

Semi-precise custom-made individually finished silicone attachments for prosthetic implant restorations of the edentulous lower jaw



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In the case of an edentulous lower jaw, interforaminal placement of endosseous implants has established itself as a simple treatment concept to improve prosthesis retention and patient satisfaction. Various attachments of different designs are available as anchors. Lastly, silicone was presented for the manufacture of individual matrices, which the dentist can incorporate into the existing dentures using various abutments chairside. In in-vitro tests, the silicone showed retention values which were comparatively low, albeit stable under artificial ageing.

Introduction

Although various health studies in recent years have demonstrated a reduction in the number of edentulous patients, the treatment of edentulous jaws remains a relevant topic in the future due to the increasing proportion of the elderly population. Insufficient positional stability and retention of conventional total prostheses often leads to significant discomfort, especially in patients with advanced alveolar process atrophy in the lower jaw. Here, the insertion of endosseous

implants has become an established treatment method. Various systems are available for implant-supported restoration, depending on anatomical and financial conditions. The fixed restoration on 4 to 6 implants has proven to be a stable but expensive option in different variations¹. The more affordable implant-supported overdentures are becoming increasingly important in light of social divergence and the widely discussed 'two-tier healthcare'. The insertion of two interforaminal implants showed stable results on the long term, assuming adequate loading



Fig. 1a



Fig. 1b

Figs. 1a & 1b: Bar on 2 (a) and 4 implants (b) in the lower jaw.



Fig. 2a



Fig. 2b

Figs. 2a & b: Peri-implant soft plaque due to inadequate oral hygiene (a). Additional cleaning instruments (such as interdental brushes) should be used for bar constructions (b).



Fig. 3a



Fig. 3b



Fig. 3c

Figs. 3a - c: Ball-head attachments (a), Locators (b), and magnets (c)



Fig. 4: TiSi.snap abutments on 2 interforaminal implants

and follow-up care². Fixing the dentures in place not only significantly improves prosthesis function, but also increases patient satisfaction and quality of life³⁻⁵.

Various attachment systems are available for anchoring the dental prosthesis, most of which are available for the most popular implant systems. Bars that lead to a primary locking of the implants are generally distinguished from solitary individual attachment systems. The relatively expensive bars enable very stable denture support, depending on configuration and cross-section. In contrast to individual attachments, their retention generally proves to be consistent over a long period of time⁶. With regards to adequate home self-care, however, they require greater manual dexterity on the part of the patients (Fig. 1 and 2)⁵.

The individual attachments are becoming increasingly popular thanks to their smaller space requirements, lower cost and ease of cleaning. In addition, it is generally possible to incorporate them into the dentures chairside or replace them if they start to lose retention. The most well-known variants are ball head anchors, Locators and magnets (Fig. 3)⁵⁻⁸.

Due to the advantages and disadvantages of the individual attachments, the debate about the ideal system remains very controversial today^{3, 9-11}. With older patients, in particular, however, it is better to choose an attachment that is easy to handle and maintain, yet provides adequate retention¹². For that reason, magnets are frequently used, especially in gerostomatology⁷. Silicone was recently presented as a chairside matrix material together with the TiSi.Snap abutment as a possible alternative to the established anchoring elements. (retention. sil, bredent medical, Senden). This material can be used for the individual production of different matrices, adapted to the matrix system in question. The silicone and the possibilities for use are presented in the following.

Silicone matrices

The TiSi.snap abutment is used as a solitary attachment system, similar to the Locator abutments or ball head anchors (Fig. 4). Various installation heights are available for these attachment systems depending on the gingival and bite height at hand (Fig. 5). The TiSi.Snap abutments have a well-defined undercut and a subsequent guide cone available at heights of 3.8 and 6 mm. In addition, angled abutments (17.5 and 35°) can be chosen for angled implants to compensate for divergence. Once the abutments have been inserted, the silicone matrix is fabricated chairside by the clinician.

Step by step

First, the denture is grounded to make a recess for the TiSi.snap abutments (Fig. 6). It should then be possible to incorporate the ground prosthesis without angulation. It should not lie directly on the abutments, so that a minimum layer thickness of 1 mm of silicone can be maintained later. In case of doubt, the fit can be checked with an indicator silicone (e.g. Fit Checker, GC, Leuven, Belgium). The area being worked on is then conditioned with a special adhesion promoter (Multisil primer, bredent medical, Senden).

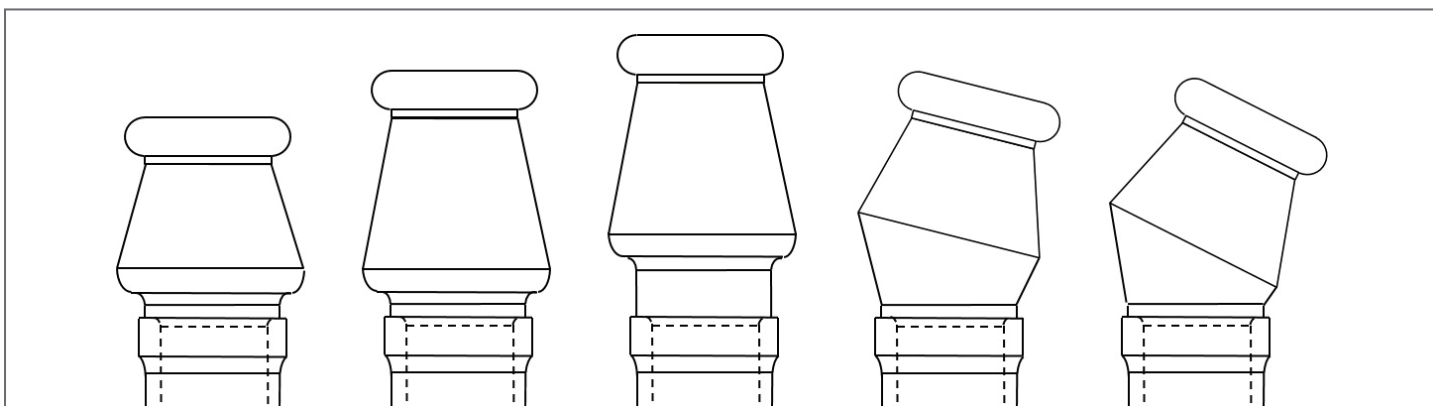


Fig. 5: Different versions of the TiSi.Snap abutments (from left): 3.8 mm guide cone and 1 mm gingival height, 6 mm guide cone with 1 and 3 mm gingival height, 17.5° and 35° angulation.





Figs. 6a-e: Complete lower jaw prosthesis before the insertion of matrices (a), prosthesis ground out in the position of the implants (b), application of the Multisil primer (c), application of the silicone (d) and finished silicone matrix (e).

The (attachment) silicone retention.sil, which is available in cartridges, is subsequently applied to the pre-treated area (as bubble-free as possible) and the dentures are positioned on the abutments. The patient is then asked to bite gently to stabilize the dentures, so that the silicone can harden (5 min). This is followed by an examination of the area and removal of excess silicone using a scalpel or burr.

The silicone is available in different variants. Due to different Shore hardnesses, the choice is offered between retention strengths of 2 N (SH 25, retention.sil 200), 4 N (SH 50, retention.sil 400) and 6 N (SH 65, retention.sil 600) (Fig. 7).



Fig. 7: Multisil primer and retention.sil 200, 400 and 600

In theory, the silicone can be combined with any matrix that has a corresponding undercut. In addition to the TiSi.snap abutments recommended by the manufacturer, these can either be Locators, ball head anchors or bars, depending on the situation and any abutment which may already be there.

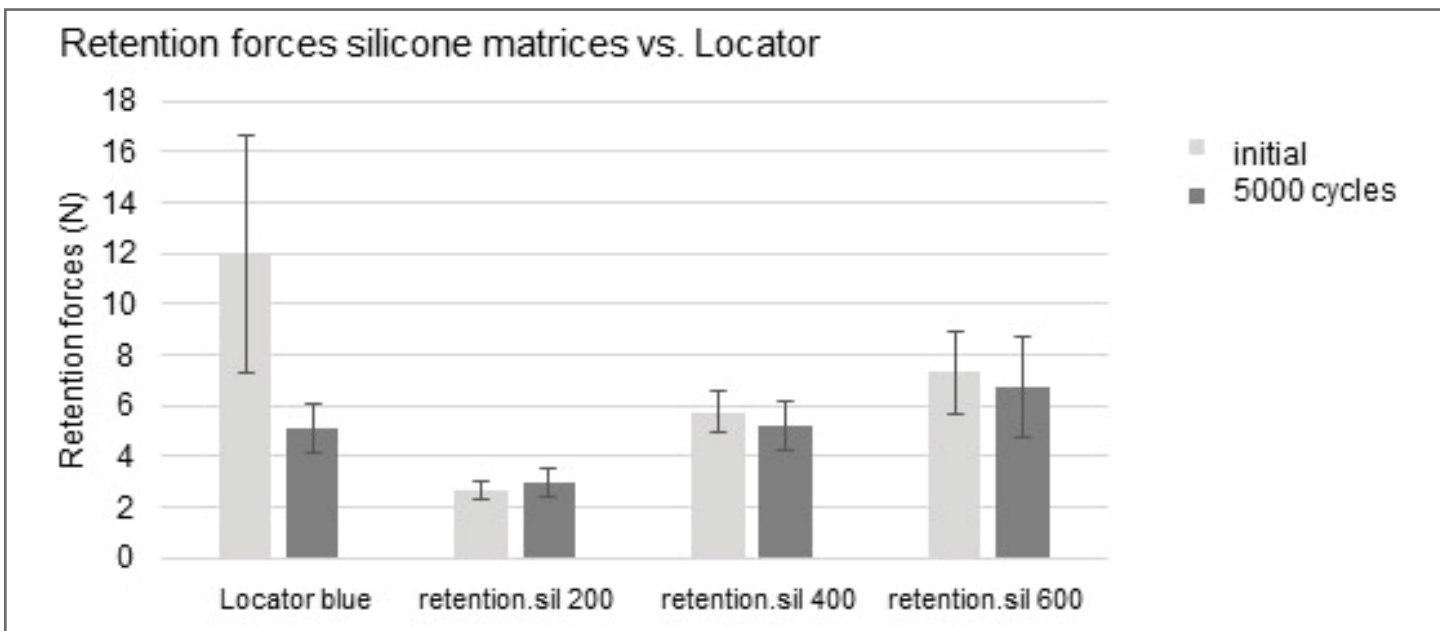
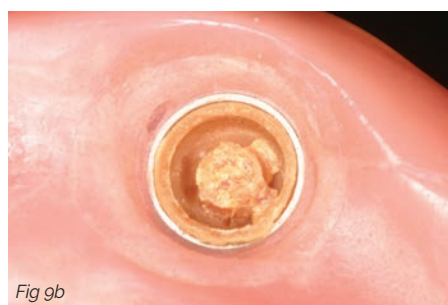


Fig. 8: Retention behavior of the silicone matrices (retention.sil 200, 400 and 600) on TiSi.snap abutments compared to Locator12.



Figs. 9a - c: Titanium nitride coating wear with angled implant in the upper jaw (a). Deformation of nylon Locator matrices with consecutive retention loss (b, c).



Figs. 10a & b: accumulation of tartar/calculus in the area of the magnets (a) and lateral perforation of the magnet capsule with subsequent corrosion (b).

Retention behavior in vitro

Unlike the established solitary individual attachment systems, there are not yet any in vivo studies on the retention behavior of silicone matrices. However, the custom-made silicone matrices on TiSi.snap abutments were confirmed to have good retention properties in their own in vitro studies, regardless of the retention strength¹². In contrast to the Locator, silicone matrices exhibit stable, albeit consistently lower retention values after simulated artificial ageing of 5 years. A clinically relevant decrease in retention values was observed even when different disinfectants were used and implants were angled (Fig. 8)¹².

Ball head anchors with gold matrices (1.96-13.7 N) are clinically less susceptible to retention loss than Locators with low interim implant angulation^{14, 16}. However, the matrices of the ball head anchors require precise alignment, as parallel as possible, which is difficult to achieve chairside and not always feasible in the laboratory. Deviations result in premature wear of the lamella and loss of retention.

Magnets have a significantly lower initial retention force (1.4-6.6 N) and are thus in the

range of retention forces which the silicone matrices also achieve¹⁷. This often proves to be advantageous, especially in older patients with compromised manual dexterity. Thanks to their comparatively smooth configuration, magnets are easier to maintain than the other attachments¹⁶. In addition to easy insertion through self-centering, they also have horizontal mobility, which reduces the eccentric force transmission to the implants if the denture is dislocated^{18,19}. As a result, they have a faster loosening mechanism than the other attachments and reduce harmful stress on the surrounding tissues²⁰. Retention can be diminished due to tartar/calculus build-up between the corresponding pairs of magnets. In addition, neglected aftercare due to changes in the prosthesis bed can lead to mechanical overloading of the magnet capsules with subsequent perforation and corrosion (Fig. 10)⁸.

RANGE OF INDICATIONS

Silicone matrices have retention values that are resistant in vitro. The extent to which the retention properties also hold up in the intraoral environment under acid influx and bacterial colonization still needs to be investigated further. Clinically, however, it has proven to be a versatile material so far.

Used as a definitive matrix, it appears to be a good alternative to conventional individual attachments, especially for elderly patients. In addition to easy handling, patients appreciate the comparatively soft feel thanks to the elasticity of the silicone. There is no need to worry about the denture tilting and deforming the matrices, even in patients with compromised manual dexterity. In the case of abutments with significant wear, where replacing the matrix is not guaranteed to adequately increase retention, it can be used as a temporary fastening material until the abutment is replaced. A stable provisional solution after implantation can also be created in a phased management program if the patient lacks the financial means for definitive dentures. The silicone can be removed at any time chairside with a burr.

SUMMARY

Silicone matrices enable both temporary and definitive fixation of removable dentures on endosseous implants at comparatively low financial cost. Both the TiSi.snap abutments recommended by the manufacturer and the attachment systems of another design with sufficient undercut (ball head anchors, Locators, bars) can be used as matrices. Thanks to its flexibility and ease of use, it is an interesting addition to the individual attachment systems available, especially in challenging and problematic cases in gerodentics. ■

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