Modified functionally generated path technique for single complete denture against non-modified natural dentition

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ABSTRACT

Background: A clinical report of a patient complaining of frequent fractures of her maxillary complete denture opposing edentulous mandibular arch is presented.

Materials and Methods: The patient was rehabilitated with a maxillary complete denture using modified functionally generated path technique to achieve harmonious occlusion between the complete denture and the natural dentition.

Discussion: Using the patient's own denture to record the functionally generated path made the technique much easier and also saved valuable chair-side time. Occlusal balancing in the trial denture bases gave us the flexibility to move the teeth slightly, or grind them in order to balance the occlusion.

Summary and Conclusion: Our modification of the functionally generated path technique resulted in successful rehabilitation of the patient without any fracture of the prosthesis in the 2-year follow-up, and has saved valuable chair-side time and laboratory effort.

Keywords: Functional chew in, functionally generated path, removable prosthodontics, single complete denture.

INTRODUCTION

Single complete denture construction against a non-modified natural dentition is a very challenging task for the dentist due to certain drawbacks like frequent prosthesis fracture, dislodgement, difficulty to obtain occlusal balance, and achieve satisfactory esthetics (due to fixed position of the natural teeth), although a variety of techniques have been suggested over the years.^{1,2} Stansbury described the first functional chew-in technique (1928) for an upper complete denture opposing lower natural teeth, based upon the work of Meyer.² Meyer developed the concept of functionally generated path for complete dentures and claimed to obtain balanced occlusion in construction of complete dentures without the need of an adjustable articulator.²⁻⁴ The materials and the equipment used were of a very simple nature but the procedure consumed a considerable amount of time.

Stansbury, in his functional chew-in technique, mounted the maxillary and mandibular casts on an articulator in centric relation at an acceptable vertical dimension. He then adapted

a new base plate and fabricated the occlusal rim made of impression compound on the edentulous cast. The compound occlusal rim was at least twice the width of the molar teeth and sufficient in height to receive an impression of the central fosse of the lower teeth. This occlusal rim was then heated and placed in the articulator to record the impression of the fosse of all opposing teeth. The occlusal rim was then trimmed bucco-lingually so that only a fin of the compound extending to the central fosse remained and the anterior region was trimmed till the level of indentation of the incisors. Carding wax was then added on the bucco-lingual sides of the occlusal fin. The assembly was then placed in the patient's mouth and the patient was asked to perform eccentric chewing movements. The opposing teeth cut their path in the soft carding wax and the compound in the central fosse acted as a guide to preserve the cusp height and a stone index was poured in this path. The original mandibular cast was placed on the articulator and maxillary teeth setting was done according to esthetics and centric occlusion. The dentures were processed, remounted, and

placed opposite the stone index. Interferences were removed in centric relation and eccentric movements to establish bilateral balanced occlusion.

The technique, when modified to a degree and applied to the construction of a single complete denture, appears to have great advantage, particularly when the denture is to be made in the existing condition of the opposing natural teeth.¹ This article presents a case report applying the functionally generated path technique to single maxillary complete denture construction, against a non-modified mandibular natural dentition.

CASE REPORT

A 60-year-old woman visited our outpatient department, with the chief complaint of frequent fractures of her upper complete dentures. Her medical history was non-contributory for dental treatment. She had her last maxillary denture fabricated 3 months back, which got fractured in the midline. Her history revealed it to be her third denture which had got fractured in a 2-year time period.

Thorough examination of the oral cavity, and radiographic assessment were done. Intra-oral examination showed a completely edentulous maxillary arch and dentulous mandibular arch (Figure 1A and B). In the mandibular arch, cervical abrasion was evident in all the incisors, left canine, both right and left premolars, and the first molars. An amalgam restoration was present in the mandibular left second molar. The mandibular occlusal plane was satisfactory without any supraeruption requiring correction. Prior to denture construction, all the teeth with cervical abrasion were restored with glass ionomer cement restoration (Ketac™ Cem Easy Mix Glass Ionomer Cement, Bangalore,

India). An acceptable level of oral hygiene was stressed and maintenance instructions were given for both the edentulous arch and the remaining natural teeth.⁵

After all prerequisite procedures were completed, the impressions of both the arches were made. Irreversible hydrocolloid impression material (Zelgan 2002; Dentsply-India, Gurgaon, India) was used for making an impression of the opposing natural dentition. The preliminary impression of the maxillary arch was made with an impression compound (DPI Pinnacle, Dental Products of India, Mumbai) and preliminary cast was poured. A custom tray was fabricated over the preliminary cast, border moulding was performed, and a final impression was made with zinc oxide eugenol impression paste (DPI Impression paste, Mumbai). The impression was boxed and poured with mechanically spatulated type III dental stone (Kalabhai, Mumbai). When set, the casts were removed from the impressions and the posterior palatal seal was established on the maxillary cast. After this, the casts were trimmed and indexed. An autopolymerizing acrylic resin (Trevalon, Dentsply Ltd, Gurgaon, India) temporary record base was constructed on the maxillary cast.^{6,7} A modeling wax occlusion rim (Metrodent, Mumbai) was made on the temporary record base.

The rim was corrected to give the desired lip support and adjusted to establish the desired vertical dimension of the occlusion. Phonetic tests, determination of the existence of adequate interocclusal distance, and esthetics were used as guides in determining the vertical dimension of the occlusion. The centric relation was recorded at the selected vertical dimension of the occlusion. A tentative jaw relation record was made and the casts were mounted on a mean value articulator. Here, we did not use an adjustable articulator because only hinge opening movement was used. Denture teeth (ACRY LUX-ruthinium, Ruthinium Dental Products Private Limited, New Delhi) were selected and

Figure 1 Pre-operative view of (A) maxillary and (B) mandibular arches.

positioned conventionally to achieve esthetics, compensating curves, and accurate occlusal plane. After the setup was complete, a trial was done in the patient's mouth.

A modification was made in the original technique, described by Stansbury. The patient's existing maxillary complete denture, which was fabricated only 3 months back, was thoroughly examined and checked for proper extensions, retention, stability, and vertical dimension. As the denture was found satisfactory, it was repaired with autopolymerizing acrylic resin. Carding wax (Metrodent, Mumbai) was added to the full width and length of the occlusal surface of the denture teeth. The entire assembly was inserted in the patient's mouth and the patient was guided to first close into centric occlusion and the indentations of the patient's mandibular anterior teeth were recorded in the carding wax. These indentations served as the future centric stops. Then, the patient was instructed to open the mouth and slowly move the jaw to either right or left (about 5 mm) and slide the jaw back into the centric position. This was repeated several times before accepting it as the final record (Figure 2). The wax indentations of the mandibular anterior teeth acted as a guide to close in the centric position. This was done for both right and left lateral excursions. Similarly, the protrusive movement was also recorded.

A small mix of type-three dental stone was made and vibrated into the wax paths of the cusps to a depth of about 10 mm. After the stone was set, the wax was cleaned from the stone core. The stone core (Figure 3) was attached to the articulator against the waxed denture and its occlusal contacts with the stone core were carefully examined.

The maxillary denture teeth were set or ground to fit the functionally generated path as recorded in the stone core. All the interfering spots were carefully ground until the incisal guide pin prevented further closure to establish maximum bilateral balanced occlusion in the centric and eccentric movements. The setup was tried in the patient's mouth for esthetics, centric, and eccentric balance. The patient's acceptance for the esthetic result was obtained before processing the denture. The waxed denture was placed in the articulator to verify the occlusion before flasking. A refractory cast duplicate of the master cast was used to fabricate the metallic denture palate extending up to the crest of the residual ridge. This was finished, polished, seated on the master cast, and the denture was processed in the usual manner.⁸ After processing, remounting of the casts was done and the increase in vertical dimension of occlusion and occlusal discrepancies were corrected by selective grinding of the teeth on the articulator (Figure 4). After proper finishing and polishing, the denture was inserted in the patient's mouth. Smooth protrusive and lateral excursions without deflusive occlusal contacts were achieved.

The patient satisfactorily accepted the denture and has been using it comfortably for the past 2 years without any adverse event, as evident in the recall scheduled appointments (Figure 5).

DISCUSSION

The described case utilized the functionally generated path technique for the fabrication of single complete dentures using simple procedures which can be easily performed in a dental office without requiring specialized equipment. The functionally generated path is a method of developing accurate occlusal relationships on simple instrumentation without using a semi- or fully-adjustable articulator that has been programed to match the patient's mandibular movements.^{9,10} The patient's own functional jaw movements were used to form a three-dimensional opposing cast or template. Although, this record looked somewhat bizarre, it represented the dynamics of mandibular movement and eliminated the need for an articulator capable of eccentric movements.¹¹

A more exacting technique with complicated instruments for achieving a harmonious occlusion in single complete dentures would have been cumbersome and often impractical for all cases. In this technique, the patient chewed in a kinetic record of his own jaw movements in gliding and masticatory mandibular excursions. These centric and eccentric records were used to achieve a harmonious occlusion in a single complete denture without modifying the natural dentition of the patient. Vig described a similar technique like Stansbury but he recommended the use of a fin of a resin placed into the central grooves instead of a compound.¹² The resin fin reportedly maintained vertical dimension better than the compound.

Sharry, 1968, described a simple technique by using a maxillary rim of softened wax. In his technique, the wax was abraded by lateral and protrusive chewing movements to generate the functional paths of the mandibular teeth cusps. This was continued until a correct vertical dimension was established.¹³ Single complete dentures should have balanced the occlusion to avoid unfavorable leverages that develop when the natural teeth oppose a complete denture promoting poor stability and retention, as well as early fracture of the prosthesis and concomitant patient dissatisfaction.⁵

The first modification in the technique was that we used the patient's existing denture instead of modeling the compound occlusal rim as the prosthesis was satisfactory in terms of retention, stability, border extensions, and vertical

Figure 2 Functional chew-in record.

Figure 4 Processed denture showing even distribution of the occlusal contacts.

Figure 3 The stone core.

dimension. By doing this, we were able to save valuable chair-side time and an extra step of the laboratory. Our second modification was to achieve the balancing of the occlusion in the trial denture base itself, against the stone index, instead of after processing. Our logic was that this gave us more flexibility in teeth setting, by having the freedom to move the teeth slightly, or grind them in order to balance the occlusion. Thus, only minor grinding of the teeth to correct discrepancies was required after denture processing.

Metallic denture base was used because the patient's chief complaint was frequent fracture of the prosthesis. Better thermal conductivity, dimensional stability, and lack of bulk with greater strength are the advantages of metallic denture base.¹⁴ The limitations of this technique are that it may not be feasible if the existing denture is not stable, the patient does not have good neuromuscular control, or the patient's existing dentition has severe occlusal plane discrepancy. Such an occlusal plane discrepancy would lead to

Figure 5 Denture seated in patient's mouth at 2-year follow-up.

total loss of cuspal anatomy of the prosthetic teeth and balanced occlusion would be difficult to attain.

CONCLUSION

Harmonious occlusion between the maxillary complete denture and the mandibular natural dentition can be obtained by modifying Meyer's functionally generated path technique. In this technique, the paths of opposing cusps are recorded in their gliding motions by means of a wax rim and the teeth are set against a stone positive of this chew-in. We simplified and modified the existing technique by using the previous denture for generating the functional path record and perfecting the occlusion in the trial denture itself.

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Erratum

The December 2011 edition of *JOBCR* (*Journal of Oral Biology and Craniofacial Research* 2011;1:44–6) had an article titled “Metastatic adenocarcinoma of the mandible—a rare entity”.

The Figures 1 and 2 that appear on pages 44 and 45 of the above article stands corrected as below.

Figure 1 Orthopantomogram showing osteolytic lesion in the mandible.

Figure 2 Computed tomography scan of abdomen showing malignant areas in the liver and adjoining structures.

We regret for the inconvenience.