Case Report

Restoration of converging implants: Restorative complexity to facilitate retrievability

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Abstract

Implant treatment should be restoratively driven, however at times, ideal implant positioning may be sacrificed for surgical convenience at the expense of restorative complexity. A prosthesis incorporating a novel design was constructed to restore two converging implants placed in close proximity utilizing standard implant impression componentry and simple clinical stages. As the use of angulated screw channel technology was not possible, a customized cast "rest" abutment and overlying telescopic crown was fabricated that facilitated access for oral hygiene and retrievability as required. The complexity of the case design was transferred to the laboratory phases of construction. The case presented a satisfactory clinical outcome for an initially challenging implant presentation and reinforced the need to work closely with the laboratory technician.

Keywords: Abutment design, case report, converging implants, prosthodontics, retrievable, splinting

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INTRODUCTION

The use of dental implants to replace missing teeth in the Western society is increasing in numbers and rate, with an estimated prevalence in the USA in 2015–2016 of 5.7% projected to increase to as much as 23% in 2026.[1] In a recent study of 10,000 general Indian urban dwellers, 23% of the respondents had heard of dental implants as a treatment option to replace missing teeth.[2] Dental implant treatment often presents benefits over more traditional treatment alternatives. Although there are established long-term survival rates >90%, complications do exist and require time, effort, and expense to manage.[3,4]

Notwithstanding the functional, esthetic, and tooth preservation benefits, patients choosing dental implant treatment need to undergo at least one surgical procedure which should, ideally, be restoratively driven. With a range of clinicians of different levels of training and experience now placing dental implants, it has been suggested operator experience may influence implant success although this may be skewed by more difficult patients attending more experienced clinicians.[5,6] On occasions, ideal implant positioning may be sacrificed for surgical convenience at the expense of restorative complexity.

The decision to screw-retain or cement-retain single implant-retained crowns has become an easy decision

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for most clinicians in most cases.[7] Long-term clinical studies have indicated no difference in clinical success between the two methods of retention and the choice of retention largely lies with clinician preference.[8] However, exceptional clinical presentations necessitate a more in-depth decision-making process and prosthesis design considerations.

The advent of angulated screw channel (ASC) technology has no doubt revolutionized the dental implant world and to a large extent transferred the decision-making process to the dental technician who can re-angulate the screw access channel to the ideal exit point in the crown within angulation limitations.[9] However, not all implant systems offer ASC options within their own company range of products, and there may be a resistance to use copy components.

This case report describes a technique to restore two converging implants placed in close proximity in the posterior left mandible utilizing standard implant impression componentry and simple clinical stages, then justifies the treatment choices and discusses some pertinent literature relevant to the management of the case.

CASE REPORT

A 68-year-old female patient was referred to a public hospital clinic for the restoration of two dental implants. The patient's medical history was insignificant, and dental history revealed previous routine restorative and periodontal care.

The lower left first and second premolars had been extracted approximately 5 years earlier due to endodontic complications, and two Nobel Biocare Replace Select Tapered, Regular Platform (4.3 mm diameter), 11.5 mm long dental implants (Nobel Biocare, Goteborg, Sweden), was placed in 2018 at the lower left first and second premolar sites four months earlier by a general dentist. The implant platforms were located 2–3 mm above the bone crest. Previous correspondence reported both implants had been reviewed and torque tested to 35 N as an indication that osseointegration had been achieved. There had been a delay in presentation for restoration due to financial restrictions and normal referral processes in the public hospital clinic.

Clinical and radiographic assessment established the upper left first and second premolars had supra-erupted by 1–2 mm into the lower premolar restorative space. The lower left first and second premolar implants were convergent, and the 5-mm healing abutments were almost in contact [Figure 1a-c].

Following discussion of the restorative options, the patient provided informed consent and treatment commenced. It was decided to utilize both implants and construct a screw-retained prosthesis that offered the benefit of retrievability while maximizing the splinted implant mechanical advantage and implant success.[10]

To reconfirm osteointegration, the implants were reverse torque tested to 35 Ncm. Following radiographic verification of the complete seating of the impression copings, two individual implant-level open tray pick-up impressions of the lower left first and second premolar implants were made with Impregum Penta Soft medium body impression material (3M™ ESPE™ AG, Seefeld, Germany) using open tray impression copings (Nobel Biocare, Goteborg, Sweden) as it was not possible to attach both impression copings to both implants simultaneously due to angulation interferences [Figure 2a and b]. An Exabite II (GC Corporation, Tokyo, Japan) vinyl polysiloxane occlusal record and facebow record were made together with an alginate impression of the opposing arch.

Two individual die stone models (Resin Rock, Whip Mix, Louisville, USA) were created incorporating the laboratory analogs [Figure 3a and b]. The maxillary arch impression was poured, and all records were used to mount the models on a semi-adjustable articulator. The implant angulations were assessed and surveyed using the guide pin from the impression copings.

A GoldAdapt Engaging abutment (Nobel Biocare, Goteborg, Sweden) was customized as a "rest" abutment for the lower left first premolar implant and cast in gold alloy (68.9% gold) (Argenco 5 type 4 gold alloy; Argen, San

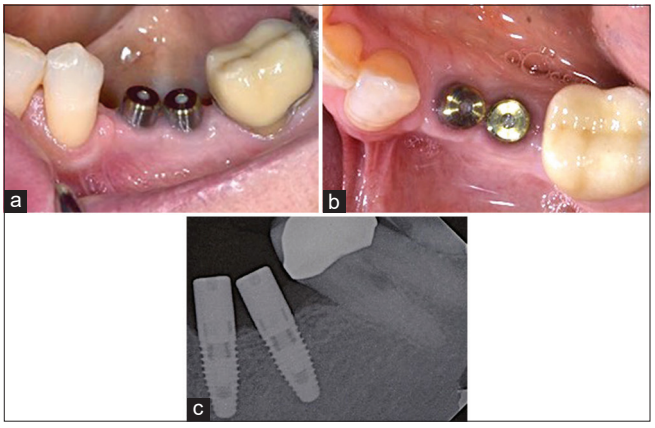

Figure 1: (a-c) Clinical and radiographic appearance of implants at initial presentation

Diego, CA, USA). The customized abutment re-aligned the path of insertion of the lower left first premolar implant to the long axis of the lower left second premolar implant [Figure 4a and b]. Allowance was made for appropriate restorative space for the future overlying crown alloy and ceramic materials. A pattern resin (Pattern resin, GC Corporation, Tokyo, Japan) coping was constructed directly onto the customized lower left first premolar abutment without any spacing [Figure 4c and d].

The lower left first premolar abutment was inserted and torqued to 35 Ncm, and the pattern resin coping (Pattern resin, GC Corporation, Tokyo, Japan) was attached [Figure 5a-c]. An open-tray implant-level impression coping (Nobel Biocare, Goteborg, Sweden) was attached to the lower left second premolar implant and complete seating was verified radiographically [Figure 6a-c].

An impression was made using Impregum Penta Soft medium-body impression material (3M ESPE AG, Seefeld, Germany) in an open impression tray that picked up both the implant impression coping and the pattern resin coping [Figure 7]. The lower left first premolar cast "rest" abutment was then removed from the implant and both healing abutments were replaced.

Laboratory analogs were attached to the lower left first premolar cast "rest" abutment and lower left second premolar implant impression coping within the impression. The lower left first premolar cast "rest" abutment was re-inserted into the pattern resin coping contained within the impression and a single working model was poured in die stone (Resin Rock, Whip Mix, Louiseville, USA) [Figure 8].

A one-piece cast gold alloy (51.5% gold) abutment and cantilevered crown coping (Novabond type 4 gold alloy; Argibond, Moorabbin, Victoria, Australia) was customized from a GoldAdapt abutment (Nobel Biocare, Goteborg, Sweden) that screwed directly onto the lower left second premolar implant and incorporated an overlaying telescopic crown coping framework for the lower left first premolar crown [Figure 9a-c]. No die spacer was applied over the lower left first premolar cast abutment, which allowed an intimate fit and avoided the use of a cement. The lower left first premolar customized abutment crown margin was located equi-gingivally on the buccal raising to slightly supra-gingivally interproximally and 1 mm supra-gingivally on the lingual aspect.

The lower left first and second premolar abutment complexes were tried in to confirm accuracy of fit clinically

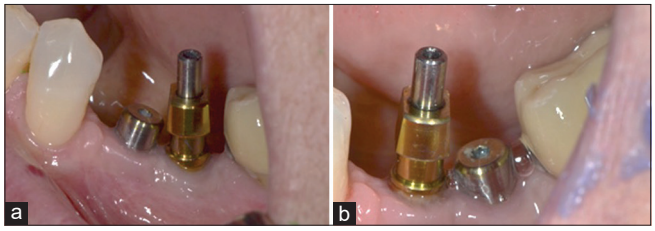

Figure 2: (a and b) Open-tray impression copings on 34 and 35 implants

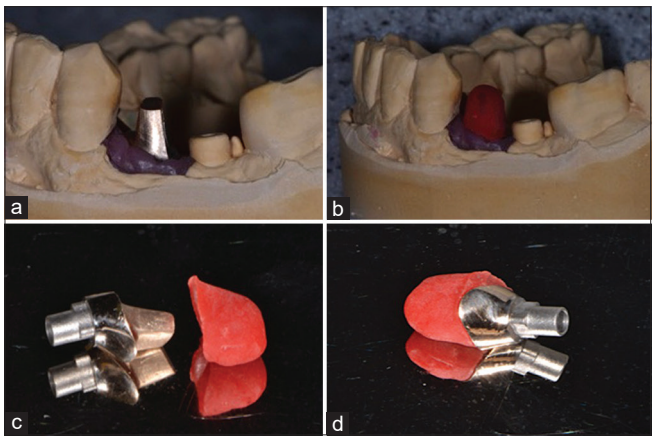

Figure 4: (a-d) The 34 cast "rest" abutment with pattern resin coping

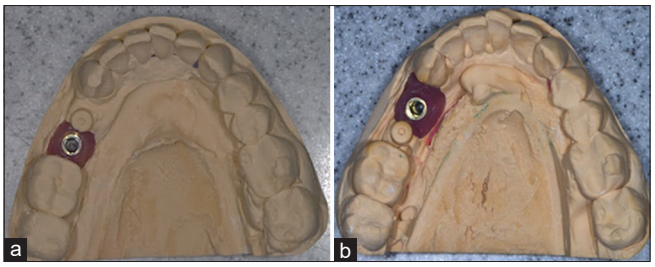

Figure 3: (a and b) Die stone models of 34 and 35 implant analogs

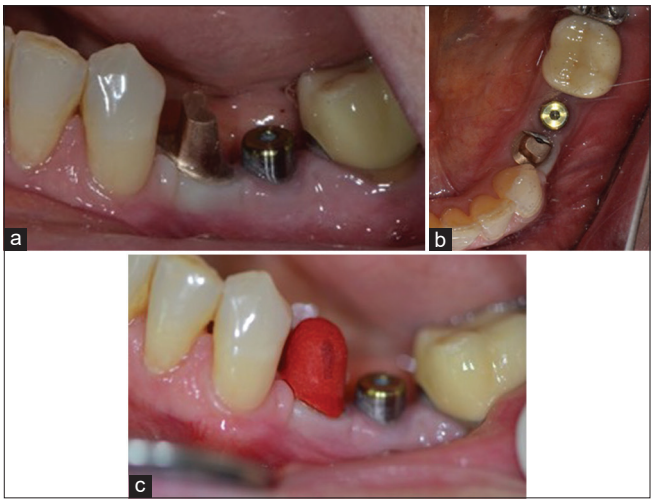

Figure 5: (a-c) Inserted abutment and overlying pattern resin coping

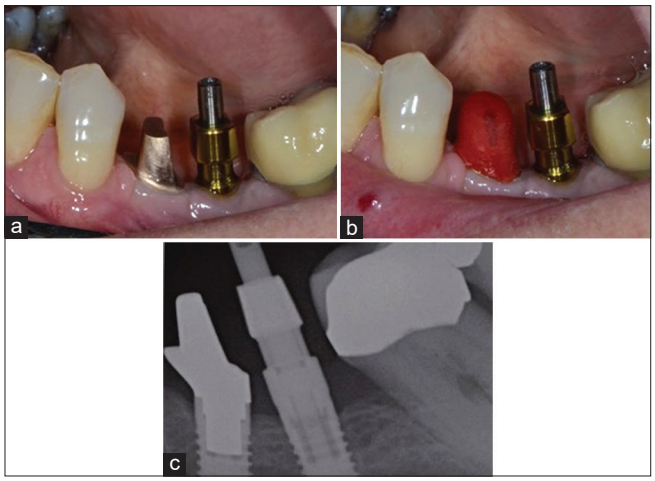

Figure 6: (a-c) An open-tray impression coping attached to the 35 implant, and 34 abutment and overlying pattern resin coping

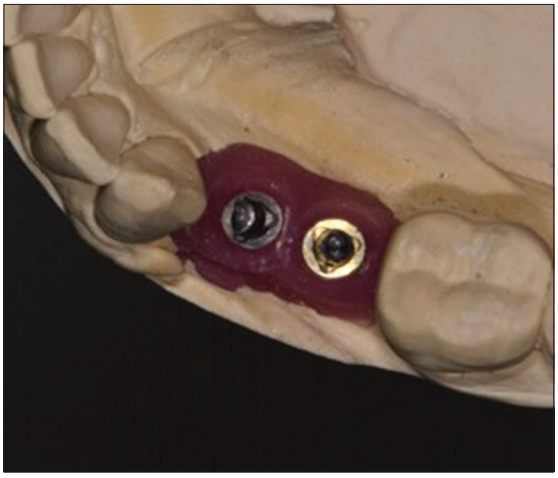

Figure 8: Single die stone working model

Figure 7: Impression of 35 picked-up implant impression coping and 34 pattern resin coping

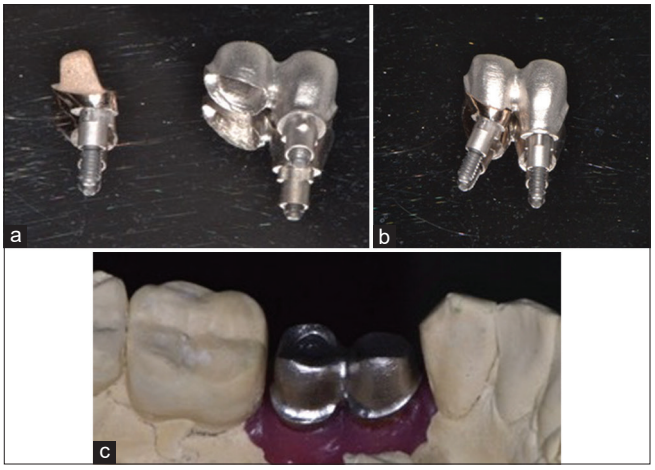

Figure 9: (a-c) The 34 cast "rest" abutment and 35 abutment with overlaying telescopic crown coping framework

and radiographically [Figure 10a-c]. Minor tissue blanching was observed that resolved within 3 min.

The prosthesis was then returned to the laboratory and layered with Duceram Kiss ceramic (Dentsply Sirona, Charlotte, NC, USA) and finished with provision for access for oral hygiene measures [Figure 11].

The lower left first premolar customized cast "rest" abutment was inserted and the TorqTite screw (Nobel Biocare, Goteborg, Sweden) was tightened to 35 Ncm in accordance with the manufacturer's instructions, and the occlusal screw access was sealed with cotton pellets and Filtek Supreme XTE (A3B) composite resin (3M ESPE, North Ryde, NSW, Australia). The one-piece lower left second premolar customized cast abutment and crown and overlying lower left first premolar telescopic crown were inserted, and the TorqueTite screw (Nobel Biocare, Goteborg, Sweden) was tightened to 35 Ncm. Complete seating was confirmed radiographically. The lower left second premolar occlusal access was sealed with cotton pellets and Filtek Supreme XTE (A3B) composite resin (3M ESPE, North Ryde, NSW, Australia) [Figure 12a-d].

The final restoration was provided with a canine-guided occlusion that protected the lower left first and second premolar implant-retained restorations through disclusion on lateral excursions. The patient was reviewed at 4 weeks postinsertion and photographic records were taken as baseline records, then subsequently reviewed at 6 months. The patient was very pleased with the result.

DISCUSSION

The management of the current case required an investigative and imaginative approach using a novel impression technique and construction of a "rest" abutment and overlaying telescopic crown coping framework to facilitate future retrievability as required.

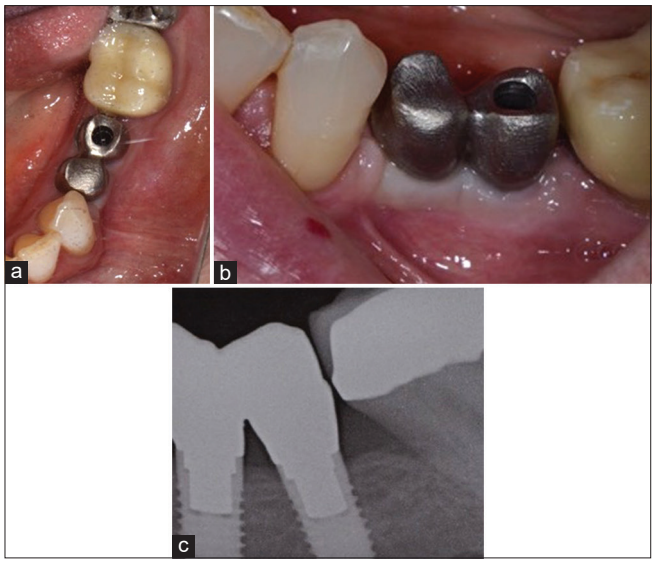

Figure 10: (a-c) Try-in of 34 and 35 abutment complexes

Figure 11: Finished prosthesis

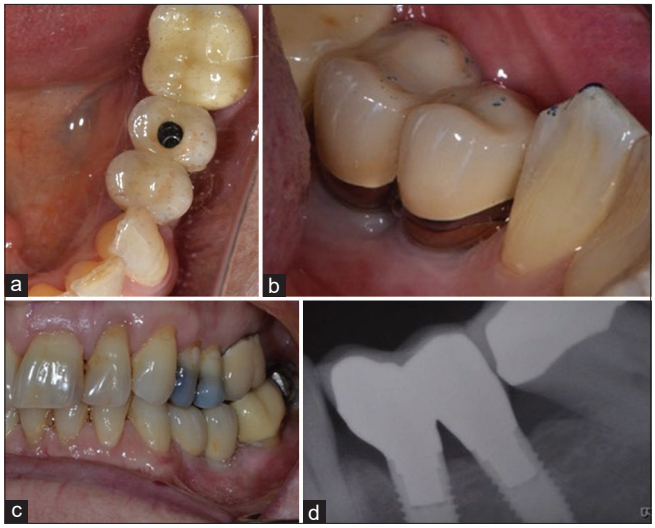

Figure 12: (a-d) Insertion of the final prosthesis

The decision to screw-retain the prosthesis was largely driven by the preference for retrievability and the ability to manage the more commonly encountered complications more easily and conservatively.[3,4] Although there have been mixed findings in the literature in relation to the incidence of biological and technical complications for screw and cement-retained crowns, it is generally accepted that cement retention carries a significant risk of cement remnants that was avoided in the current case.[7,11,12]

The positioning of the two converging, closely approximated implants was suboptimal and it was acknowledged some bone remodeling and/or loss may eventuate as the inter-implant distance was less than a commonly accepted ideal.[13] It was expected that periodic removal of the prosthesis would be required. The path of insertion was selected for convenience as it offered greater ease of access for insertion and removal.

It was acknowledged that other treatment methodologies utilizing the implants existed. Alternatively, individual or splinted crowns could have been cemented on customized implant abutments or an ASC prosthesis could have been constructed. The ASC option was not available in the company's range of products for this particular implant system (Replace Select) but is available for Nobel Biocare Conical Connection implants (Nobel Biocare, Goteborg, Sweden). In the presented case, the implants had already been placed without restorative input into the planning. A single-piece screw-retained casting using nonengaging abutments could have been constructed, however it was felt there would be too much load during normal function placed on the retaining screws as the only form of retention as there would be no engagement into the internal implant trilobe connection. The implemented design avoided the use of cement retained prosthesis with its reported clinical issues particularly in the current case where the removal of excess cement would have been challenging.[12,14]

A potential limiting management issue exists with ASC systems in that the type of implant screw and corresponding driver may not be known to the managing clinician if the treatment history is not available.[15] Attempting to engage the specific screw head may cause damage and subsequently add to the complexity of removing the screw and prosthesis.

The open-tray impression technique was selected because of its proven effectiveness, accuracy, and ability to verify complete seating in relation to the relatively sub-gingival location of the implant platform.[16,17] Saboury and Hadi presented a case where two implants had good axial orientation but were placed too close together, thus preventing impression copings from being placed on both

simultaneously.[18] The authors utilized custom abutments, a pattern resin transfer jig, multiple impressions, and multiple casts to fabricate a working model.[18] The technique had the advantage of not needing additional specialized components.[18]

Chaimattayompol *et al.* presented an impression technique that utilized screw-retained titanium or frictional fit plastic implant index copings in the cases of unfavorable implant proximity, angulation , or limited space.[19] Michalakis *et al.* proposed a more simplified approach and presented a case in which impression copings were modified and splinted for two implants in close proximity.[20] This technique can work well as long as sufficient impression coping volume remains to preserve their structural integrity after the necessary modifications.

Ahuja *et al.* described a technique for developing a master cast for convergent implants involving making an implant-level impression using a transfer coping for the posterior implant.[21] A positional index was then fabricated intraorally and subsequently the master cast was altered to incorporate the second implant analog.[21]

Selecman and Wicks advocated the use of solid plastic, press-fit, closed-tray impression copings on convergent implants, however the disadvantages were acknowledged including the inability to verify complete seating of the coping radiographically.[22] In contrast, the technique utilized in the presented case report utilized standard implant impression componentry and standard laboratory techniques.

The overriding limitation in the presented case was that treatment was not restoratively driven which resulted in convergent implant angulations and close implant proximity. Ideally, the implants would have been angulated in a more parallel manner. Potentially, for the replacement of two standard dimension lower premolars, only one implant was needed to retain a cantilevered prosthesis.[23] A further limitation was the need for the patient to return for four treatment visits as necessitated by the prosthesis design requirements.

CONCLUSIONS

A prosthesis incorporating a novel design was constructed to restore two converging implants placed in close proximity utilizing standard implant impression componentry and simple clinical stages. As the use of ASC technology was not possible, a customized cast "rest" abutment and overlying telescopic crown was fabricated that facilitated access for oral hygiene and retrievability as required. The complexity of the case design was transferred to the laboratory phases of construction. The case presented a satisfactory clinical outcome for an initially challenging implant presentation and reinforced the need to work closely with the laboratory technician.

Ethics approval and consent to participate

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Consent for publication

Informed consent was provided for the publication of this content.

Declaration of patient consent

The author certifies that he has obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initial will not be published, and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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