

# 10

## Complications and maintenance

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The proposed success criteria for dental implant systems were described in Part 1. It has been suggested that longitudinal studies of implant systems should be a minimum of 5 years (preferably prospective studies rather than retrospective), with adequate radiographic and clinical supporting data to determine the level of failure and complication rate. As described in previous chapters, failure of osseointegration of individual implants should be relatively rare, with most failures occurring during the initial healing period or following abutment connection and initial loading. Longer term complications are associated with general wear and tear, inadequate attention to oral hygiene, poorly controlled occlusal forces, poor design of prostheses or use of an inadequately tested implant system.

Maintenance requirements and complications vary widely between patients, depending on susceptibility to caries and periodontal disease in the dentate patients, complexity and type of implant supported prostheses, functional demands and the patient's ability to attain an adequate standard of oral hygiene.

### Re-evaluation of the implant retained prosthesis

It is generally recommended that patients treated with implant prostheses are seen at least on an annual basis, but in many cases they will also require routine hygienist treatment at 3, 4 or 6 monthly intervals according to individual requirements. At each re-evaluation appointment the following should be reviewed:

#### Condition of the prosthesis/restoration

The prostheses should be checked for signs of wear or breakage. Fixed restorations should have the cementation or screw fixation checked. This may include checking the screws which retain the prostheses and those which retain the abutments (see below). The occlusion should be re-evaluated, particularly where there has been occlusal wear of the prostheses or co-existing natural dentition. In published longitudinal studies of implant systems it was necessary to remove fixed bridge superstructures to evaluate the success of individual implants. However, this is not generally recommended in normal patient follow-up unless there is suspicion that there is a problem with one of the implants. Fixed prostheses which

have proved difficult to clean by the patient may require removal to allow adequate professional cleaning, which is easier with screw retained fixed prostheses than cemented types.

Removable prostheses need to be checked for retention and stability. In the case of prostheses with combined implant and mucosal support it is important to check that the implants are not suffering from overload caused by loss of mucosal support because of further ridge resorption. It has been suggested that removable prostheses often require more maintenance in the form of adjustment and replacement of retentive elements such as clips and 'ball retainers', compared with fixed prostheses.

#### Screw retention and crown cementation

Multiple units are more likely to be screw retained whereas the majority of single units are cemented. The screws retaining a prosthesis to the abutment are often covered with a layer of restorative material, such as composite or glass ionomer, which may need replacing. Screws which are accessible should be checked to ensure that they have not loosened. This is more likely to occur in an ill-fitting prostheses or where high loads have been applied (see the section on Implant Component Failure).

Crown decementation of single tooth units is unusual, even in cases where a relatively weak temporary cement has been used. This is because of the close fit of the abutment to the crown, and in some cases a high degree of parallelism between them which may make separation impossible. A more common complication is failure to seat the crown at the original cementation because of failure to relieve hydraulic pressure within the crown using a cementation vent (fig. 1). The resulting poor marginal fit and exposure of a large amount of cement lute may result in soft tissue inflammation because of the increased bacterial plaque retention. A vent also helps to reduce excess cement being extruded at the crown margins which can give rise to considerable inflammation, including soft tissue abscess and fistula formation. Plaque retention and development of inflammation may also be the initial sign of a loose abutment (see below).

#### Abutment connection

Repeated chewing cycles may produce abutment loosening and development of a gap

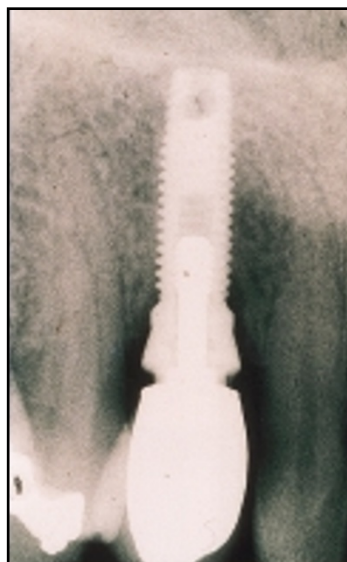
**Maintenance requirements vary with the complexity of treatment provided. In well planned and treated cases, complications should be rare.**

#### In this part, we will discuss:

- Re-evaluation of the implant retained prosthesis
- Routine hygiene treatment requirements
- Management of other specific complications

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**Fig. 1** A radiograph of a single tooth implant replacing an upper canine. There is a large gap between the crown and the abutment because of failure to seat the crown properly during cementation. The fact that the crown did not interfere with the occlusion suggests that the original fault was failure to seat the impression coping — the crown was therefore made to fit an abutment at the wrong level



**Fig. 2** There is considerable inflammation in the labial soft tissues surrounding this single tooth implant replacing the upper left central incisor. The patient had suffered a severe blow to the crown which had bent and loosened the abutment screw. The resultant subgingival gap had allowed bacterial infection. The situation was corrected with replacement and tightening of the abutment screw



between abutment and implant. This complication can be largely prevented by attention to occlusal contacts and adequate tightening of the abutment screw in the first place by using specifically designed torque wrenches/hand pieces. Variations in the designs of abutment/implant interface such as the morse taper of the ITI system, or internal conical seal of the Astra system, should reduce the occurrence of this complication. Abutment loosening is more likely to occur in patients with a parafunctional activity, in situations where inadequate attention has been paid to the occlusal contacts in all excursions, and rarely when the crown has been subjected to accidental trauma (fig. 2). Most single tooth restorations have cemented crowns with no direct access to the abutment for screw tightening. Therefore, should this be required, removal of the crown is necessary. It is important to note that under circumstances of direct trauma it is preferable to have a design system where hopefully a weaker and more easily replaceable component is damaged.

**Status of the soft tissue**

The standard of oral hygiene should be evaluated and the presence of supragingival calculus noted

(see later the section on Routine Hygiene Treatment Requirements). The mucosa surrounding the implant abutments at the emerging restorations should appear free of superficial inflammation. The transmucosal part of the implant restoration may emerge through non-keratinised mucosa, particularly in situations where there has been severe loss of bone eg edentulous jaws. In contrast, many restorations emerge through soft tissue which appears very similar to adjacent keratinised gingiva. There are considerable differences between the appearances of these tissues, in that the non-keratinised mucosa will appear red, possibly more mobile and will have visible blood vessels within it. Gentle pressure on the exterior surface of the soft tissue should not result in any bleeding or exudate and will produce minimal discomfort. Probing depths may be evaluated but will depend upon the thickness of the original mucosa (see Part 2) and any overgrowth of gingival tissue which may have occurred. Ideally probing depths should be relatively shallow (< 4 mm) with no bleeding. If increased probing depths, soft tissue proliferation, copious bleeding, exudate or tenderness to pressure are found (fig. 3), the area should be examined radiographically (regardless of whether radiographic re-evaluation is scheduled) to determine whether there has been any loss of marginal bone or loss of integration. In these circumstances it may be advisable to dismantle the implant superstructure to allow adequate examination of individual abutments and implants.

**Radiographic evaluation**

Radiographs (fig. 4) are frequently used in implant treatment to evaluate:

- Initial osseointegration
- Seating of abutments
- Fit of prostheses
- Baseline bone level evaluation following completion of prosthetic treatment
- Longitudinal evaluation of bone levels.



**Fig. 3.** Marked soft tissue inflammation around a mandibular bridge. The embrasure spaces were tight and the patient found it difficult to clean



**Fig. 4** A periapical radiograph of two implants incorporated in a fixed bridge showing a number of important features. In both implants the thread profiles are clearly visible confirming good paralleling technique. The implant on the left side has the bone crest coincident with the top thread and a good fit of the abutment and casting. In contrast the implant on the right side has a bone level at the second or third thread and a gap between the abutment and casting

- Wide saucerised areas of marginal bone loss visible on radiographs.  
This problem will be dealt with in the section on the treatment of peri-implantitis.

**Routine hygiene treatment requirements**

The patient's oral hygiene should be reviewed and reinforced where necessary. An individual with a healthy dentition and a single tooth implant replacement should have the simplest maintenance requirements and few, if any, complications. The patient should be able to maintain the peri-implant soft and hard tissues in a state of health equivalent to that which exists around their natural teeth, almost without professional intervention (fig. 6). This can be achieved with routine toothbrushing and flossing. However, in some circumstances, the contour of the single tooth restoration is not ideal and instead of producing a smooth readily cleansable emergence profile, poor positioning of the implant may have resulted in a degree of ridge lapping (fig. 7). This will require modification of oral hygiene techniques to clean under the overhanging crown morphology, with dental tape or superfloss passed or threaded under the overhang. Single tooth restorations rarely have calculus formation on their highly

**Re-evaluation of the implant retained prosthesis**

- Condition of the prosthesis/restoration
- Screw retention and crown cementation
- Abutment connection
- Status of the soft tissue
- Radiographic evaluation

In all cases every effort should be made to minimise distortion and produce comparable reproducible images (see Part 5) to allow longitudinal assessment. Most implant systems report some bone loss in the first year following loading, followed by a steady state in subsequent years in the majority of implants. It would seem reasonable to radiograph annually for the first 3 to 5 years, then bi-annually up to 10 years in the absence of clinical signs or symptoms. If progressive bone loss is detected, the clinician has to decide whether this is most likely caused by bacteria induced inflammation or excessive loading (fig. 5). It may be very difficult to differentiate between the two, and in some circumstances the two factors may be combined.

Occlusal factors are more likely to be implicated in situations where there has been:

- A history of parafunction
- A history of breakages of the superstructure or retaining screws (or screw loosening)
- An angular/narrow pattern of bone loss
- Too few implants placed to replace the missing teeth
- Excessive cantilever extensions.

Bacteria induced factors are more likely to be implicated where there is:

- Poor oral hygiene
- Retention of cement in the subgingival area
- Macroscopic gaps between implant components subgingivally
- Marked inflammation, exudation and proliferation of the soft tissue



**Fig. 5** A periapical radiograph of two implants incorporated in a maxillary bridge. The abutments and casting are well seated. The bone level on the left implant is at the first thread but at the fifth thread on the right implant. The bone loss at the latter implant is quite saucerised. However, it should be noted that the abutment screw in the right implant had previously fractured because of occlusal overload. The apical part of the old screw is visible and the more radiopaque new screw is coronal to this



**Fig. 6** A single tooth implant replacing an upper lateral incisor. The soft tissue health is very good with no signs of inflammation or bleeding. The patient cares for this unit in the same manner as the natural teeth

**Fig. 7** A single tooth restoration viewed from the side to show a ridge lap profile. This is not ideal and oral hygiene procedures have to be modified to cope with the situation



problem does not arise. Ultrasonic instruments and steel tipped instruments are contra-indicated.

**Management of other specific complications**

There are a number of complications which require early or urgent treatment.

**Implant component failure**

Retention and abutment screws which repeatedly loosen suggest either a poor fitting restoration superstructure or excessive loading. These factors require correction and proper management to avoid this complication and this is dealt with in Parts 4 and 7. Failure to deal with these problems, particularly in patients who exhibit parafunctional activities, may predispose to screw fracture (retention screws or abutment screws)(figs 5 and 9).

In many instances the fractured screw can be unwound by engaging the fractured surface with a sharp probe or using a commercially designed retrieval kit. The screw can then be replaced and due attention given to correction of the cause of the problem.

Fortunately, fracture of the implant is rare. It is more likely to occur with:

- Narrow diameter implants, particularly when the wall thickness is thin
- Excessive load
- Marginal bone loss which has progressed to the level of an inherent weakness of the implant, often the level where wall thickness is thin at the apical level of the abutment screw.

Implant fracture is rarely retrievable, and requires either burying the fractured component beneath the mucosa or its removal (fig. 10). The latter can be difficult and traumatic, usually requiring surgical trephining which may leave a considerable defect in the jaw bone.

**Fig. 8a** Calculus will form on titanium abutments



**Fig. 8b** Plastic scalers rather than stainless steel should be used to remove calculus from titanium surfaces to avoid damage



glazed porcelain or polished gold surfaces. Professional scaling is not therefore normally required.

In patients with more complex fixed or removable prostheses development of readily cleansable embrasure spaces by the technician considerably facilitates patient's oral hygiene. Where calculus deposition has occurred, this should be removed. Calculus should be removed from titanium abutments with instruments which will not damage the surface (fig. 8). In many cases the abutments used are low profile with minimal exposure of the titanium surface subgingivally and this



**Fig. 9** A periapical radiograph of two implants used to replace three units including a distal cantilever. The abutment screw in the distal implant has fractured. The screw was replaced and the cantilever extension removed



**Fig. 10** The apical part of an implant which fractured. The implant was short. Overloading and bone loss led to failure

**Soft tissue complications**

Most inflammatory conditions can be corrected with attention to oral hygiene and professional cleaning. However, there are a number of instances which may require surgical correction:

- Soft tissue overgrowth
- Soft tissue deficiencies
- Persistent inflammation/infection.

Soft tissue proliferation may occur under supporting bars of overdentures. It may require simple excision if there is adequate attached keratinised tissue apical to it, or an inverse bevel resection as used in periodontal surgery to thin out the excess tissue but preserve the keratinised tissue to produce a zone of attached tissue around the abutment. In direct contrast, some patients experience considerable discomfort because of trauma from the removable denture on mobile non-keratinised mucosa surrounding the abutment. The technique of free-gingival grafting can be used to correct this problem (see Part 8). Soft tissue problems may arise because of poor implant positioning. Persistent inflammation or discomfort may require recontouring of the soft tissues to allow patient cleaning, and this may reveal the less than satisfactory aesthetics produced by poor planning and execution of treatment (fig. 11). In other more severe cases the only remedy may be to remove the implants or bury them permanently beneath the mucosa. Poorly designed or constructed prostheses may need to be replaced, but in some cases this would also involve correction of the implant position. A compromise solution may therefore be sought.

**Peri-implant lesions**

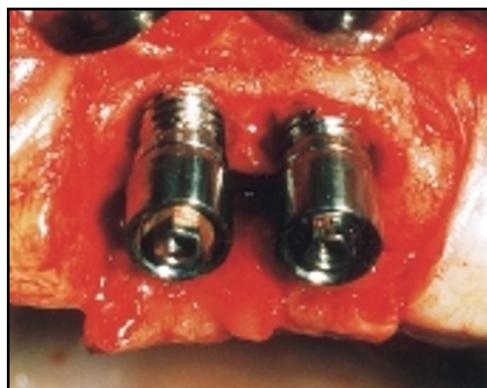
In the case of well documented implants systems, inflammatory peri-implant lesions are rare. The possible aetiology of these lesions was described above and in Part 2. Potential occlusal factors should be diagnosed and corrected. Lesions which are thought to be caused by bacterial colonisation/contamination of the implant surface are managed in a similar fashion to lesions of periodontitis around teeth.



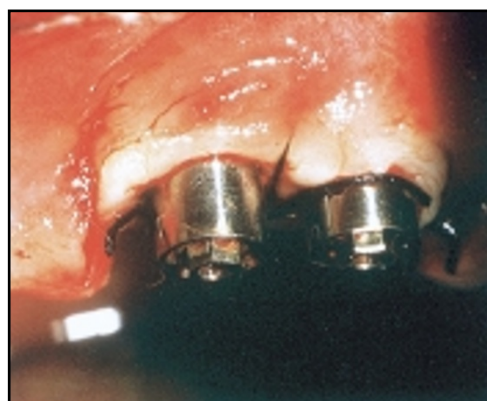
**Fig. 11a** This patient had repeated soft tissue abscesses and discomfort around the implant supported bridge. The probe shows a soft tissue sinus



**Fig. 11b** Soft tissue surgery (as in periodontal surgery) has resulted in apical displacement of the tissue. There is an aesthetic compromise but the patient has better access to clean the under surface of the bridge and around the abutments. The original problem was caused by poor positioning of the implants in the embrasure spaces, rather than under the crowns



**Fig. 12a** Elevation of soft tissue from around two implants which had suffered from marginal bone loss and persistent inflammation. The implants surfaces were thoroughly cleaned and the soft tissue sutured at a more apical level (fig. 12b)



**Fig. 12b** Flaps sutured at a more apical level to allow improved oral hygiene by the patient

The keratinised mucosa should be preserved as much as possible, by employing an inverse bevel incision to separate it from the underlying inflammatory tissue. Following incision to bone the soft tissue flaps should be elevated to expose normal adjacent bone. The inflammatory tissue surrounding the implant is readily removed (fig. 12). The main difficulty is adequately disinfecting the implant surface. This is more readily accomplished on a relatively smooth surface but may be almost impossible on a very porous surface such as a hydroxyapatite coating. Therefore, rough surfaces require more extensive debridement than a smooth surface which may be adequately disinfected using a topical antiseptic such as chlorhexidine or simple polishing. Inflammatory peri-implant lesions are not sufficiently common to have allowed comparison of different methods

of cleaning to promote resolution of the soft tissue inflammation or repair of the bone. In cases where regenerative techniques have been used and bone fill has occurred, there is considerable controversy as to whether or not the regenerated bone forms a new osseointegration with the previously contaminated implant surface.

### **Conclusions**

Regular review and maintenance of patients are essential to maintain the health of implant supporting tissues, to prevent minor complications and measure one's own long-term success at providing this treatment. With meticulous planning, provision of treatment and use of a tried and tested system, the complication rate is low. However, it is important to realise that complications do occur and for patients to appreciate the value of long-term care.

## **BDA matters**

### **Senior Members Group**

In October 1992 a senior Members Group was formed for BDA members most of whom had retired from active practice.

The Group meets every two months in the Postgraduate Centre of the Glasgow Dental Hospital and School for a talk by a selected speaker at 12 noon. This is followed by a small buffet lunch between one and two o'clock.

Among the wide range of topics over the last six years have been travel, finance, photography, painting, flying, sport, local history, dental education, music, philately, animal studies, health service matters, and the occasional hour of reminiscence.

None of the topics is taken too seriously, and the mild banter among members is very refreshing. A small committee headed by Mr Bob McKechnie (tel: 0141 884 3103) and assisted by Professor Roy MacGregor and Mr Alex Thomson, administers the arrangements for the Group.

Anyone who considers themselves to be sufficiently senior, and particularly newly-retired members are most welcome.

### **The Lindsay Society**

The Lindsay Society for the History of Dentistry brings together people with an interest in dental history and literature.

Membership of The Lindsay Society is open to all members of the BDA who are interested in dental history. Interested non-dentists and members of the dental team may also join the society.

Founded in 1962, the society is named after Lilian Lindsay (née Murray). Lilian became the first British woman to qualify as a dentist in 1895.

An annual subscription to the Lindsay Society is £12, including subscription to the journal *Dental Historian*. For an application form and further details contact the Treasurer of the Society:

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