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Mandibular Implant-Retained Complete Overdenture using Retentive Abutments: A Case Report

Abstract: An implant-retained complete lower denture is considered by many as the gold standard in the oral rehabilitation of the edentulous mandible. Its relative simplicity, minimal invasiveness, predictability, efficacy and affordability make it an attractive treatment option. The commonly used methods for anchoring overdentures to implants utilize bars, studs and magnets. There is little evidence, however, to suggest that any one method is significantly superior to another.

This paper reviews treatment options available to restore the edentulous mandible and also reports on a patient treated using the Locator® system, which is a relatively new type of stud attachment. This case report describes a chairside technique using the Locator® system to retain a complete lower denture.

Clinical Relevance: The Locator® system provides the dental practitioner with a useful attachment option for patients requiring an implant-retained overdenture.

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The report of the 1998 Adult Dental Health Survey¹ revealed that 13% of adults in the UK were edentulous. Although there has been a marked move away from the extraction of large numbers of teeth, there are still significant numbers of edentulous adults in the UK. Edentulism can be debilitating and many difficulties associated with complete dentures arise from the inability to function with mandibular dentures.

The following treatment options exist for the edentulous mandible:

- No treatment;
- Conventional complete mandibular dentures;

- Implant-retained mandibular overdentures;
- Implant-retained fixed restorations.

Conventional complete mandibular dentures

When teeth are lost, patients often experience difficulty with a prosthesis. The alveolar ridges, hard palate and buccal shelves used for support and retention can provide only a poor substitute for the masticatory efficiency of the natural dentition. Tolerating conventional complete dentures, particularly in the lower arch, can be difficult for many patients who may experience problems with retention and stability.

Factors that adversely affect successful use of a mandibular complete denture include:

- Mobile tissues of the floor of the mouth;
- Atrophic alveolar mucosa covering the residual ridge;
- Reduced bony support;
- Muscular factors;
- Age of the patient and its influence on adaptation.

Wearing maxillary complete dentures is usually less problematic than mandibular because of the inherent displacing movement of the tongue and muscular borders. The palate also provides a relatively stable base and wide surface area with thick fibrous tissues. These lend support to the prostheses and help resist occlusal forces.

Reduction in the volume of oral tissue because of residual ridge resorption compromises the retention of dentures (Figure 1). It has been demonstrated that the



Figure 1. Resorbed lower ridge.

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edentulous mandible may lose up to four times more bone volume than the edentulous maxilla.² In the past, several methods have been employed to augment the quality of the supporting tissues; these included vestibuloplasty, ridge augmentation and grafting procedures. These methods have met with variable success and, since the advent and success of osseointegrated implants, have fallen out of vogue.

Implant-retained mandibular overdentures

Conventional dentures will not meet the desires or needs of all patients. The use of osseointegrated implants to substitute for missing teeth was developed by Brånemark over 40 years ago³ and several studies have demonstrated the success of this treatment modality.^{4,5,6} Implant-retained removable complete overdentures offer an effective rehabilitation for the edentulous mandible. The prosthesis is constructed utilizing full extension to provide maximum stability and support. It has recently been recommended that the restoration of the edentulous mandible supported by two implants is the gold-standard treatment.⁷ A 97% implant survival with two implants, irrespective of keratinized tissue or duration of edentulism, has been reported.⁸

It has been shown that, in some patients, the functional and psychosocial limitations seen with mandibular complete dentures are significantly improved by using implants to stabilize mandibular overdentures.^{9,10}

Although there may be marked resorption of the mandibular residual ridge, there is usually sufficient basal bone anteriorly to accommodate implants.

Implant placement may, indeed, help to prevent or decelerate further bone loss.



Figure 2. Ball attachment.

The anterior mandibular bone under an implant overdenture may resorb as little as 0.5 mm over a 5-year period, and long-term resorption may remain at 0.1 mm annually.¹¹

Implant-retained fixed restoration

Another option for restoring the edentulous mandible is the provision of implant-retained fixed restorations. A fixed prosthesis requires that the implants provide all support and retention for the prosthesis and, consequently, require that a least four implants need to be placed. Fixed prostheses have a limited ability to compensate for vertical and horizontal bone loss, and therefore may not provide adequate lip and facial support. The increased number of implants required to support a fixed prosthesis often means that this treatment option is more costly.

Treatment planning for mandibular overdentures

Successful implant therapy relies upon careful planning and precise execution in order to ensure a successful and predictable outcome. The number and location of the implants is decided using appropriate radiographs, photographs, diagnostic casts, diagnostic jaw registrations and trial dentures.

An important consideration is ensuring that there is sufficient space for the prosthetic components of the implant attachment system. The minimum space requirements differ according to the dimensions of the attachment and implant system used. Inadequate space for prosthetic components can result in an overcontoured prosthesis, lack of freeway space, attachments separating from the denture, fracture of the prosthesis and overall patient discomfort and dissatisfaction. Potential solutions to decreased vertical space include alveoloplasty surgery at the time of implant placement, selection of implant attachments and abutments which have minimal heights, and incorporation of a metal framework into the overdenture.

Treatment planning should deal with the patient's original complaints and meet his/her expectations. It is important that the patient has a clear idea of what the final outcome is likely to be and understands and acknowledges the limitations of the proposed treatment, including the possibility of implant failure. Implants can lend support and retention

to a denture but will never match up to the natural dentition.

A trial denture can be used to fabricate a surgical template to facilitate placement of implants into optimal positions. Alternatively, if the patient's existing denture is satisfactory, this may be duplicated and used instead.

Implant position is usually dictated by the amount of available bone. Bone augmentation procedures may, however, allow placement in a more ideal position. Implants for mandibular implant overdentures are usually placed bilaterally in the anterior mandible in the canine regions, avoiding the mental foramina. It is preferable that implants are placed parallel to each other and perpendicular to the proposed plane of occlusion of the prosthesis.

One consideration when planning for overdentures is the technique for incorporating the attachment matrices into the overdenture. One method is to carry this out in the dental laboratory and the other approach is their intra-oral pick-up at the chairside. This stage is important and, if not performed correctly, can negatively influence overdenture fit or contribute to the dislodgement or fracture of the attachment from within the overdenture.

Types of attachment

There are several attachment options available for clinicians restoring patients with two mandibular implants:

- Ball and stud attachments;
- Bar attachments;
- Magnet attachments.

When choosing an attachment system to retain implant overdentures, it is important to consider simplicity, ease of maintaining good hygiene, costs and retention capacity.

Ball and stud attachments

The ball attachment consists of a spherical matrix that is usually attached to the implant (Figure 2). The matrix is housed inside the denture base and fits over the matrix. This provides retention by means of spring-action arms or an interchangeable elastic ring. The ball and stud attachment offers good retention and support and relatively easy maintenance. It has been shown that ball attachments are less costly, less technique sensitive, and easier to clean than bars. Furthermore, the potential for mucosal hyperplasia is reduced with ball attachments.¹¹ Balls are relatively bulky within

the denture and need generous vertical space to allow for all retentive components. They may be a suitable choice if the implants are divergent. The Locator® (Zest Anchors, Inc, UK) attachment is a type of stud attachment.

Bar attachment

This system uses plastic or metal clips cured into the denture base (Figure 3a) to engage a metal-alloy bar (Figure 3b) connected rigidly to both implants. This system has been shown to provide the best retention.¹² There are several notable disadvantages of this attachment which include, difficulty in maintenance, and the increased horizontal space requirement within the denture base that can predispose the denture to fracture. It can also be difficult to replace the attachments or relines the denture. Gingival hypertrophy beneath the bar may be problematic as oral hygiene procedures may be more difficult. A recent randomized control trial concluded that an overdenture on two implants interconnected by a single bar may be the first treatment of choice, with high cost-effectiveness, efficacy, stability and good long-term patient satisfaction.¹³

Magnets

Magnets are another popular attachment system. An implant-supported overdenture with magnets comprises magnets incorporated into the denture (Figure 4a) acting upon keepers (Figure 4b) attached to implant abutments.¹⁴ Retention depends upon the forces of attraction between the magnets and the keepers. They are advantageous in areas where space is at a premium and are relatively easy to maintain. For optimal performance of magnet attachment systems, relatively good parallelism and correct angulation of the implants is required.¹⁵ Disadvantages of magnets include their expense in comparison to other systems and their lack of longevity due to corrosion and loss of magnetism. Newer magnet systems are much improved in this respect. Small movements of the denture during function can break contact between the magnets and the keepers. Some patients tolerate this well, however, a number of patients find this produces an annoying clicking sound.¹⁶

Maintenance requirements

Irrespective of the type of attachment used, regular maintenance of the overdenture is required. Further treatment may

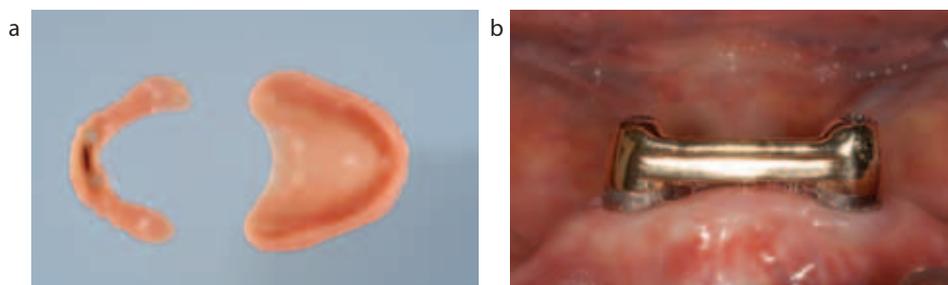


Figure 3. (a) Plastic clips cured into the denture base; (b) gold bar.

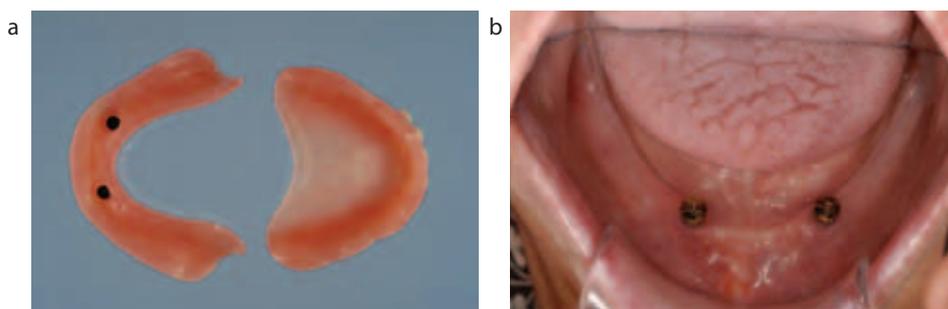


Figure 4(a). Magnets incorporated into the denture base; (b) magnet keepers.

involve relines of the prosthesis, replacement of matrix components, good oral hygiene and scaling around the implants. There is a chance that components may break and this is most frequently encountered during the first year. Minor soft tissue problems, particularly hypertrophic tissue beneath a bar, may also be encountered.

Case report

This case reports the prosthetic management of an edentulous 65-year-old male patient who was referred to Birmingham Dental Hospital with problems relating to the retention of his lower complete denture. Clinical and radiographic examination revealed generalized ridge resorption but with sufficient remaining bone for placement of implants in the mandible.

Treatment planning included fabrication of new upper and lower complete dentures and a lower surgical template. Four Astra Tech Osseospeed™ (Astratech UK) 11 mm implants were placed in the interforaminal region of the mandible. Following a 3-month healing period, prosthetic restoration commenced. Existing dentures were well constructed. Given the limited interocclusal space, however, it was planned to use the Locator® system as the abutments and components have a small vertical height.

This particular attachment system comes in varying heights, to accommodate soft tissue thickness, and has a low profile. The retention can be varied, with a choice of plastic retentive elements that are easily replaced. The abutment is screwed directly into the implant and is selected to fit the thickness of the mucosa and depth of the implant, aiming to have the abutment as low as possible to expose the retentive element. The Locator® abutments, together with the resilient overdenture attachments, are designed to retain tissue-supported overdentures using two or four implants. Although the Locator® components used to restore this patient were purchased from Astratech UK, several other dental implant companies sell Locator® abutments and attachments which are compatible with several different brands of implant.

Attachments can be incorporated indirectly in the laboratory during processing of the denture or as a direct chairside procedure. As the existing dentures were satisfactory, a direct approach was chosen and is described subsequently.

Clinical procedure

■ Locator® abutments were selected to fit the thickness of the mucosa and depth of the implant with the goal to have the abutment as short as possible, to expose the retentive element. The healing abutments were removed.

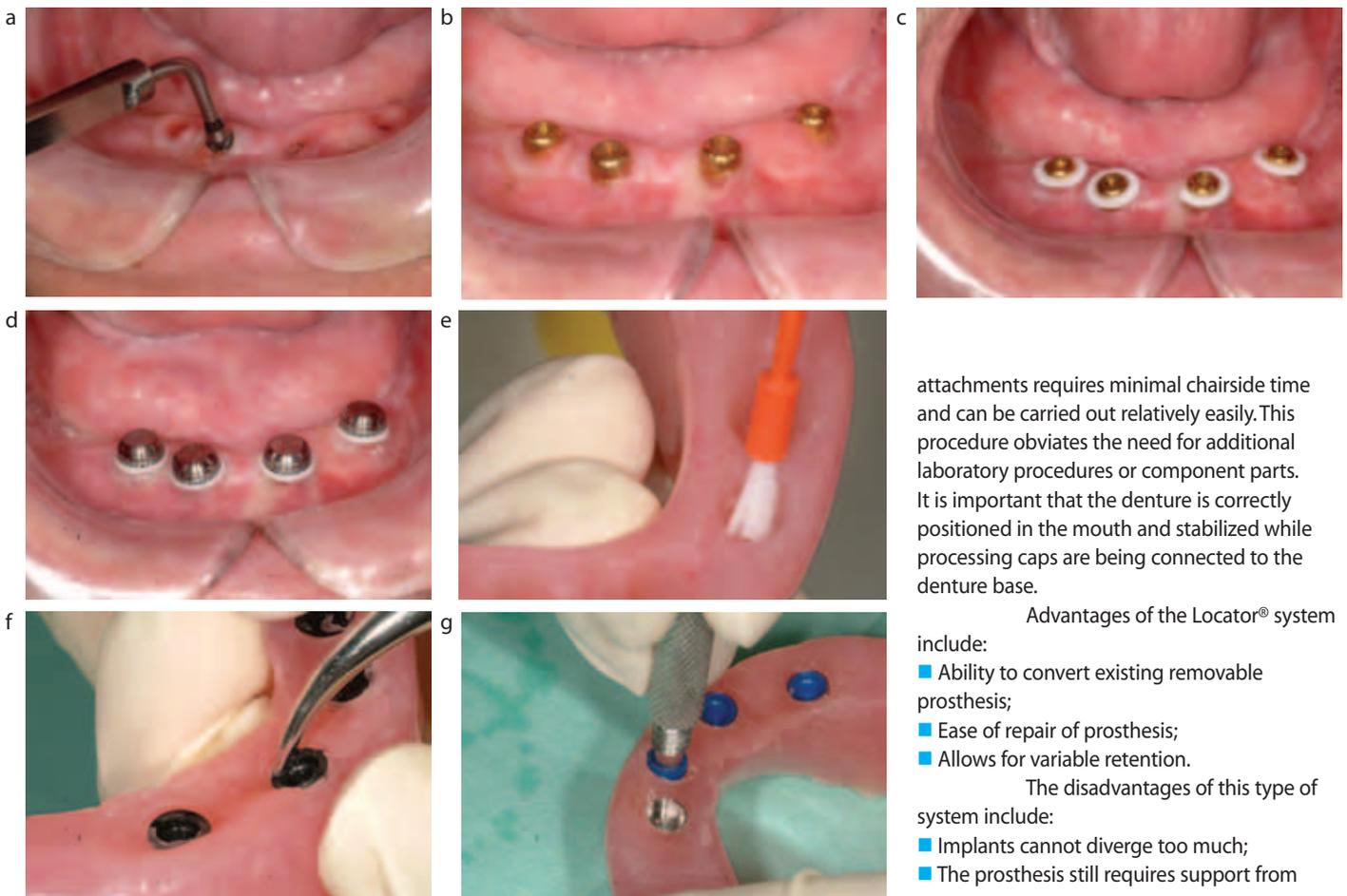


Figure 5. (a) Depth gauge tool to determine abutment height; (b) Locator® abutments; (c) spacer rings placed over abutments; (d) processing caps attached to abutments; (e) relief areas in denture base and placement of acrylic; (f) removal of processing inserts to reveal the housing caps; (g) inserts pressed into the metal housing.

A depth gauge tool (Astratech UK) was used to determine the height and 4 mm abutments were chosen for this case (Figure 5a).

- The Locator® abutments were screwed directly into the implants and hand tightened with the Locator® abutment tool (Astratech UK). Final tightening was carried out with a torque wrench to 25 Ncm² (Figure 5b).
- Spacer rings were placed over the head of each abutment to prevent flow of acrylic resin into unwanted areas (Figure 5c).
- The Locator® processing caps were firmly attached to each abutment (Figure 5d).
- Relief areas were cut into the denture base and cold cure resin placed into the recesses (Figure 5e).
- The denture was seated in the correct position and the occlusal contact maintained until completion of acrylic polymerization.

- The prosthesis was removed and the white spacer rings discarded. The insert removal tool was used to remove the black processing inserts to reveal the housing caps (Figure 5f).
- The preferred Locator® insert (blue) was pressed into the metal housing, using the insert seating tool (Figure 5g). The retention can be varied with a choice of plastic retentive inserts that are easily replaced.
- The fit surface of the denture was adjusted to remove excess acrylic resin.

The patient was given advice on denture maintenance. Upon review, the patient was functioning satisfactorily and very happy with the outcome.

Discussion

Direct clinical placement of the

attachments requires minimal chairside time and can be carried out relatively easily. This procedure obviates the need for additional laboratory procedures or component parts. It is important that the denture is correctly positioned in the mouth and stabilized while processing caps are being connected to the denture base.

Advantages of the Locator® system include:

- Ability to convert existing removable prosthesis;
- Ease of repair of prosthesis;
- Allows for variable retention.

The disadvantages of this type of system include:

- Implants cannot diverge too much;
- The prosthesis still requires support from mucosa;
- Regular maintenance is required to replace and repair matrix components.

Summary

Implants can be used to provide predictable retention, stability and support for overdenture prostheses. Using implants and retentive anchors for the retention of a mandibular complete overdenture is a cost-effective procedure. The high success rate and reliability of mandibular overdentures have been demonstrated and the clinical outcome of this treatment is superior compared with conventional mandibular dentures.

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