Treatment options for the edentulous arch

**mCME**

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**Introduction**

Historically, when a patient’s dental condition reached a state of total tooth loss, treatment was limited to a complete denture with no hope of improving that status. The greatest challenge, particularly when working with a lower jaw was providing a denture with reasonable stability and retention. Success was greatly dependent upon the skill of the practitioner but also on the neuromuscular ability of the patient, their supporting structures and a philosophical attitude toward their condition. Treatment for patients suffering complete edentulism has been revolutionized by the ongoing success of dental implants such that the standard of care for the mandible is an implant overdenture.

The spectrum of prosthetic modali-
ties developed since the acceptance of endosseous implants to the dental market ranges from the very simple to the astonishingly complex. As this field of study once directed by spe-
cialists, has evolved into a mastery of the general practice, favor of ex-
peditious and reproducible methods has gained dominance over complex therapies. Implant overdentures and fixed hybrid prostheses are choices typically offered by the dentist based upon a patient’s financial ability. While both are generally successful, the overdenture and the hybrid prosthesis are not without pitfalls.

The implant-retained overdenture

The implant-retained overdenture is described as a prosthesis that is attached and is supported by, the natural tis-
ues retained by the dental implant; the patient will typically be assisted rather than supported. Placement of two to five implants is commonly found for the edentulous mandible with emphasis on creating a large anteroposterior spread be-
tween the endosseous pillars. If more than two implants are clustered in a small AP range, the prosthesis may not move freely about a single axis of rotation and the denture may dis-
locates during function.

By creating the fulcra on the most posterior overdenture abutments, the denture will pivot in function resulting in disengagement from the attachment mechanism and cause premature wear of the retentive components. Therefore, an increase in the number of implants beyond two does not necessarily provide a linear increase in retention and sta-
bility. In fact, the opposite may be true. Support is provided by the mandible itself, resorption of the supporting structure will result in increased tipping of the denture during function, resulting in dislodg-
ment. Therefore, the dentist and pa-
tient must be cognizant of the need for relining of the prosthesis peri-
diodically to assure optimal performance.

Recommendation is, therefore, placement of two implants in the posterior mandible to allow one axis of rotation. These implants should also be positioned such that future implants may be considered should the patient wish for an implant-sup-
ported alternative.

The hybrid prosthesis

The screw retained hybrid prosthesis is a fully implant-supported struc-
ture and, therefore, is not affected by incremental resorption of the resid-
ual ridges. It has gained in popularity as the technically difficult and costly gold frameworks have been replaced by CAD/CAM titanium structures and by proven success of angled im-
plant placement to increase the AP spread. Because the restoration has a metal substructure, it is possible to cantilever posterior to the terminal abutment, increasing the length of the functional arch.

However, the esthetic component of the restoration, namely the denture teeth and acrylic resin matrix, are inherently weak materials originally intended for use in complete and partial dentures where functional load is comparatively low. If insuffi-
cient inter-arch space is available, the risk of fracture or displacement of denture teeth or resin base is high as the materials will be too thinned to withstand forces generated during function and especially parafunc-
tion.

ATLANTIS Conus concept: the removable implant-support-
ed bridge

As described above, the tissue-sup-
ported overdenture performs best with only two implants placed in the anterior regions. When more than two implants are placed, the goal should be to provide a completely implant-
supported result. The Atlantis Co-

nus concept provides the optimal functioning convenience of a fixed hybrid but also allows patient retrievability for unobstructed oral hygiene practice, regardless of the degree of ridge lap. It is in effect, a prosthesis that can be removed by the patient, with the sta-
bility of a fixed bridge.

The concept centers around patient-

Specific indications, each ranged to a 5 degree convergence, and parallel-
lel to each other in the dental arch. Recommendation is for at least four implants in the mandible and four to five implants in the maxilla. These uniquely designed, conical abutments are fitted by correspond-
ing metal SysCones caps (IDENTIFY Implants) which are incorporated into the prosthesis. The result is a friction fit, stable, retentive and fully implant-supported bridge that remains removable by the patient.

No special latches or plunger attach-
ments are necessary to retain it. The patient merely slides the bridge in vertically onto the abutments and removes it in the opposite way. Be-
cause the abutments are a part of the ATLANTIS (IDENTIFY Implants, Walham, MA) portfolio, it is avail-
able for all major systems.

In addition, because each abutment is custom made, correction of angled implant placement is possible up to 30 degrees. Two major require-
ments are necessary: the dentist must make an accurate, implant-
level impression and a scan must be made of either an approved denture set-up or of a completed denture to be retro-fitted. The ATLANTIS Conus Abutments are then designed to be positioned optimally within the denture contours. The fixed yet re-
moveable prosthesis offers the advant-
ges of excellent chewing function, improved esthetics and fracture re-
istance (as no screw access holes are present) and optimally facial sup-
porting contours, without comprim-
ing oral hygiene. For the patient.

**Case Report**

A 73-year-old woman with a history of 15 years of complete edentulism of the maxilla and mandible, and five endosseous implants in the ante-
or mandible, presented with a chief complaint of a non-reten-tive and un-
stable lower denture. The implants were standard diameter, externally hexed, Branemark fixtures. She had a moderate resorption of both the maxillary and mandibular residual ridges (Fig. 1).

The patient had bone loss involving the implant bodies but comparing the radiographic evidence available, documenting her condition through the years, it appears the bone loss oc-
curred soon after implant placement and no appreciable change was seen thereafter.

During those 15 years, her treatment history included initial retention of the implants with a complete denture retained by the Locator at-
tachment system (Zest Anchors), and the maxilla was restored with a complete denture. She advised that the result was unsatisfactory as the lower denture displaced during function.

Her history further reveals that the Locators were replaced with Preci-Oxli attachments (Keka At-
chments) with no demonstrable improvement. The patient was later retreated by the author, with new maxillary and mandibular complete dentures and new Locator attach-

Figure 1. Pre-treatment radiograph showing five implants clas-
ted in the anterior mandible

Figure 2. Clinical image of patient. Note the wear of the metal abutments due to disengagement of the nylon retention inserts as a result of function during function.

Figure 3. Duplication of an acceptable denture serves as a custom transmucosal abutment.

Figure 4. Open try, impression copings seated on the dental implants. One implant is selected for disuse and covered with a biomaterial abutment.

Figure 5. Completed final impression using the custom try and light body and medium body PVS, as well as rigid bite registration material around the impression copings to eliminate any movement of the copings.
ments used to retain the lower prosthesis. The attachment male components were secured intra-orally using autopolymerizing acrylic resins in the possibility of laboratory error. The patient continued to experience problems with the lower denture coming loose during function and was referred for a replacement of the nylon male inserts, replace-
ment with Extended Range inserts due to its improved performance. The metal abutments demonstrated considerable wear as well (Fig. 4). Replacing the long axis and recreating the acrylic to the analogs was agreed that a new maxillary and mandibular complete denture would be fabricated and ATLANTIS Conus abutments would be made to secure the lower restoration.

Clinical and laboratory procedures
Because the existing dentures were made within the last five years and were acceptable with regard to tooth position and vertical dimension, it was decided that clear, acrylic resin duplicates of each denture would be made to serve as custom trays. Double-sided impressions of each denture were made and delivered to the dental laboratory for fabrication of the duplicates. Once processed, the copy denture borders were shortened by 2 mm to allow border molding. The duplicate of the mandibular denture was split in two pieces, one for each Locator housing and therefore the position of the denture implants. Holes of adequate diameter to allow the duplicate denture to be placed in the patient’s mouth over impression copings were prepared (Fig. 5). The intaglio surface of both the upper and lower duplicate denture were relieved to allow for a wax impression. The patient returned for final impressions and the Locator abutments were removed and kept in appropriate order to avoid confusion when re-seating them at the appointment completion. Open tray impression copings were connected to the Locator abutments. The impressions were removed and placed significantly more shallowly than the rest was casted (Fig. 4). Light-body polyvinyl siloxane was injected into the base of each impression coping and medium- body putty was placed in the tray. The tray was seated, ensuring that the copings were fully engaged and completely accessible through the holes previously prepared. The patient was instructed in facial and tongue movement to achieve proper peripheral extension. Light-body (RIGENT) autopolymerizing light material was injected around each impression coping to rigidly adhere to the impression tray. This step is critical as reliance on flex-
ible impression copings may allow transfer error when constructing the working cast. Once the impression materials were fully set, the screws retaking the im-
pression copings were removed and the final impression and tray were withdrawn from the patient (Fig. 6). All Locators were decapsulated and the case was shipped to DENTSPLY Implants for duplication of the duplicates. Once processed, the images of the abutment designs were made available for review and approval before manufacturing (Fig. 7). Once the design was presented, a copy of the abutment, approval for production of the patient-specific abutments was granted. It is impor-
tant to note that the abutments included the incisal edge of the denture and the abutments were designed to be placed close to the soft tissue height surrounding each implant, but always supragingival to guarantee unobstructed seating of the finished restoration. Each abutment was milled to a 5-degree taper to match the SynCone caps ensuring an intimate friction-fitting. Upon abutment mili-
dation, the images of the abutment designs were made available for review and approval before manufacturing (Fig. 7). Because the ATLANTIS Conus concept results in a fully implant-supported prosthesis, the periph-
eral borders of the finished structure were greatly reduced and the occlusal at-
table was abbreviated at the first molar. The lengths of functional arch follows the identical AP spread princi-
ples used for hybrid prostheses to avoid excessively long cantilevers. At this point, the structure is a bridge and not an overdenture. To facilitate seating of the abutments in the pa-
tient, a clear matrix was made with the abutments on the original working cast, where they have remained since receipt. Each abutment was identified with one, two, three and four black ink dots respectively based on their position on the cast. The clear matrix was seated over the abutments and corresponding black dots were drawn on it to line up ex-
actly with those on the working cast. The SynCone caps were lift-
ed and a rubber dam was placed around the abutments to prevent curing resin (Fig. 17). The patient was in-
structed to gently close into full occlusion and the caps were re-
seated (Fig. 14). Attaching processing mate-
rials (Chairside by Zest Anchors) was placed in the reservoirs of the pros-
theses and seated over the SynCone caps on the abut-
monts. The upper denture was placed and the patient was instructed to gently close into full occlusion and to maintain position for two min-
utes while setting occurred. After two minutes, the excess flow of pick-
up resin was checked for hardness and an additional mate-
rial was injected. The prosthesis was ready for restoration. Removal was uneventful although retention was considerable, removal of the bridge can only occur follow-
ing the long-axes of the abutments, so tapping or rotating is possible (Fig. 13, 15, 16). Once removed, the excess pick-
up material was removed and the bridge was properly polished where needed. The abutments were then placed with Teflon tape to within 3 mm of the surface, and the remaining space was filled with flowable composite resin (Fig. 17). The patient was in-
structed on placement and removal and repeated the exercise until we were satisfied she would experience no difficulties performing this. The clear, duplicate copy of the bridge was seated onto the abutments us-
ing a chair-side self-setting material (Fig. 18). This copy serves as a temporary de-
vice for the patient to wear when cleaning the finished bridge or when sleeping to protect the tongue from scraping against the abutments. A panoramic radiograph was taken at completion of treatment (Fig. 19). The patient returned after one week and again after six weeks, and report-
ed at both visits that the lower bridge did not move at all during function and stayed seated until she removed it. She commented on the ease of cleaning the dental abutments, and she reported no discomfort and no food embrasure. Overall, the pa-
tient was very pleased with the result (Fig. 20).
Intraoral welding and lingualized (lingual contact) occlusion: a case report

By Dr. Luca Dal Carlo, Dr. Franco Rosso, Dr. Maria I. Pasqualini, Dr. Mike Shulman, Dr. Michele Nardone, MD, Tomasz Grotowski, Dr. and Sheldon Winkler

Intraoral welding was developed by Pierluigi Mondani of Genoa, Italy, in the 1970s to permanently connect submerged implants and abutments to a titanium wire or bar by means of an electric current (Fig. 1). The current is used to permanently fuse the titanium to the abutments in milliseconds, so the heat generated does not cause any pathology or patient discomfort.

If possible the implants are placed without flaps. The titanium wire or bar is bent and aligned passively to the contour of the labial and lingual surfaces of the implants before applying the electric current to permanently connect titanium implants. The technique follows a strict surgical and prosthodontic protocol, which includes using a number of implants as close as possible to the number of teeth to be replaced, achieving primary stability by engaging both cortical plates (bicorticalism), immediate splinting of the implants utilizing intraoral welding and immediate insertion of a fixed provisional prosthesis with satisfactory occlusion. The technique provides for immediate loading and does not jeopardize the integration process.

Although intraoral welding has been used successfully in Europe, especially Italy, for many years, it has yet to achieve everyday use in the United States. Intraoral welding can fulfill a great need for business and socially active members of the Italian affiliate of the American Academy of Implant Prosthodontics, NuovoGISI, have long and successful experiences in the USA.

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By inserting the prostheses with adequate retention and stability the same day as the surgery, patient complaints and discomfort can be avoided or substantially reduced. The instantaneous stability that results from the splinting can reduce the risk of failure during the healing period. Intraoral welding can also eliminate errors and distortions caused by unsatisfactory impression making, as the process is performed directly in the mouth.

Intraoral welding can fulfill a great need for business and socially active members of the Italian affiliate of the American Academy of Implant Prosthodontics, NuovoGISI, have long and successful experiences in the USA.

Fig. 1. Schematic drawing of Mondani intraoral solder unit

Fig. 2. Preoperative panoramic radiograph of 10-year-old caucasian woman

Fig. 3. Nonresorbable teeth visible after removal of the patient’s prosthesis

Fig. 4. Eight titanium one-piece implants are inserted.

Fig. 5. Immediate stabilization of the eight implants and two additional implants previously inserted in the posterior regions by welding each implant to a 2.5 mm supporting titanium bar.

Fig. 6. Panoramic radiograph after 90 days suggests complete integration

Fig. 7. Healthy gingiva was observed after 90 days

Fig. 8. Lower implants welded together intraorally

Fig. 9. Three-tooth mandibular fixed prosthesis

Fig. 10. Seven-year follow-up radiograph shows satisfactory preservation of bone surrounding all of the implants

Fig. 11. Intraoral photograph of the definitive prosthesis shows healthy gingiva
Discussion

The number of implants placed for an edentulous patient should be based upon whether the design is to be implant-supported or non-supported. If the goal is a maximalist design utilizing the soft tissue for support, two or more implants using locator attachments are appropriate to retain a mandibular denture and will provide a predictable outcome. However, when more than two implants are used, resilient overdenture retainers are employed, them is not a corresponding linear increase in retention of the denture and the result may suffer. Therefore, when at least four implants are planned, the restoration should be designed as implant-supported to maximize the value of the patient’s greatest investments.

This article discusses just such a situation where a patient had experienced repeated low value from her investment of five implants. By redesigning her treatment to become implant-supported through the use of the ATLANTIS Conus concept, a successful result was achieved without the greater expense of a fixed hybrid. The final result was functionally similar to that of a fixed restoration while providing lip and cheek support of a removable prosthesis without complicating or obstructing oral hygiene.

The minimalistic design of the ATLANTIS Conus concept provides outstanding retention of the prosthesis designed to be non-removable. Implant patients chew in a relatively flat elliptical and the bridge can be only removed vertically. The abutments themselves are patient-specific, can be made from any of the many implant systems, allowing rescue of many frustrating results with over-dentures.

As long as there is sufficient interarch space (at least 12 mm), existing finished dentures can be retrofit with ATLANTIS Conus abutments, reducing patient cost while providing a stable result. Cast chrome frame reinforcement is advised for all new ATLANTIS Conus prostheses as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required interarch space.

The clinical procedure is relative simple and comparable to implant overdentures, however, because the abutments are patient-specific, tooth position must be established before the design of the abutments is begun.

Conclusion

A patient with an 11-year history of implant-supported, gradual diminution of the residual ridge will present immediate stabilization of the eight implants and 2 additional implants that were previously inserted in the posterior regions was achieved by welding (Jaccard) Intraoral Welding (Carl Zeiss, Inc., Jena, Germany) each implant to a 1.5 mm supporting titanium bar (Acemonti, Casarco, Italy), which previously had been built to fit passively on the palatal mucosa (Fig. 3). A provisional resin prosthesis was inserted, which provided an acceptable vertical dimension and lingual contact occlusion. Oral hygiene procedures were demonstrated to the patient and reviewed at all future appointments.

After 90 days, a panoramic radiograph suggested complete integration (Fig. 6) and a healthy mucoza was observed (Fig. 7). The definitive full-arch gold-ceramic fixed prosthesis was inserted, which greatly pleased the patient and her family.

In the lower arch, the first and second bicuspids were extracted and implants placed in the first bicuspids and first molar regions. The implants were welded together intraorally (Fig. 8), followed by the fabrication and cementation of a three-piece fixed prosthesis (Fig. 9).

A 7-year follow-up radiograph (Fig. 10) shows satisfactory preservation of bone surrounding all of the implants. An intraradicular photograph of the definitive prosthesis shows healthy gingival tissue (Fig. 11).

References


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Clinical report

A healthy 50-year-old caucasian woman presented for treatment at the office of one of the co-authors (JDC) with a mobile, painful, 12-tooth eminiscous alloy-feramic fixed prosthesis (Fig. 1). The prosthesis was removed and all of the remaining abutment teeth were found to be recontoced with extraction intarct (Fig. 2). After removal of the retained teeth, eight one-piece implants were inserted in one session (Fig. 3).

Figure 15. Completed bridge with SynCone caps processed in position. Because they have been processed intra-arch, there is no error in fit, these caps are extensively retentive allowing only vertical displacement of the prosthesis.

Figure 16. Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.

Figure 17. ATLANTIS Conus abutments torqued to specified level, obturated with Teflon tape and composite resin.

Figure 18. Laboratory processed, clear duplicate prosthesis with siliconized veneer material to improve retention; to be used as an analog to protect the lingual of the edentulous ridge.

Figure 19. Panoramic radiograph of the abutments seated on the four selected implants. Because the retention is improved by the crown supported, gradual diminution of the residual ridge will prevent any consequence to the patient.

Figure 20. Completed bridge in place showing flange length suitable to prevent food.

Figure 21. ATLANTIS Conus concept provides outstanding retention of the prosthesis. This patient had previously inserted the prosthesis as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required interarch space.

Figure 22. Occlusal plane height must be corrected to guard against interference with the denture base, and simplifies setting of the occlusion and any subsequent occlusal adjustments.

Figure 23. An intraoral photograph of the definitive prosthesis shows satisfactory preservation of bone surrounding all of the implants. An intraradicular photograph of the definitive prosthesis shows healthy gingival tissue.

Figure 24. Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.

Figure 25. ATLANTIS Conus concept provides outstanding retention of the prosthesis. This patient had previously inserted the prosthesis as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required interarch space.

Figure 26. Occlusal plane height must be corrected to guard against interference with the denture base, and simplifies setting of the occlusion and any subsequent occlusal adjustments.

Figure 27. An intraoral photograph of the definitive prosthesis shows satisfactory preservation of bone surrounding all of the implants. An intraradicular photograph of the definitive prosthesis shows healthy gingival tissue.

Figure 28. Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.

Figure 29. ATLANTIS Conus concept provides outstanding retention of the prosthesis. This patient had previously inserted the prosthesis as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required interarch space.

Figure 30. Occlusal plane height must be corrected to guard against interference with the denture base, and simplifies setting of the occlusion and any subsequent occlusal adjustments.

Figure 31. An intraoral photograph of the definitive prosthesis shows satisfactory preservation of bone surrounding all of the implants. An intraradicular photograph of the definitive prosthesis shows healthy gingival tissue.

Figure 32. Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.

Figure 33. ATLANTIS Conus concept provides outstanding retention of the prosthesis. This patient had previously inserted the prosthesis as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required interarch space.

Figure 34. Occlusal plane height must be corrected to guard against interference with the denture base, and simplifies setting of the occlusion and any subsequent occlusal adjustments.

Figure 35. An intraoral photograph of the definitive prosthesis shows satisfactory preservation of bone surrounding all of the implants. An intraradicular photograph of the definitive prosthesis shows healthy gingival tissue.

Figure 36. Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.

Figure 37. ATLANTIS Conus concept provides outstanding retention of the prosthesis. This patient had previously inserted the prosthesis as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required interarch space.

Figure 38. Occlusal plane height must be corrected to guard against interference with the denture base, and simplifies setting of the occlusion and any subsequent occlusal adjustments.

Figure 39. An intraoral photograph of the definitive prosthesis shows satisfactory preservation of bone surrounding all of the implants. An intraradicular photograph of the definitive prosthesis shows healthy gingival tissue.

Figure 40. Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.

Figure 41. ATLANTIS Conus concept provides outstanding retention of the prosthesis. This patient had previously inserted the prosthesis as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required interarch space.

Figure 42. Occlusal plane height must be corrected to guard against interference with the denture base, and simplifies setting of the occlusion and any subsequent occlusal adjustments.

Figure 43. An intraoral photograph of the definitive prosthesis shows satisfactory preservation of bone surrounding all of the implants. An intraradicular photograph of the definitive prosthesis shows healthy gingival tissue.

Figure 44. Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.

Figure 45. ATLANTIS Conus concept provides outstanding retention of the prosthesis. This patient had previously inserted the prosthesis as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required interarch space.

Figure 46. Occlusal plane height must be corrected to guard against interference with the denture base, and simplifies setting of the occlusion and any subsequent occlusal adjustments.

Figure 47. An intraoral photograph of the definitive prosthesis shows satisfactory preservation of bone surrounding all of the implants. An intraradicular photograph of the definitive prosthesis shows healthy gingival tissue.

Figure 48. Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.

Figure 49. ATLANTIS Conus concept provides outstanding retention of the prosthesis. This patient had previously inserted the prosthesis as the tremendous increase in strength of the bridge by the frame more than offsets the slight increase in cost and may actually reduce required interarch space.

Figure 50. Occlusal plane height must be corrected to guard against interference with the denture base, and simplifies setting of the occlusion and any subsequent occlusal adjustments.

Figure 51. An intraoral photograph of the definitive prosthesis shows satisfactory preservation of bone surrounding all of the implants. An intraradicular photograph of the definitive prosthesis shows healthy gingival tissue.

Figure 52. Completed restoration. Note the absence of screw access holes for a prosthesis that looks like a denture yet fits like a bridge.