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Case Report

Analysis and management of implant-prosthetic complications: Description of a diagnostic and therapeutic algorithm with a clinical case

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ABSTRACT

Patient: A 65-year-old non-smoker man with stabilized chronic periodontitis and in good general health conditions presented to our observation. The patient reported crown mobility, gingival inflammation and localized pain, corresponding to the mandibular right first molar rehabilitated with a cement-retained implant crown. This clinical situation suspected a fracture of an implant-prosthetic component. Through the described diagnostic algorithm, an abutment hexagon fracture was revealed. Thus, a minimally invasive treatment was carried out in order to use the residual implant-prosthetic components for a new implant-prosthetic rehabilitation.

Discussion: Fractures of implant-prosthetic components are clinical occurrences that may result in irreversible failures. The main causes of a possible fracture are dependent on biomechanical considerations and production processes of implant-prosthetic components. The respect of the rigorous planning and the employment of the implant-prosthetic devices of the same manufacturer are recommended.

Conclusions: Specific employments and protocols have to be offered in order to manage the fractures of implant-prosthetic components. This work showed that through the described diagnostic and therapeutic algorithm, the clinician can be guided towards a proper diagnosis and a correct management of the cases where a fracture of implant-prosthetic components may occur.

1. Introduction

Nowadays implant-prosthetic rehabilitation represents the gold standard in single, multiple, and total edentulous areas, with excellent long-term performances, as highlighted by literature data [1–4]. These outcomes have been achieved through more accurate and predictable surgical and prosthetic protocols, and through more powerful implant-prosthetic devices [5,6]. Nevertheless, implant-prosthetic rehabilitation may present a series of complications or failures, depending on the surgical and prosthetic adopted techniques, the placement of different number of implants, the maxillary or mandible localization. In general, complications concerning implant-prosthetic rehabilitation can be divided into two main groups, i.e., biological and technical complications. The biological complications are represented by the mucositis and the peri-implantitis, which may occur before or after the prosthetic phase [7–10]. The technical complications are represented by damages or fractures of the fixture, abutment, crown and abutment-fixture connection. These technical complications are usually influenced by parafunctional activities, non-axial functional loading, incorrect three-dimensional placement of the implant, lack of precision of the prosthetic components [7,10–13]. Although there are few literature data, the aim of this work was to describe an executive therapeutic protocol through a diagnostic algorithm, aiming at guiding the clinician when fractures of the implant-prosthetic components may occur. This algorithm was characterized by different working phases depending on specific clinical cases, as shown in Table 1. In the therapeutic protocol, advantages and disadvantages were also described for different treatments, which are adopted in the cases of fractures of the implant-prosthetic components. Furthermore, a case was analyzed in order to specifically describe how to manage a fracture of the abutment with internal-hexagon connection system (IH) through a minimally invasive treatment. Having information concerning the implant-prosthetic rehabilitation, which damage

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Table 1
Schematic diagnostic and therapeutic protocol for analysis and management of implant-prosthetic components fracture. Adv: advantages; Dis: disadvantages.

Clinical examination (mobility of the crown)		Radiographic examination	
Diagnostic protocol			
Mobility crown on horizontal plane	+: suspected fracture of prosthetic components (screw and/or abutment) −: unlikely fracture of prosthetic components	No radiographic evidence of prosthetic components fracture	Removal of the prosthetic components: • Unscrew in case of screwed implants
Mobility crown on bucco-lingual and/or mesio-distal planes	+: abutment more likely to fracture		• Drilling out crown and unscrew in case of cemented crown
	−: screw more likely to fracture	Radiographic evidence of prosthetic components fracture	Determination of the fracture level:
Mobility crown on Vertical plane	No crown mobility: abutment more likely to fracture		• Fixture: remove the implant
	Partial crown mobility: screw more likely to fracture		• Screw: drill out the crown and unscrew
	Full crown mobility: no fracture of prosthetic component but full loss of abutment-fixture connection		• Abutment: drill out the crown, unscrew and remove the abutment

Therapeutic protocol			
Crown removal	Fixture Removal	Invasive treatment: use of mechanical systems (piezosurgery, trephine drill)	Adv: rapidity, more predictable Dis: demolition of considerable amount of bone
		Minimally invasive treatment: use of dedicated kit to specific coupling fixture-mounter and removal the fixture	Adv: considerable saving of healthy bone Dis: operator and fixture dependent, less predictable, expensive
	Abt. Screw Removal	Invasive treatment: creation of cracks on the head portion of the screw with the purpose of creating an engagement for the removal systems	Adv: more predictable Dis: increased damage risk of the internal implant architecture
		Minimally invasive treatment: use of dedicated kit to remove the fractured screw or tipped serrated mounter which is activated in anti-rotation with controlled torque to rub the screw	Adv: decreased damage risk of the internal implant architecture Dis: operator dependent, less predictable
	Abt. Hex Removal	Invasive treatment: Anesthesia, flap preparation, the implant head highlighting, creation of cracks on the inner surface of the fractured abutment portion, engagement of the same slice, trying to remove with dedicated kit for leverage	Adv: excellent visibility of the field of action, more predictable Dis: operator-dependent, less predictable, increased damage risk of the internal and external implant architecture (shoulder and thread)
		Minimally invasive treatment: no anesthesia, no preparation of the flap, direct engagement of the fractured hexagon through the use of a specific mounter with controlled tightening ranging from 35 to 50 N/cm followed by alternate fluctuations in the mesio-distal and bucco-lingual planes	Adv: excellent intra- and post-operative, no implant damage and immediate reuse of the fixture for a new prosthetic rehabilitation Dis: difficult technique, less predictable, operator-dependent, no dedicated kit for each implant systems, expensive

is suspected, is a key prerequisite to be able to precisely use and follow each step of the described protocol. Data that have to be collected are the implant manufacture, implant type, implant-abutment connection system, date of the implant placement, implant location, surgical timing, implant insertion torque, prosthetic timing, screw insertion torque, abutment type and prosthesis type (screwed or cemented, used cement type, single crown or bridge or full-arch).

2. Outline of the case

A hexagon abutment fracture was found by the authors of the present article after several years of masticatory function. In order to analyze and manage the hexagon abutment fracture, a diagnostic and therapeutic algorithm was used. The diagnostic phase adopted clinical and radiographic signs, as reported in Fig. 1. The therapeutic phase employed a minimally invasive treatment, as described in Fig. 2. A 65-year-old non-smoker man with stabilized chronic periodontitis and in good general health conditions presented to our observation with crown mobility, gingival inflammation and localized pain, corresponding to the mandibular right first molar rehabilitated with a cement-retained implant crown. The patient did not report signs or symptoms of bruxism. The implant had been placed three years before our first visit: a 4.0 mm-diameter and 11 mm-length Astra Tech OsseoSpeed TX Dentsply with IH was placed in June 2012 after 4 months since the extraction of 4.6. An Atlantis CAD/CAM titanium abutment was placed using a 20 Ncm controlled tightening. After 2 months, a cemented prosthesis was realized using a gold alloy. A temporary cement was used for the cementation of the implant crown. The patient reported that regular follow-up had occurred during the months following the definitive crown insertion. Furthermore, no clinical symptoms were reported until 3 years after the conclusion of the implant-prosthetic rehabilitation. Therefore, a diagnostic algorithm was followed through careful clinical inspection and an endoral radiography in order to investigate the potential pathological damage of the bone around the implant, the implant-bone interface and the prosthetic structures, as shown in Fig. 1. On clinical examination, the mobility of the crown was evaluated in the horizontal, mesio-distal and bucco-lingual, and vertical planes, as shown in Figs. 3–5. The rotation of the crown in the horizontal plane was revealed, suspecting a fracture of the screw or the abutment, or of both, as reported in Fig. 4. Then, the mobility of the crown in the buccolingual and mesio-distal planes was evaluated (Fig. 4). A positive outcome was observed in both planes, demonstrating that fracture of the abutment is more likely than the fracture of the screw. Conversely, the mobility of the crown in the vertical plan was not found (Fig. 5). This observation supported the previous assumption, i.e. the fracture affected the abutment instead of the screw. This supposition also excluded that the fracture affected the fixture (Fig. 5). On radiographic examination, the fracture level was evaluated. There was no radiographic evidence of the crown and the screw fractures but there was radiographic evidence of abutment fracture. Consequently,