

CAD-CAM IMPLANT ABUTMENTS-A SOLUTION FOR CHALLENGING CLINICAL CASES

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ABSTRACT

Due to the success of osseointegration and improved surgical protocols, implant placement has become a routine practice in most of the dental clinics. The latest developments focus on the implant superstructure and prosthodontic phase. In digitally driven world, use of virtually designed and milled implant abutments is growing exponentially. More and more dentists are going in for customised milled abutments for predictable soft tissue contours and esthetics. The present article discusses about the restorative options for a few clinical situations where custom milled abutments seemed a best option.

Key words: Angulated Screw Channel, CAD-CAM Abutments, Custom Abutments, Milled Abutments

INTRODUCTION

Stock abutments are popular as they are readily available, precise fitting and are quick solutions.¹ Most of the implant manufacturers provide abutments in titanium and zirconium in different shapes, sizes, angulations and collar heights. For a well placed implant using stock abutment reduces the cost and time, though a huge inventory has to be maintained to be able to choose a correct abutment according to a particular clinical situation. However due to anatomical constraints 3 dimensional implant placement may not always be at a desired location. Creating a custom abutment by modifying the stock abutment may need lot of adjustments either by the restorative dentist or the lab technician. It will not affect the titanium abutment but can induce stresses in zirconium abutments making them susceptible to fracture.²

Abutments can be custom cast by using a plastic waxing abutment sleeve. It

is modified to establish desired contours and invested. Through the decades old technology of lost wax, a mould is created and the abutment is cast. It is a tedious process and may result in inaccuracies and poor fit.³

A reliable interfacial contact is desirable to maximise stability of abutments and prosthesis and avoid biological complications. It has been demonstrated that gaps at the implant abutment interface might increase the stresses at prosthetic components, implants and peri-implant bone. As a consequence of misfit –caused stresses, screw loosening or fracture might happen. In addition, the implant abutment margin could favor bacterial accumulation and therefore it could be a source of peri-implant inflammation.

Custom CAD/CAM abutments combine most of the advantages of stock and cast custom abutments.⁴ In addition to a predictable fit and durability, all the

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parameters are modifiable including the emergence profile, thickness, finish line location, and external contour. However there is substantial initial investment on the scanner and milling unit.

Clinical situations

Indications for custom abutments include :

1. A natural looking emergence profile.
2. Lack of parallelism between two or more implants that are to be splinted together (Figure 1a-c).
3. If interocclusal restorative space is insufficient
4. If the angulations of implant is unfavourable for occlusion and function.
5. If the required collar height is more than 1mm higher than the available collar heights (Figure 2a-c).
6. To have correct width and soft tissue contours corresponding to the size of tooth being restored.

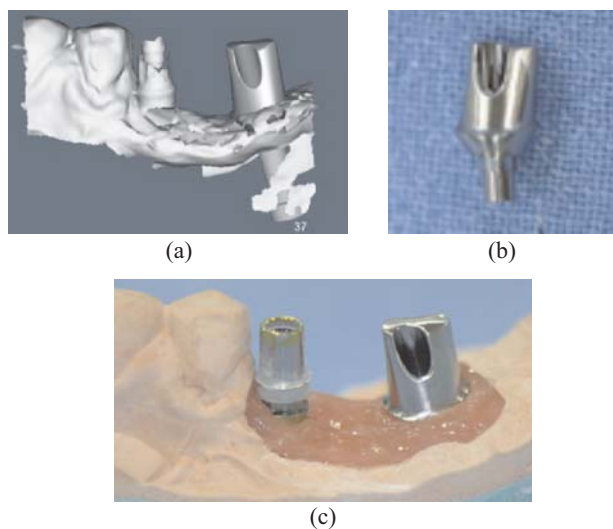


Figure 1: Paralleism between two abutments and harmony between peri implant soft tissue and tooth achieved.
 (a) scanned and designed abutment, (b) milled abutment and (c) milled abutment on the model.

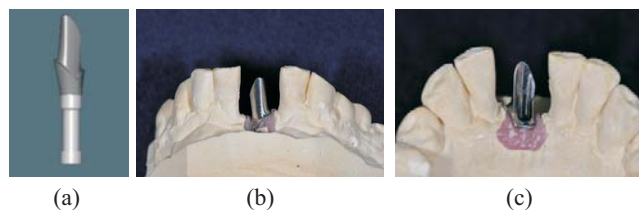


Figure 2: Customised Collar height and Improved emergence profile.
 (a) scanned & designed abutment titanium custom abutment
 (b) labial view (c) lingual view

Various companies that offer milled custom abutments are 1. NobelProcera® (Nobel Biocare), 2. Bella Tek® Endocde® (BIOMED-3 i), 3. Straumann® CARES® (Straumann) 4. Atlantis™, (DENTPSLY) 5. Aadv (GC) CAD/CAM production will also facilitate the durability of the veneering ceramic by contouring the abutment according to the morphology of the definitive crown.^{5,6} Such anatomical contouring aims to reduce the thickness of the veneering ceramics and has been found to reduce the risk and severity of ceramic chipping.^{5,6} Abutments can be milled both in titanium and zirconium. Natural looking emergence profile, predictable soft tissue contours enhances the esthetics, fit and patient comfort

CAD-CAM workflow

After taking the impression model is poured (Figure 3a). When the model is ready a locator or a scan post compatible with the particular implant system is placed in the implant analog and model is scanned (Figure 3b-e). The scan post determines exact location of implant with the help of a software and then through CAD an abutment is designed (Figure 3f-i). Another method is by scanning a wax up of abutment (Figure 5a-c). While designing the abutment collar height, crown height, peri-implant tissue contours, implant angulation and emergence profile are critical factors. The collar height should be subgingival in esthetic zone. However taking the margin too subgingival can prevent the removal of excess cement. While keeping the collar supragingival, for health of peri implant tissues, care should be taken not to encroach upon cervico-occlusal height that may compromise the retention of a cement retained crown especially in case where interocclusal clearance is less. The cervical marginal width of abutment should be in harmony with natural contours of crown. The angulations of multiple abutments to be splinted together should be parallel. The emergence profile should provide best esthetics and function.

After all the parameters of abutment design are finalised it is electronically send to a milling unit.



Figure 3a: Working cast with Implant analogues and Gingival mask, mounted on the scan table



Figure 3b: Working cast with Implant analogues and Gingival mask removed



Figure 3c: Scan Posts on the Implant analogues



Figure 3d: Nobel Procera 2G Scanner with Casts and Scan posts

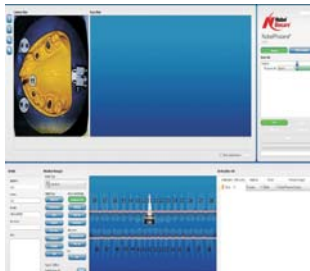


Figure 3e: Nobel Procera Software window for Surface scanning and Designing



Figure 3f: Nobel Procera Software window with the situation as scanned data



Figure 3g: Nobel Procera Software window with the situation for designing



Figure 3h: Nobel Procera Software window with the designed Procera zirconia parallel abutments



Figure 3i: Procera zirconia parallel abutments

Figure 3: CAD Abutment work flow

Advantages of customised abutments:

1. Anatomically designed with optimal emergence profile, they offer best esthetic results.
2. Precise engineering and milling ensures that they have high quality of finish and precise fit that produce a stable connection between implant and abutment preventing bacterial entry.
3. Margins can be placed in accessible areas from where cement can be easily removed.
4. No modification required by the restorative dentist or the technician.
5. Necessity for maintaining a huge inventory of stock abutments is not there.
6. Anatomic contouring of abutment reduces the thickness of veneering material thereby preventing its chipping.

Latest addition to this category is angulated screw channel (Figure 4a-e) and full contour zirconia (Figure 5a-c), thereby broadening the horizons of restorative dentistry. Angulated screw channel offers an advantage of being used in situations of restricted mouth opening or to change the screw position from esthetically unacceptable areas to areas where screw is not visible.

More recently, chair-side construction of an implant abutment have introduced using CAD/CAM and is available using the Cerec system (Sirona). This will eliminate the process of impression taking simplifying dentistry.

CONCLUSION

CAD-CAM implant abutments, because of their precise fit, versatile design, and simplicity of work process are fast becoming a very good option for implant restorative work. Their growing trend and popularity may soon replace the stock abutments.

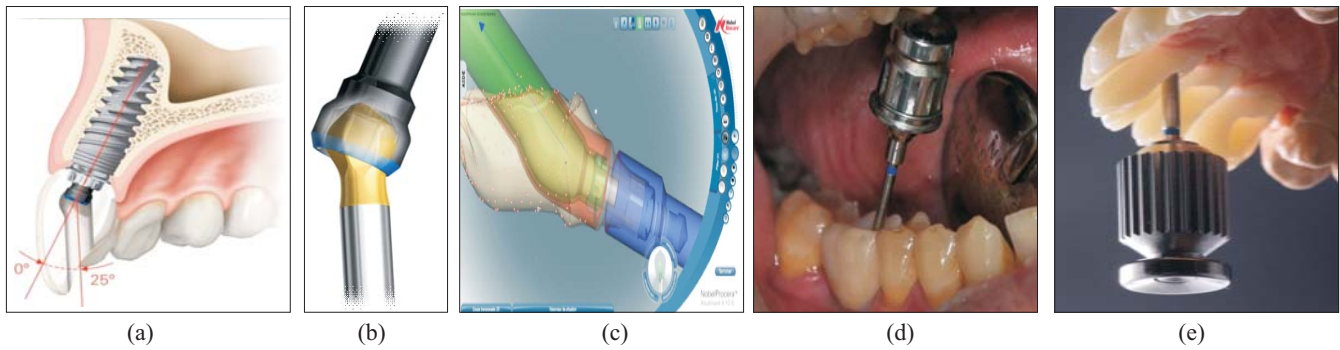


Figure 4: Angulated Screw Channel Custom CAD Abutments (ASC TMNobel Biocare)

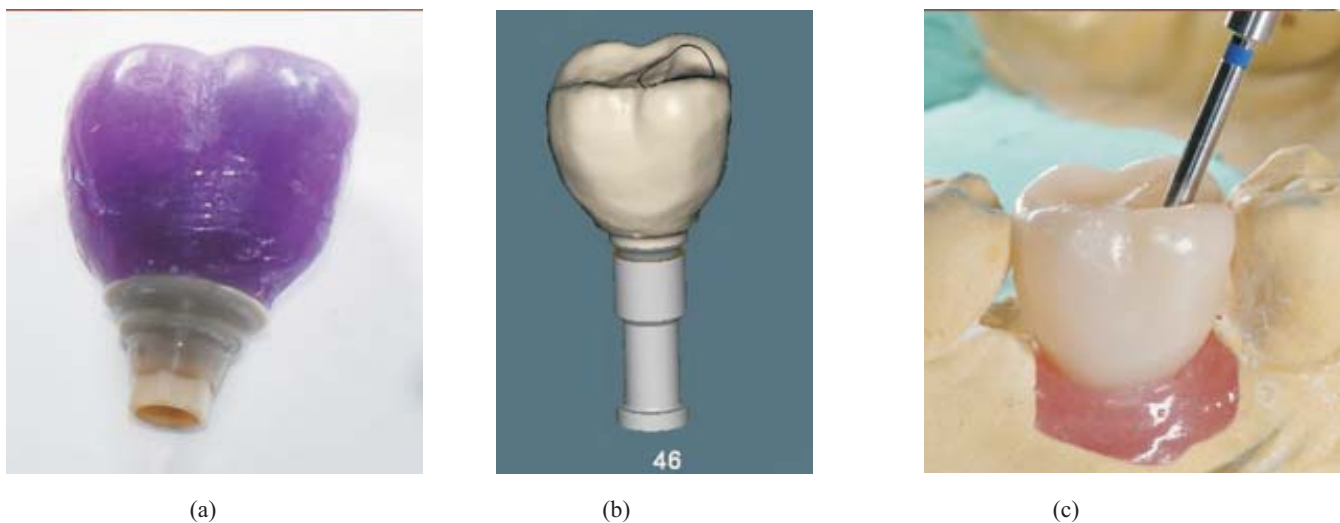


Figure 5: Wax-up abutment ready for scanning (a), scanned and designed abutment (b) and full contour milled zirconium abutment with angulated screw channel on the model. (c) The angle of screw had to be changed due to limited mouth opening in patient.

Stock Abutments	Cast abutments	Custom CAD CAM Abutments
<ul style="list-style-type: none"> • Easily available • Accurately machined and matched • Not suitable for all situations and implant locations • Laboratory turnaround time is less • Cost effective • Huge inventory to be maintained 	<ul style="list-style-type: none"> • Tedious and long process • Accuracy of fit is always debatable 	<ul style="list-style-type: none"> • Customised form and shape can be designed according to a situation • ASC abutments can save laboratory time and procedures • Special lab equipment required • cost intensive

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