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"Monday Morning Pearls of Practice by Bobby Baig"

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Part 1: Are Dental Implants Prone to Fracture??

Introduction:

1. Treating partially dentate patients with dental implants is generally considered today as a safe and predictable treatment, with a ten-year survival rate of over 93% (Pjetursson et al., 2010). That means that after a follow up time of 10 years, 93% of the implants are still in the jaw bone and 7% had to be removed and are considered lost.
2. During service, implants, just like any other mechanical structure, may experience complications. Those complications can be of a biological or a mechanical nature.
3. Complications, as severe as they can be, do not necessarily lead to the loss or extraction of the implant and more often they can be treated and/or controlled.

Implant Loss: Unfortunately, some can lead to the implant loss. Implant loss can be divided into two categories.

1. Early losses: Which occur no later than 6 months after implantation, or before the implants are loaded.
   A. Early losses are mainly of a biological nature, during which the process of osseointegration could not be achieved due to surgical trauma, infection during the implant placement and the healing process, and instability of the implant due to premature loading.
   B. More than 50% of implant losses are defined as early losses.

2. Late losses: Occurs beyond a period of 6 months after implantation. Late losses can be divided into two groups, according to the cause of the loss.

Biological Complications: Related to progressive loss of bone support around the implant because of infection or inflammation, termed peri-implantitis.

A. Approximately 50% of implant losses are defined as late losses, which occur due to loss of bone support
B. Most of these losses occur during the first year after loading.

Mechanical Complications: Generic term for mechanical damage of the implant, its components, or to the superstructure supported by the implant.

A. Implant loss, in the context of mechanical complications, includes of course implant fracture, which is considered a severe complication requiring extraction of the implant and its supporting bone.
B. Implant fracture is considered a severe but rare complication, with a 5-year complication rate of up to 4%. Pjetursson et al 2014, Dhima et al 2014.

Both the patients below have been referred to me for evaluation of constant implant crown loosening in spite of screw tightening. Fig 1 and Fig 2.

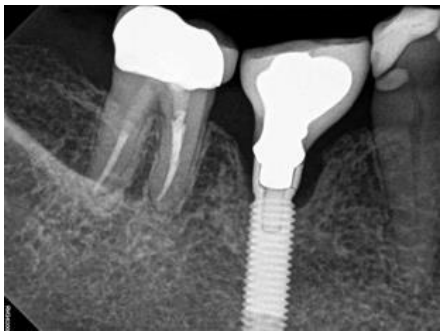
Fig 1. 

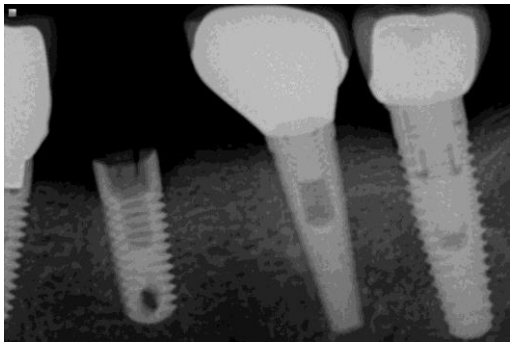
Fig 2. 

Fig 1: Fracture of implant platform - mesial aspect. Fig 2: Fracture of implant platform- Lingual aspect.

C. 5-year complication rate for a total number of mechanical complications ranging from 16.3% to 53.4%. Pjetursson et al. (2014)
D. Fracture of the fixation screw is one of the most common mechanical complications, with a 5 and 10 year estimated complication rate of 9.3% and 18.5%, respectively.
E. Mechanical complications were more frequent than biological ones.
F. The study also showed that mechanical complications occur significantly later than biological complications, with a mean time of 5 years for biological complications to occur versus 7.6 years for mechanical complications.
G. Fracture of the fixation screw (8.5%), and abutment fracture (5.5%) were the top observed mechanical complications.

Pommer et al. (2014)

Recently published a systematic review meta-analysis on the incidence of implants' fracture, reviewing a large number of clinical studies that reported such fractures. Their study estimated an incidence of implant fracture to be 2.8% after a follow up time of 8 years. Most fractured implant included in this study occurred just after a mean time of 4.17/3.5 years. These incidences clearly highlight the importance of the follow up time on the occurrence of implant fracture. The type of

restoration supported by the implants, when the type of restoration whether removable or fixed prosthesis, may influence the loads that are transmitted to the implant and thus the incidence of mechanical complications arises.

Occlusal Load / Implant design and Implant Fracture:

1. Occlusal loads' magnitude is a key factor contributing to the load imposed on the implants.
2. Para- function habits such as bruxism and clenching may increase the load magnitude on the implant/ prosthesis system leading to early occurrence of mechanical complications.
3. Mechanical reliability of implants depends also on their overall design, materials used and surface treatments for improved osseointegration.
4. Examining the fracture surface of retrieved fractured dental implants and implant components (fractographic analysis) is the optimal procedure to assess structural integrity.
5. Metal fatigue (Suresh, 1994) has been identified as the implants' main fracture mechanism by many studies

Surface Roughening Procedures and Implant Fracture:

1. The surface roughening procedure, aimed at promoting osseointegration was also evaluated as a potentially damaging factor to the mechanical performance and reliability of the implants.
2. Large crater-like areas, sharp edges, dents and scratches, with embedded foreign (ceramic) particles, introduced during the surface treatment, were also identified as an additional cause for fatigue crack initiation (Shemtov-Yona et al., 2014.)

Conclusion:

Having addressed the relatively high rate of occurrence of mechanical failures over prolonged periods, one may wonder whether those observed fractures actually initiate at the very late stages of the implant life, or whether small cracks might develop at rather early stages, while going un-noticed during the usual follow-up evaluations, and only seen and diagnosed when the fractured implant leads to complete loss of the prosthesis, and collapse of the rehabilitation procedure.

CONTD: NEXT EDITION:

Scanning the surfaces of failed implants, which failed (but did not fracture) due to bone loss and implant's mobility, after prolonged time of use, has never been performed so far.
In next edition I will discuss a study regarding scanning the surface of retrieved implants that had to be removed. This will contain a wealth of new information related to the presence of developing micro-cracks in the implant structure.

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