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Management of a Patient with a Failed Transmandibular Implant

Abstract: The Transmandibular Implant System (TMI) had been developed in order to provide a patient with a severely resorbed mandible with a stable and retensive implant-supported overdenture. Failure of the transmucosal posts may necessitate removal of the transmandibular implant in total and treatment with an implant-supported prosthesis.

The purpose of this paper is to describe overcoming failure of a transmandibular implant without removal and synchronous placement of endosseous dental implants in the interforaminal region, providing an implant-retained overdenture to the patient.

Clinical Relevance: Transmandibular implants are rarely used nowadays and management of a failed transmandibular implant is reported even less often. Where bone height is adequate, dental implants may be placed in the anterior mandible, even when the failed transmandibular implant is not completely removed.

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The severely resorbed mandible has always been a challenge for both surgeons and prosthodontists to restore. Patients with a severely reduced mandible due to atrophy, trauma or tumour surgery commonly complain of a loose lower denture and difficulties with eating and speech.

The transmandibular implant is a transosteal implant developed in the late 70s by Bosker[1,2,3] in order to improve masticatory function and denture comfort in patients with severely resorbed mandibles (4–6 mm vertical height). Its use has also been reported for a partially dentate mandible[4] and even for reconstruction following mandibulectomy.[5]

The implant is fabricated from a bioinert gold alloy (18-carat 5% noble metal alloy which contains 70% gold, 5% platinum, 12.8% silver and 12.2% copper) and is placed between the mental foramina from a submental approach. It consists of a baseplate, transosseous cortical screws, transmucosal pins (posts/struts) and a superstructure attached to the posts. When assembled, it possesses a rigid box-frame design that helps to protect the implant from stresses of elongation and compression in the mandible during function.[1]

The prosthesis is then fabricated as a removable overdenture and retention is achieved by means of retention sleeves adapted to Dolder bar segments of the superstructure. The prosthesis design is intended to direct the masticatory load to the bar portion of the superstructure, distributing the forces throughout the entire implant.[6] Both surgical[2,3,7] and prosthodontic[8,9] considerations have been described in detail.

While Bosker[1] and other multicentre studies[2,3,6] had initially reported an overall success rate of more than 95%, high implant loss has been reported in a recent study following this treatment approach.[10] In addition, an unacceptable success rate of 56% was reported in a 15-year single centre study.[11] The importance of surgeon experience and passing of the learning curve has been stressed.[3,11]

The main reported reasons for implant removal were integration failure or infection, mandibular fracture and pain/dysaesthesia.[11] Loss of integration around the distal posts, loosening of distal locking screws and difficulty in obtaining passive fit of the superstructure have been reported as reversible complications.[2,3,6,12] Fractured posts[2,11] and unsatisfactory denture retention[11] have also been reported.

Furthermore, the risks of lower lip paraesthesia and perioperative jaw fracture[6] are considerably higher with the Transmandibular Implant System than with dental implants. Soft tissue complications often refer to hyperplastic tissue formation

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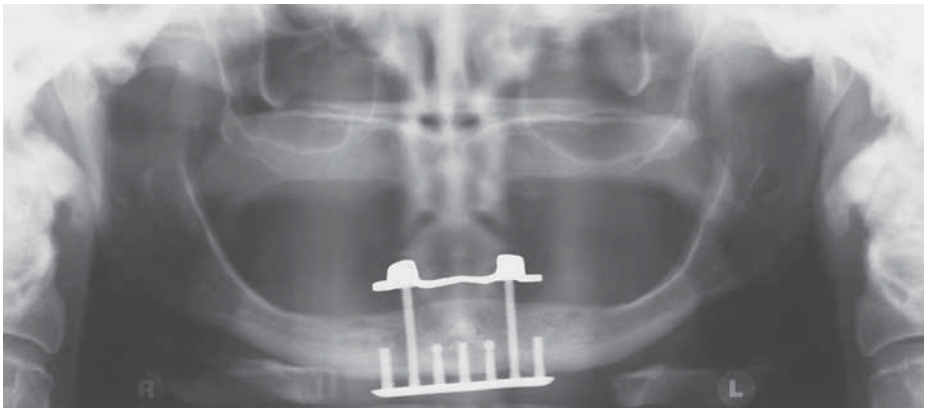

Figure 1. Panoramic view of the transmandibular implant which appears osseointegrated.

Figure 2. Failing transmandibular implant with loose gold superstructure and poor oral hygiene around the right and left posts.

Figure 3. Old scar resulting from submental approach for transmandibular implant placement.

adjacent to the lateral posts. Less often, unattached mucosa trauma was situated around the posts, owing to tension of the insertion of the depressor angulis oris muscle on the top of the extremely resorbed mandible.[2]

Case report

A 56-year-old female patient was referred to the Oral Surgery Clinic (Eastman Dental Institute and Hospital, London, UK) complaining of repeated infections around mandibular implants and a loose lower overdenture. The patient had received a transmandibular implant to support a lower overdenture 17 years previously. Radiographic examination revealed that the Transmandibular Implant System consisted of a baseplate, five cortical screws placed into the inferior border of the mandible, and two transmucosal posts friction-fitted to the baseplate (Figure 1). Intra-orally, fastener nuts were threaded on top of the two posts and acted as the base for a soldered gold superstructure (Figure 2). The two posts in the lower canine regions had distal Ceka attachments and were joined by a gold bar.

Gingival inflammation and exposed implant threads were evident intra-orally around both right and left posts (Figure 2). Records also showed that increasing numbers of threads were becoming exposed, and oral hygiene was becoming increasingly difficult to maintain.

A lower overdenture with new male Ceka attachments had been successfully constructed four years previously, but was now non-retentive. In addition, the female attachments were now too worn for retention to be improved with new male attachments**.** A diagnosis of a failing transmandibular implant was made.

In view of the recurrent infections around the posts, and worn attachments, it was clear that neither replacement of the fastener nut nor renewing the gold superstructure was appropriate. It was therefore decided to attempt to remove the transmandibular implant and insert two dental implants in order to support a mandibular overdenture. Clinical and radiographic examination indicated that it may be possible to place two implants in the canine regions even if the complete transmandibular system could not be removed. Prosthetic work-up and patient consent were completed.

The procedure was carried out under general anaesthesia. First a submental incision was made via the old scar in the submental area (Figure 3). Following exposure of the baseplate at the lower border of the mandible, it was evident that the transmandibular implant was solid and probably still osseointegrated. It was decided to leave it *in situ*.

Following local anaesthesia, an intra-oral labial incision exposed the mandibular crest between the mental foramina. The mental nerves were identified and protected and the loose gold suprastructure with attachment system (nuts) was manually removed (Figure 4). Three Brånemark System implants (Mk III, Regular Platform, Nobel Biocare AB, Gothenberg, Sweden) were placed in the anterior interforaminal region of the mandible according to the manufacturer's instructions. The positioning of the implants was determined by the remaining transmandibular implants and available bone, and it was decided to place an additional midline implant for further support if needed. While the middle fixture was 13 mm long, 11.5 mm fixtures were placed in distal sites owing to limited space availability and proximity to the mental nerves (Figure 5). Cover screw positioning was followed by haemostasis and suturing of mucosa and skin. The patient was advised to keep her lower denture out for two weeks and the early postoperative period was uneventful.

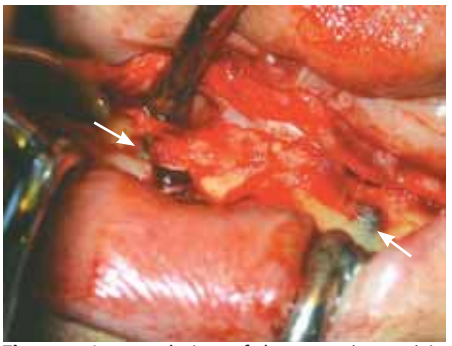

Figure 4. Intra-oral view of the posts (arrows) in the anterior mandibular crest following removal of the gold superstrucure and attachment system.

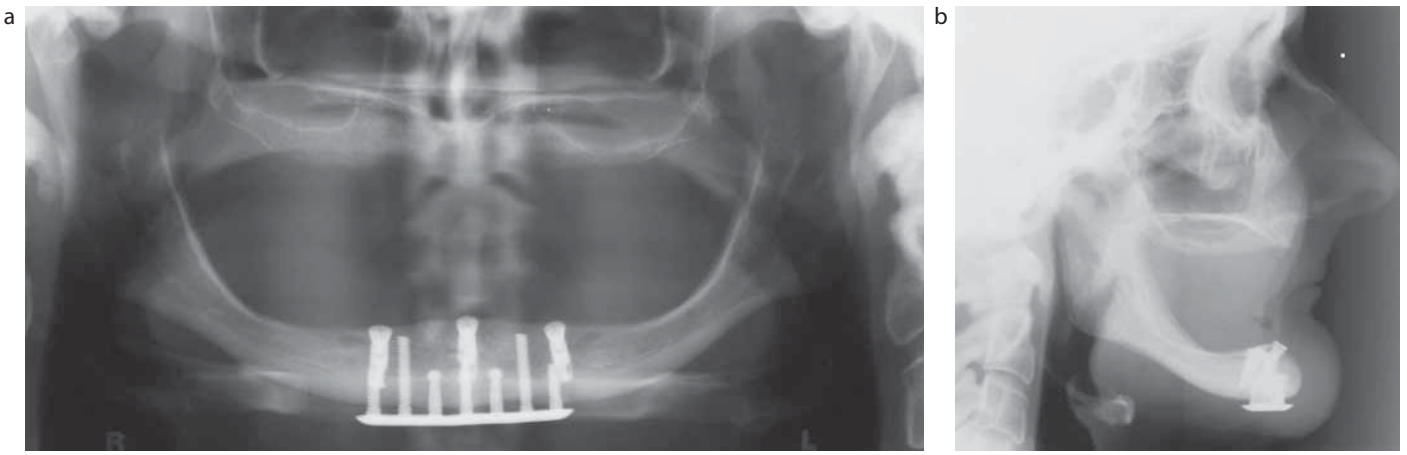

Figure 5. Postoperative panoramic **(a)** and lateral cephalometric **(b)** views show the position and direction of dental implants.

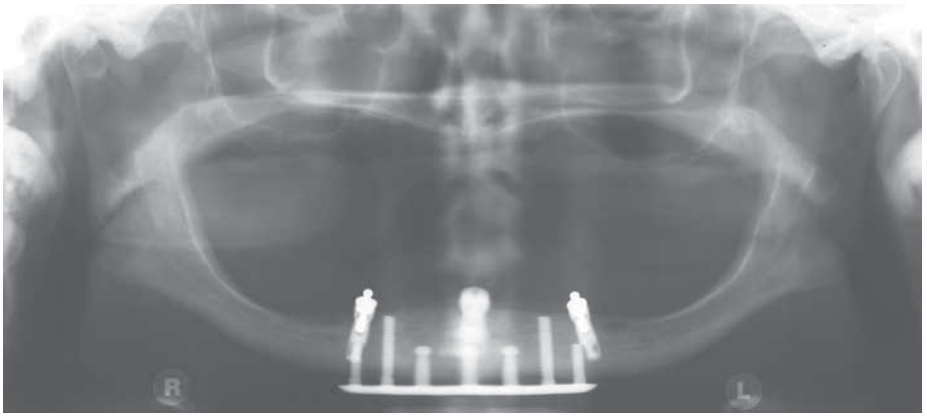

Figure 6. Panoramic view following ball attachment insertion.

At second stage surgery, 4 mm healing abutments were attached three months later. Owing to their buccal inclination, the distal implants emerged through unattached mucosa following soft tissue healing. However, this did not present as a problem for the patient, who was able to maintain a strict oral hygiene programme. The final prosthetic stage was to provide the patient with an implant-retained overdenture using 3 mm ball attachments on the distal implants (Figure 6).

Discussion

Long-term studies on endosseous implant systems have determined the better clinical performance of root-form implants, when compared to the Transmandibular Implant System.[10] Moreover, major disadvantages, like the nature of the complex surgical procedure, the necessity for general anaesthesia, the limited options available in the oral restoration and the retention of the denture[9] cannot be ignored.

Repairability of the TMI system is said to be predictable,[13,14,15] however, this could not be applied successfully in our case. Although successful over a 17-year period, repeated infections, loss of attachment and difficulties of maintaining a successful lower overdenture all contributed to a more predictable outcome being sought. At the same time, the declining general health status of the patient, and difficulty in access to care facilities, necessitated a viable restorative solution with as low a level of maintenance as possible. These parameters are commonly taken into account with patients of this age group.

Furthermore, sufficient bone was left to allow for the placement of three dental implants in the interforaminal region, even without completely removing the failed transmandibular implant. Clinical and radiographic reviews indicate that the dental implants have remained osseointegrated two years after placement. The patient was very satisfied with the function of the implant-retained overdenture.

Summary

Although no longer advocated, transmandibular implants have been provided for patients with extensive mandibular alveolar bone loss when adequate denture stability and retention was not possible with a conventional complete denture. Although it is no longer an option for mandibular implant-supported prostheses, failures of the restoration or loss of osseointegration do occur and necessitate implant removal.

However, only when the attachment system fails, and the remaining bone volume in the interforaminal region is adequate for dental implant placement, can an implant-retained overdenture be provided without compulsory transmandibular implant removal.

Acknowledgements

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Cochrane Synopses

M Esposito, MG Grusovin, HV Worthington, P Coulthard. Interventions for replacing missing teeth: bone augmentation techniques for dental implant treatment. *The Cochrane Database of Systematic Reviews* 2006, Issue 1. Art. No.: CD003607. DOI: 10.1002/14651858.CD003607.pub2.

'Some patients have insufficient bone to place dental implants but there are many surgical techniques to increase the bone volume making implant treatment possible.

Short implants are more effective and cause less complications than conventional implants placed in thin mandibles augmented with bone from the hip. Bone substitutes (Bio-Oss or Cerasorb) might be used instead of autogenous bone graft to fill large maxillary sinuses. Bone can be regenerated in a vertical direction using both the osteodistraction technique and guided bone regeneration techniques, but it is unclear if one technique is preferable. There is not enough evidence supporting or refusing the need of augmentation procedures when single extracted teeth are immediately replaced with dental implants, nor is known whether any augmentation procedure is better than the others. There is not enough evidence to demonstrate superiority of any particular technique for regenerating bone around exposed implants.'

SJ Littlewood, DT Millett, B Doubleday, DR Bearn, HV Worthington. Retention procedures for stabilising tooth position after treatment with orthodontic braces. *The Cochrane Database of Systematic Reviews* 2006, Issue 1. Art. No.: CD002283. DOI: 10.1002/14651858.CD002283.pub3.

'There is not enough evidence about the effects of different types of retainers to keep teeth in position after the use of orthodontic braces.

Retention is the phase of orthodontic treatment that attempts to keep teeth in the corrected positions after orthodontic (dental) braces. Without a phase of retention there is a tendency for the teeth to return to their initial position (relapse). To prevent relapse almost every patient who has orthodontic treatment will require some type of retention. There is a lack of robust evidence on which to base clinical practice in this area. This review found weak, unreliable evidence that a simple surgical procedure, combined with a retainer, is better than a retainer alone at keeping teeth in the corrected positions after orthodontic braces are removed. There is an urgent need for high quality randomised controlled trials in this crucial area of orthodontic practice.'

Matharu L, Ashley PF. Sedation of anxious children undergoing dental treatment. The Cochrane Database of Systematic Reviews 2006, Issue 1. Art. No.: CD003877. DOI: 10.1002/14651858.CD003877.pub3.

'Fear of the dentist or behaviour management problems can result in a child's tooth decay going untreated.

Behavioural techniques play an important role in managing anxiety, however, some children still find it difficult to tolerate dental treatment and may require sedation. This review examined the effectiveness of drugs that sedate a child whilst keeping them conscious. Due to the poor quality of the research, the review was unable to determine which drugs or methods of sedation are the best for managing a child's anxiety or behaviour.