation injuries to teeth. Endod Dent Traumatol 1987;3:296–303.
6. Kirschner H, Filippi A, Pohl Y, Ebelseder K. Unfallverletzungen der Zähne. Hannover: Schlütersche; 2002. p. 14.
7. Huelke DF, Harger JH. Maxillofacial injuries: their nature and mechanisms of production. J Oral Surg 1969;27: 451–60.
8. Andreasen JO. Response of oral tissues to trauma. In: Andreasen JO, Andreasen FM, editors. Textbook and color atlas of traumatic injuries to the teeth, 3rd edn. Copenhagen: Munksgaard; 1994. p. 77–149.
9. Yamamura T, Shimono M, Koike H, Terao M, Tanaka Y, Sakai Y, et al. Differentiation and induction of undifferentiated mesenchymal cells in tooth and periodontal tissue during wound healing and regeneration. Bull Tokyo Dent Coll 1980;21:181–221.
10. Mason ME, Triplett RG, Van Sickles JE, Parel SM. Mandibular fractures through endosseous cylinder implants: report of cases and review. J Oral Maxillofac Surg 1990;48:311–7.
11. Rangert B, Krogh PHJ, Langer B, Van Roekel N. Bending overload and implant fracture: a retrospective clinical analysis. Int J Oral Maxillofac Implants 1995;10:326–34.
12. Buser D, Maeglin B. Komplikationen mit ITI-Implantaten. In: Schroeder A, Sutter F, Buser D, Krekeler G, editors. Orale implantologie. Stuttgart: Thieme; 1994. p. 442–73.
13. Balshi TJ. An analysis and management of fractured implants: a clinical report. Int J Oral Maxillofac Implants 1996;11:660–6.
14. Velasquez-Plata D, Lutonsky J, Oshida Y, Jones R. A close-up look at an implant fracture: a case report. Int J Periodontics Rest Dent 2002;22:483–91.
15. Green NT, Machtei EE, Horwitz J, Peled M. Fracture of dental implants: literature review and report of a case. Implant Dent 2002;11:137–43.
16. Boggan RS, Strong JT, Misch CE, Bidez MW. Influence of hex geometry and prosthetic table width on static and fatigue strength of dental implants. J Prosthet Dent 1999; 82:436–40.
17. Edge MJ. *In vivo* fracture of the tricalcium phosphate coating from the titanium body of an osseointegrating-type dental implant: a case report. Int J Oral Maxillofac Implants 1988;3:57–8.
18. Yokoyama K, Ichikawa T, Murakami H, Miyamoto Y, Asaoka K. Fracture mechanisms of retrieved titanium screw thread in dental implant. Biomaterials 2002;23:2459–65.
19. Hobkirk JA, Havthoulas TK. The influence of mandibular deformation, implant numbers, and loading position on detected forces in abutments supporting fixed implant superstructures. J Prosthet Dent 1998;80:169–74.