attachment considerations, options and selection

Initially, with the edentulous patient receiving an implant supported or retained prosthesis, the difference between natural teeth and implants needs to be recognized. Natural teeth have periodontal ligament, nature’s shock absorbers. When patients come into occlusion, there may be up to 1mm of movement between opposing natural teeth. Implants do not have this movement, or shock absorbers, and therefore implants need to be protected. Compare the analogy of driving a truck down a road with potholes; the natural tooth side has shocks and the implant side does not. Further, when deciding if the restoration will be abutment or tissue supported, keep in mind that mucosa can move up to 500 microns and abutments need to be protected when going from abutment to tissue supported during function.

Natural teeth provide proprioception. This protects the teeth by providing neurological stimulus, letting the brain know if it is overloaded or teeth are potentially being damaged during movement. Teeth are sensory organs and the tactile sensory feedback coordinates chewing, swallowing, and breathing. The only tactile sensation available to implant restorations comes from bone deformation, which results in a threshold level 50 times greater than that of the natural dentition.\(^{(1)}\)

The absence of mechanoreceptors impairs fine motor control by a reduced feedback mechanism. Studies also show that subjects with dentures and implants are unable to position their jaws as precisely as those with natural teeth. This lack of positional control, coupled with increased tactile sensory thresholds, results in much greater force being applied to implant restorations versus tooth-borne prosthetics.\(^{(2)}\)

Therefore, implant prosthetics are likely to experience a greater incidence of mechanical damage. Implant-supported fixed hybrid prostheses experience 3.8 times more prosthetic complications than biologic complications.\(^{(3)}\) It is important to design a prosthesis that may be serviced and repaired as the patient ages and needs change.

When choosing the appropriate restoration, opposing arch force, interocclusal space, bone quality, patient health and dexterity (hygiene), pictures and vides of function, speech and smile line (gingival transition), parafunctional movements, and most importantly, patient expectations and desires all need to be reviewed by the restorative team (Fig. 1).

Since today’s message is choosing the correct attachment, assume that a full arch Fixed Detachable (hybrid) restoration is not being provided because a) the patient had a high, medium, or gummy smile line and removing bone to place the implants above...
the prosthesis tissue junction was not an option; b) the patient needed a flange to restore lip contours and restore their youthful appearance; and/or c) the patient did not have either the necessary hygiene or dexterity now, or in the future, to clean the prosthesis.

The decision has been made to provide the patient with a removable prosthesis, and a checklist of criteria can assist in deciding between a bar and stud overdenture.

A CBCT scan is key to identifying how many, and where, implants can be placed to decide if this will be 100 percent implant supported (rigid, non-moving), or a combination of implant and tissue supported (resilient, moving) prosthesis.

Another key will be understanding the difference in bone quality in the mandible and maxillae. In general, bone is 50 percent more dense in the mandible than in the maxillae, providing support for greater opposing forces (Fig. 2). It is one of the driving factors to place bars in the maxillae as opposed to studs. The

![Figure 1](image)

![Figure 2](image)
bar connects our weaker implants together, better distributing opposing forces. Recent studies have shown success with four implants in the maxillae; if only two implants are going to be used, a bar should be chosen.

Goodacre and Kan have shown that overdenture restorations in the maxillae have a 78.7 percent implant survival rate (0-10 years) compared to 95 percent in mandibular bone. Anadioti recently published a 97.7 percent success rate (0-5 years) for stud overdentures in the maxillae on 4 implants.

The goal is to restore as much function as possible for edentulous patients, and with enough well-placed implants to fully support the prosthesis, a bar overdenture is the best option. This is a rigid, non-moving restoration. It feels fixed to the patient yet can be removed for easy cleaning, can have a flange for esthetics, and can be independently serviced (Fig. 3).

Independently serviced is a major advantage of a rigid overdenture bar compared to a fixed detachable. If there is an issue that requires servicing with a fixed detachable, the entire restoration must be removed: composite removed, Teflon tape pulled out, and each screw removed to service the prosthesis.

Conversely, if a Hader Bar overdenture feels loose, an assistant may simply remove the prosthesis and replace the Hader clip in seconds. This is easy servicing and time saving for both patient and clinician. Further, a patient is more likely to come in for an economical 30-minute servicing appointment than an expensive two-hour removal and cleaning of a fixed prosthesis.

Bars provide splinting (protection in the maxillae), can accommodate divergent implants, and provide great prosthesis stability.

If the case is going to be a combination of abutment and tissue supported prosthesis, a bar or stud can be used. Think of a two implant mandibular overdenture. A huge deciding factor in bar or stud needs to be the residual ridge.

The flanges of the denture will be able to provide great stability for a patient with a taller ridge. A super resilient attachment can be placed, think an O-ring, with its omniplanar movement, and the patient will have both support, stability, and retention (Fig. 4). If the ridge has atrophied, however, and is “pancaked”
there will be zero prosthesis stability (Fig. 5). If O-rings are placed on this patient, due to the lack of posterior stability, the patient would be returning to the clinician’s practice all the time complaining the “attachment feels loose.” Even using super strong 8lb Locator attachments, it would still “feel loose” because of the lack of prosthesis stability.

It is imperative to keep in mind when choosing a treatment modality that the stability of the denture has a stronger influence on patient satisfaction than retention.

If a bar is chosen that will be a combination of abutment (anterior) and tissue supported (posterior), the design or retainer needs to provide either a vertical, rotational, or hinge movement to protect the abutments as the prosthesis goes from abutment to tissue supported during function (chewing, swallowing, etc.).

Overdenture bar attachment can be direct retainers, on top of the bar, or on the side of the bar. The most popular include the following.

The Hader Bar is the most widely used bar retainer in the world. It is the shortest (10mm from implant platform to opposing tooth) and narrowest (3mm) bar option while also being the most versatile depending upon which clip option you select (Fig. 6).

For a tissue supported prosthesis, the metal Ackermann clips can be used (Fig. 7). The metal clips provide both vertical and rotational movement on a single straight bar segment. The easily replaceable plastic Hader riders provide just rotational movement on a single straight bar segment, and are ideal when there are two or more sections on a rigid construction, as multiple sections prohibit movement and rotation. The plastic Hader clips provide an audible click for patient security and the prosthesis is rigid or non-moving (Fig. 8).

LOCATOR® is designed to be cast, welded, or threaded (recommended) on top of a bar. For long-term serviceability, the threaded is recommended (Fig. 9). Locators require 15mm of vertical and 5.5mm of prosthetic space. They have eight different retention levels to provide easy customization to the patient’s needs. If it is a tissue supported prosthesis, the traditional black processing insert can be used. If it is an abutment supported prosthesis, the yellow bar processing insert can be used. This unique insert is designed to provide less movement than the black insert.
The Clix ball is also designed to be threaded into a bar structure (Fig. 10). It requires 12mm x 4mm of prosthetic space. The Clix provides resilient ball and socket rotation when used on the distal of a resilient bar, and a firm audible snap and limited movement on a rigid construction. This is an ideal situation on rigid bars in the maxillae, where vertical movement is not indicated.

Sagittal balls, like the Sagix, are ideal when vertical space is compromised (Fig. 11). The Sagix only requires 10mm x 3mm of prosthetic space. These are ideal for split bars, as well as on the lingual and buccal of traditional bars. The Sagix does not require sagittal parallelism, and therefore allows for rotational and vertical movement on resilient cases.

The Universal Plunger Loc is designed to stop lift-off and movement and provides patient confidence. This low profile attachment is very often used with an anterior Hader clip and only requires 10mm x 4mm of restorative space (Fig. 12). These are most commonly used on rigid/abutment supported overdentures, but they can be resilient as well; simply open up the hole
in the bar to provide the movement desired (Fig. 13). The patient does, however, need to have the dexterity to engage and disengage the plungers during insertion and removal.

A stud attachment is ideal in the edentulous mandible when the restorative team has placed the implants in an ideal position (Fig. 14). Position F is not where implants should be placed for a two-implant stud case. Implants in the bicuspids have both an anterior and posterior cantilever, making this a “pier” abutment. It will be very difficult to keep both tissue supported areas relined and supported and the attachments will “feel loose.”

Position X has the advantage of having a minimal anterior cantilever as well as having the most restorative space for prosthetic components. Position O has gained popularity in recent years for two reasons; first, there is only one movement, posterior, to handle. Second, if the patient decides to have more implants placed down the road (for example, in the bicuspid area, in front of the mental foramen), this provides a better A/P spread and increases the odds of providing a better restoration, a rigid, non-moving, implant supported fixed or removable prosthesis.

LOCATOR is the most widely used stud attachment in the world today (Fig. 15). It self-parallels to correct divergent implants, is easy to insert/remove for the patient, and has eight different retention levels. It only requires 2.73 x 5.5mm of restorative space. The LOCATOR is unique with its pivoting function for abutment protection, tissue support, and attachment longevity. The nylon male stays in constant contact with the abutment during patient function, the movement being the metal housing around the nylon male. It is no surprise that this attachment lasts up to eight times longer than previous generation attachments as well as the multiple new copies on the market that do not pivot. Many new systems have come to market with “longer lasting” rigid inserts; beware that if inserts do not pivot, abutments will likely be replaced, not inserts, down the road.

Clix Ball abutments are also used in overdenture stud applications, and allow up to 30 degrees of angle correction while only requiring 4 x 4mm of space (Fig. 16). It is ideal for patients with poor hygiene (no cup or receptacle to accumulate debris) or limited buccal-lingual space. Because the housing may be rotated 30 degrees in any plane (for example, to the lingual), the Clix are ideal esthetic space savers in the anterior maxillae, where implants are often placed facially flared (in order not to perforate the buccal plate).

O-Ring attachments are simple and very easy to use (Fig. 17). They are the most resilient stud attachment available, providing vertical, rotational, and hinge movements to protect abutments. O-rings
Magnets are not ideal, however, for cases with over 10 degrees of divergence and have minimal retention options. They require 6mm x 4.5mm of restorative space. Traditionally, O-rings are used when protecting weaker teeth or (small diameter/ weaker bone) implants due to the resilient omniplanar movement.

Magnets are a useful tool for patients who have limited dexterity, such as patients who had a stroke, Parkinson’s, or have a caregiver insert/remove the prosthesis. Magnets self-align and rotate for ease of use, and now provide lateral stability (Fig. 18).

At the end of the day, selection of attachments is an important component of the restorative process. A collaborative effort by the dentist and the dental technician can help ensure success. JDT

About the Author

Chris Bormes graduated from Gonzaga University prior to attending the dental laboratory technology program at City College of San Francisco. Chris has earned both ICOI Fellowship and Mastership in Dental Technology; graduated from both Ticonium’s and Bego’s Partial Denture Programs; is a candidate for CDT in Complete Dentures; wrote the Preat Corporation Technical Manual, and has invented six different attachments. Chris has lectured both nationally and internationally and is recognized as an expert in attachments and implantology. Chris joined Preat Corporation in 1997 and was named President in 2010.

References