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Case Report

Evaluation of oral health impact profile of patient of distal extension kennedy class I arches rehabilitated using combined analog digital protocol: A case report

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ABSTRACT

Digitization and its application in field of implantology and fixed prosthodontics has been time tested and is being gradually being utilized in removable prosthodontics also. Fabrication of CPD Framework using ExoCAD and other digital software's has a wide array of advantages over conventional techniques. These are highlighted in the present case report. This clinical report highlights and cast partial denture fabricated using combination of conventional and digital protocols and checking its fit on 3D printed cast and altered cast.

1. Introduction

Computer-aided design and computer-aided manufacturing (CAD-CAM) has revolutionized rehabilitation of partially edentulous residual arched owing to it automation, ease, and accuracy. Traditional casting methods fabricating cast partial denture has been well documented. However, these casting may show inaccuracy dur to tendency of various alloys to shrink.[1] Firtel et al. reported average casting shrinkage for cast cobalt alloy to be 2.3%.[2] Williams and colleagues described concepts for digital surveying and utilization of stereolithographic resin pattern for fabrication of cast partial dentures.[3] Intraoral scanners were introduced in 1980 and since have shown good potential in making impression of hard tissues and mucoperiosteum. Most of the intraoral scanners are based on the image-capture technique of static soft tissue making it a unsuitable option for making altered impressions of distal extension arches, due to the inherent elasticity of mucosal tissue in residual edentulous ridge.[4] Utilization of additive and subtractive computer aided design and manufacturing (CAD/CAM) protocols present considerable possibilities for improving the quality of life of patients rehabilitated with cast partial dentures by reducing inaccuracies and limitation of casting using conventional approach.[5] This case report describes rehabilitation of kennedys class I partially edentulous maxillary and mandibular arch using conventional and digital protocols.

2. Case Report

A 40-year bank employee reported to department with chief complaint of loose lower denture and difficulty in speech. Dental history revealed that the patient had undergone multiple extraction of teeth 5 years back and had been wearing removable partial denture for past 4 years. Intraoral examination revealed kennedy's class I partially edentulous maxillary and mandibular arches (Figure 1). Existing denture was evaluated to fit and accuracy and was found to be loose and ill-fitting. With two important challenges of retention of prosthesis and improvement of speech, various

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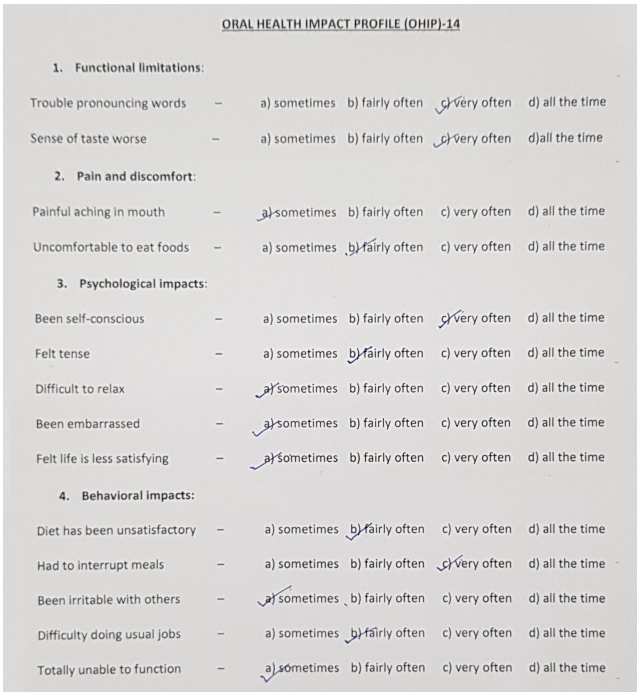
treatment options including removable prosthesis, implant retained removable and fixed prosthesis were discussed with the patient. Patient desired removable prosthesis and hence a treatment plan to rehabilitate maxillary arch and mandibular arches with cast partial denture with semi-precision attachment in lower CPD using combination of conventional and digital protocol was finalised. Informed consent was obtained and Oral health related Quality of life (OHRQoL) was measured using a self-report questionnaire with oral health impact profile-14 (OHIP-14) (Figure 2).[6]

Fig. 1: a) Intraoral view of maxilla, **b**) Intraoral view of mandible



ORAL HEALTH IMPACT PROFILE (OHIP)-14

1. Functional limitations:

Trouble pronouncing words	a) sometimes	b) fairly often	c) very often	d) all the time
Sense of taste worse	a) sometimes	b) fairly often	c) very often	d)all the time

2. Pain and discomfort:

Painful aching in mouth	a) sometimes	b) fairly often	c) very often	d) all the time
Uncomfortable to eat foods	a) sometimes	b) fairly often	c) very often	d) all the time

3. Psychological impacts:

Been self-conscious	a) sometimes	b) fairly often	c) very often	d) all the time
Felt tense	a) sometimes	b) fairly often	c) very often	d) all the time
Difficult to relax	a) sometimes	b) fairly often	c) very often	d) all the time
Been embarrassed	a) sometimes	b) fairly often	c) very often	d) all the time
Felt life is less satisfying	a) sometimes	b) fairly often	c) very often	d) all the time

4. Behavioral impacts:

Diet has been unsatisfactory	a) sometimes	b) fairly often	c) very often	d) all the time
Had to interrupt meals	a) sometimes	b) fairly often	c) very often	d) all the time
Been irritable with others	a) sometimes	b) fairly often	c) very often	d) all the time
Difficulty doing usual jobs	a) sometimes	b) fairly often	c) very often	d) all the time
Totally unable to function	a) sometimes	b) fairly often	c) very often	d) all the time

Fig. 2: Preoperative OHIP evaluation

Primary impressions were made using irreversible hydrocolloid impression material and poured using type II dental stone (Figure 3). Surveying of diagnostic casts was done to access the favourable undercuts. Plan was made to place surveyed crowns with strategic abutments and semi precision attachment in lower CPD. Tooth preparation was done for strategic abutments, and impression made using two-step putty wash impression technique using polyvinylsiloxane impression material after appropriate gingival displacement.

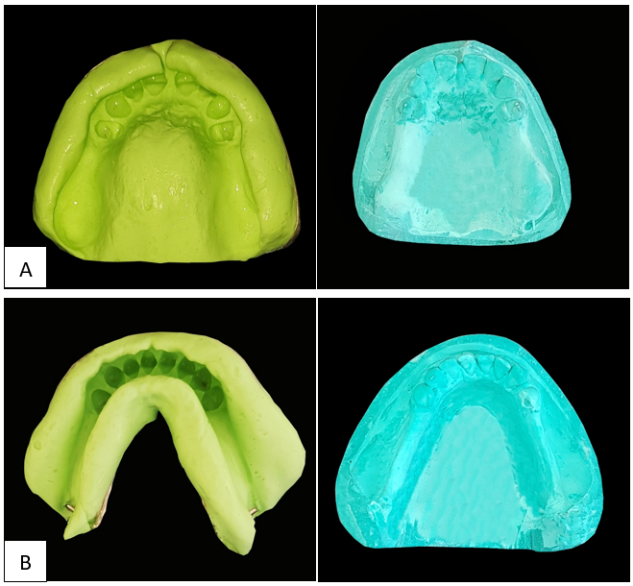


Fig. 3: a): Maxillary primary impression and cast; **b**): Mandibular primary impression and cast

Complete coverage crowns were fabricated for strategic abutments for both maxillary and mandibular arches with attachment of semi precision attachment to lower crowns (Figure 4). They were luted after assessing for fit and inaccuracies. Impression for master cast was made using polyvinyl siloxane impression material.

Fig. 4: a): Surveyed crowns irt 14, 24; **b**): Semi precision attachment in lower arch

Master casts were scanned using optical scanner to obtain STL file on which designing of prosthesis was

done using CAD software. Firstly, digital surveying was carried out to determine the path of insertion of prosthesis (Figure 5). Secondly maxillary and mandibular framework was designed three dimensionally. For the maxillary arch, Antero- posterior palatal strap major connector with a mesh pattern as a minor connector was designed and for mandibular arch, Lingual bar was designed (Figure 6).

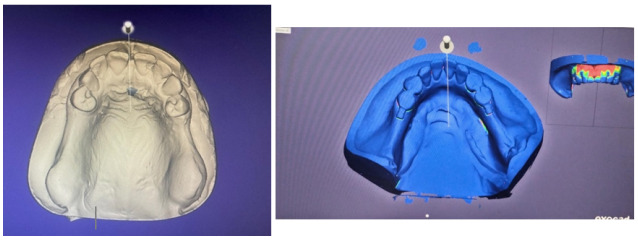


Fig. 5: Digital surveying

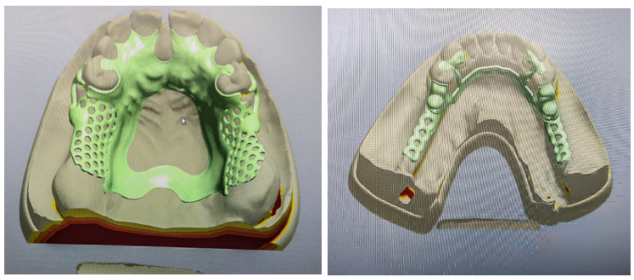


Fig. 6: Designing of framework components

Designed framework STL was transferred to a 3D printer after attachment of supports which printed the framework using a digital light processing (DLP) technology (Figure 7). 3D printed framework jobs were rinsed following standardized procedures and cured using UV curing unit (Vericom MAZICR D Oven) for final polymerization.

Fig. 7: 3D printed resin framework

These frameworks were tried intra-orally and evaluated to confirm the fit, accuracy, and extensions (Figure 8). With precise fit of these framework, the same STL file was used to mill the frameworks in cobalt-chromium (Co-Cr) using 5 axis milling machine (Figure 9). Metal try-in of the frameworks was performed to check the fit and accuracy (Figure 10). Custom tray was fabricated on these frameworks, border molding was done to record the peripheral extensions and functional impression made using zinc oxide eugenol impression paste in closed mouth technique at an established vertical dimension (Figure 11). An altered cast was obtained followed by maxillomandibular relations and teeth arrangement (Dentsply Sirona Cosmo HXL) with bilateral balanced occlusion scheme. Trial of the waxed-up denture was done and processing of CPD was done using conventional procedures.

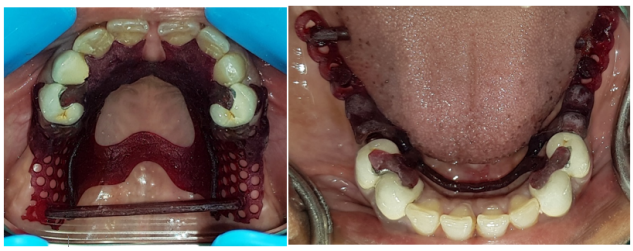


Fig. 8: Intraoral trial of 3D printed resin framework

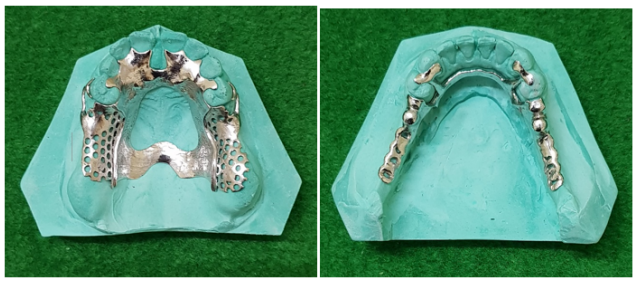


Fig. 9: Milled cast framework

Fig. 10: Intraoral trial of cast metal framework

CPD was delivered to patient (Figure 12). Oral health related Quality of life (OHRQoL) was measured for the new prosthesis using a self-report questionnaire with oral health impact profile-14 (OHIP-14) (Figure 13), also comparison of weight of old and new prosthesis was carried out (Figure 14).

Fig. 11: Functional impression

Fig. 12: a): Definitive maxillary prosthesis; **b**): Definitive mandibular prosthesis

ORAL HEALTH IMPACT PROFILE (OHIP)-14

1. Functional limitations:					
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Totally unable to function	–	a) sometimes	b) fairly often	c) very often	d) all the time

Fig. 13: Postoperative OHIP evaluation

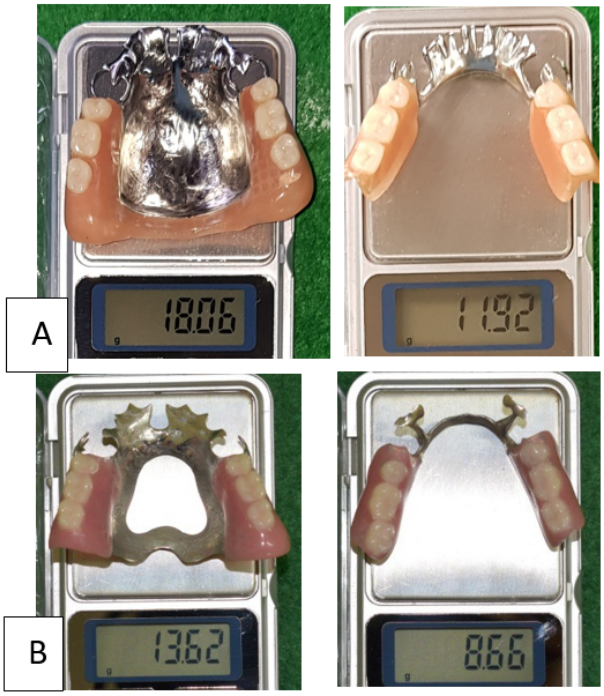

Fig. 14: a): Weight of old prosthesis; **b**): Weight of new prosthesis

3. Discussion

Digitization of removable partial dentures in comparison with conventional procedures help reduce clinical and laboratory time. Digital steps include digital impressions with intraoral scanners, computer aided designing (CAD) and computer-aided manufacturing (CAM).

Frameworks fabricated using intraoral scanners for Kennedy class III situations has shown to be highly satisfactory.[7] However, Hayama et al observed Kennedy class I distal extension cases, the definitive impression using conventional procedures showed better results compared to those with digital impressions.[8]

Several authors suggest completely digital workflow in fabricating frameworks for RPD[9,10] but these studies are heterogenous and limited studies are available evaluating the support of mucosa in distal extension arches. Altered cast technique in rehabilitating distal extension removable partial dentures has advantage of increasing support of the denture base and decreasing forces on the abutment teeth.[11]

Digital designing eliminates conventional framework wax-up which require human involvement and may incorporate errors causing misfit. Also, conventional wax up cannot be tried in patient's mouth, whereas 3D printed resin pattern offer advantage of intraoral trial to assess any misfit.

Milling of the framework may be done using either subtractive or additive manufacturing techniques. Arnold et al. reported superior adaptation of framework using subtractive manufacturing as compared to additive

manufacturing.[5] Negm et al. also reported better fit of framework produced by milled PEEK in comparison to conventional methods.[12]

Slade and Spencer introduced OHIP scale which consisted of 49-item questionnaire to measure dysfunction, discomfort, and disability attributed to oral situations.[13] Since this questionnaire was long and time-consuming, Slade subsequently introduced a shorter version, the OHIP-14 with comparable reliability and validity. Same scale was used in this study to assess the oral health impact using old and new prosthesis.

Based on extensive research we were able to make evidence-based decisions in choosing the treatment plan described in this clinical report.

4. Conclusion

Distal extension cases can be rehabilitated utilizing CAD-CAM and 3D printing methods. These techniques reduce number of clinical appointments, chair time, and laboratory procedures reducing human errors. Combined conventional-digital protocols may be applied in tooth-tissue supported prosthesis to achieve maximum support from both teeth and mucosa. Using OHIP 19 questionnaire we were able to evaluate the better oral health impact using this technique.

5. Source of Funding

None.

6. Conflict of Interest

None.

References

1. Gay WD. Laboratory procedures for fitting removable partial denture frameworks. *J Prosthet Dent*. 1978;40(2):227–9.
2. Firtell DN, Muncheryan M, Green AJ. Laboratory accuracy in casting removable partial denture frameworks. *J Prosthet Dent*. 1985;54(6):856–62.
3. Williams RJ, Bibb R, Rafik T. A technique for fabricating patterns for removable partial denture frameworks using digitized casts and electronic surveying. *J Prosthet Dent*. 2004;91(1):85–8.
4. Kattadiyil MT, Mursic Z, Alrumaih H, Goodacre CJ. Intraoral scanning of hard and soft tissues for partial removable dental prosthesis fabrication. *J Prosthet Dent*. 2014;112(3):444–8.
5. Arnold C, Hey J, Schweyen R, Setz JM. Accuracy of CAD-CAM-fabricated removable partial dentures. *J Prosthet Dent*. 2018;119(4):586–92.
6. Locker D, Allen F. What do measures of "oral health-related quality of life" measure? Community Dent. *Oral Epidemiol*. 2007;35:401–11.
7. Mansour M, Sanchez E, Machado C. The Use of Digital Impressions to Fabricate Tooth-Supported Partial Removable Dental Prostheses: A Clinical Report. *J Prosthodont*. 2016;25(6):495–7.
8. Hayama H, Fueki K, Wadachi J, Wakabayashi N. Trueness and precision of digital impressions obtained using an intraoral scanner with different head size in the partially edentulous mandible. *J Prosthodont Res*. 2018;62(3):347–52.
9. Tregerman I, Renne W, Kelly A, Wilson D. Evaluation of removable partial denture frameworks fabricated using 3 different techniques. *J Prosthet Dent*. 2019;122(4):390–5.
10. Soltanzadeh P, Suprono MS, Kattadiyil MT, Goodacre C, Gregorius W. An In Vitro Investigation of Accuracy and Fit of Conventional and CAD/CAM Removable Partial Denture Frameworks. *J Prosthodont*. 2019;28(5):547–55.
11. Holmes JB. Influence of impression procedures and occlusal loading on partial denture movement. *J Prosthet Dent*. 1965;15:474–83.
12. Negm EE, Aboutaleb FA, Alam-Eldein AM. Virtual evaluation of the accuracy of fit and trueness in maxillary poly(etheretherketone) removable partial denture frameworks fabricated by direct and indirect CAD/CAM techniques. *J Prosthodont*. 2019;28(7):804–10.
13. Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. *Community Dent Health*. 1994;11(1):3–11.

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