CASE REPORT / *CAS CLINIQUE*

Removable Prosthodontics / *Prothèse Amovible*

REHABILITATION OF A PATIENT WITH SINGLE COMPLETE TOOTH SUPPORTED OVERDENTURE AGAINST THE UNMODIFIED NATURAL DENTITION USING FUNCTIONALLY GENERATED PATH TECHNIQUE- A CASE REPORT

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Abstract : Meyer's proposed chew-in technique also called functionally generated path (FGP) technique, is indicated for the restoration of an edentulous arch that is opposed by natural teeth as it does seem to provide the most accurate method of recording occlusal patterns, also help to minimize the effects of negative factors, and to overcome the deficiencies of articulators. As stated by Rudd and Morrow, this technique is especially suitable for tooth-supported complete dentures, due to inherent stability of tooth-supported record bases helps in recording jaw relationships accurately. Whenever a single complete denture is opposed by natural dentition, problems observed are abrasion of the artificial acrylic resin teeth and frequent fractures of resin denture base due to occlusal stresses. Hence this case report describes the single complete tooth supported overdenture with a metal-based denture and metal occlusal surfaces against unmodified natural dentition which has shown to achieve a good denture stability with occlusal harmony, and patient satisfaction.

Keywords: balanced occlusion, functionally generated path technique, overdenture, single complete denture, stability

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RÉHABILITATION D'UN PATIENT PAR UNE PROTHÈSE COMPLÈTE SOUTENUE PAR UNE SEULE DENT, EN REGARD D'UNE DENTITION NATURELLE NON MODIFIÉE À L'AIDE DE LA « FUNCTIONAL GENERATED PATH TECHNIQUE » – A PROPOS D'UN CAS

Résumé : La technique de mastication proposée par Meyer (FGP), est indiquée pour la restauration d'un arc édenté opposé à des dents naturelles puisqu'elle semble fournir la méthode la plus précise d'enregistrement des modèles occlusaux. Elle aide également à minimiser les effets des facteurs négatifs, et à pallier aux déficiences des articulateurs. Comme indiqué par Rudd et Morrow, cette technique est particulièrement adaptée aux prothèses complètes à appui dentaire, car la stabilité inhérente des bases d'enregistrement à appui dentaire aide à enregistrer avec précision les relations entre les mâchoires.

Chaque fois qu'une prothèse complète unique est opposée à la dentition naturelle, les problèmes observés sont l'abrasion des dents artificielles en résine acrylique et les fractures fréquentes de la base de la prothèse en résine dues aux contraintes occlusales. Par conséquent, ce cas clinique décrit une prothèse complète à base métallique, supportée par une seule dent, avec des surfaces occlusales métalliques contre une dentition naturelle non modifiée et qui a démontré une bonne stabilité avec une harmonie occlusale et a obtenu la satisfaction du patient.

Mots clés: Occlusion équilibrée, technique de Meyer, prothèse amovible unitaire, stabilité.

Introduction

The Meyer's concept (1960) of functionally generated path (FGP) for construction of complete dentures claimed to obtain balanced occlusion without the requirement of an adjustable articulator. He named it as a chew-in technique which is classically described as "3D static expression of dynamic tooth movement". Primarily this technique is indicated for the restoration of an edentulous arch that is opposed by natural teeth as it does seem to provide the most accurate method of recording occlusal patterns, also help to minimize the effects of negative factors, and to overcome the deficiencies of articulators [1,2,3]. Rudd and Morrow stated that a proper occlusion can be established by using a functionally generated path (FGP) technique [3].

This technique is notably suitable for tooth-supported complete dentures, due to inherent stability of tooth-supported record bases helps in recording jaw relationships accurately [3].

Overdentures offer better support, preserve the alveolar bone, and greatly enhance the patient's denture coordination and ability to control the denture in his or her physiologic environment due to sensitive ability to be aware of occlusal contact [2].

The problem with single complete denture opposing natural teeth is that of abrasion of the artificial acrylic resin teeth and frequent fractures of resin denture base due to occlusal stresses [2]. Hence this case report describes the single complete tooth supported overdenture with a metal-based denture and metal occlusal surfaces against unmodified natural dentition which has shown to achieve a good denture stability with occlusal harmony, and patient satisfaction.

Case Report

Clinical findings:

A 65-year-old male patient reported to the Department of Prosthodontics, Crown and Bridge, Dr. D. Y. Patil Dental College and hospital, Pimpri with the chief complaint of inability to chew food due to multiple missing teeth of upper jaw and wanted to get them replaced. Patient presented with history of diabetes and hypertension for 15 years and was on the medication for the same. Also, patient had habit of smoking and tobacco chewing for past 15 years which he had quit since a year. Patient had multiple carious and decayed upper teeth for which he underwent extractions a few months back.

Patients intraoral and extraoral examination showed that only teeth 13 and 23 were present in maxillary arch and mandibular complete dentition was present (Figure 1A).

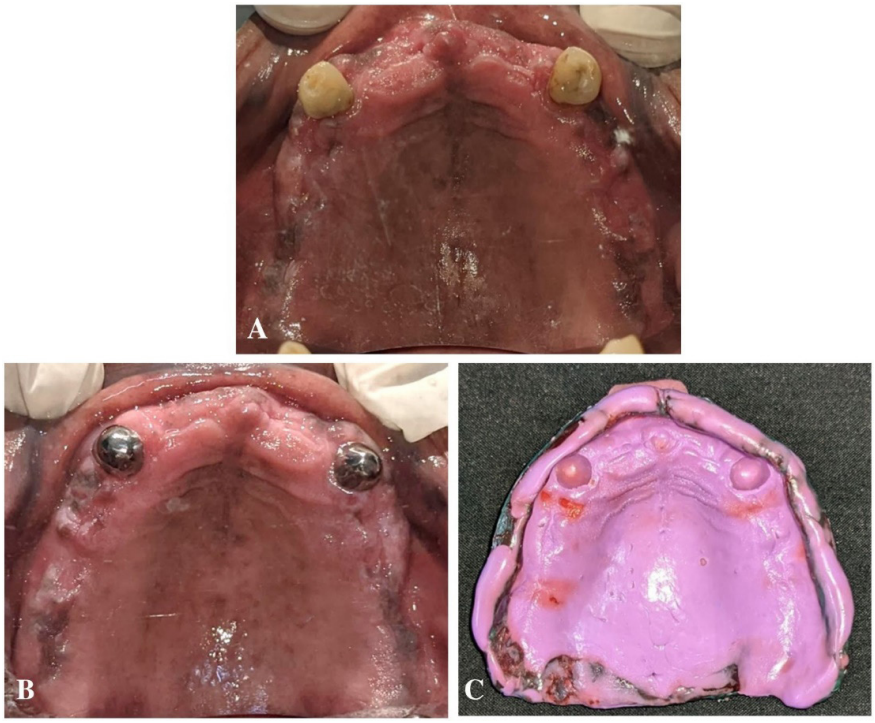

Figure 1: A) Intraoral Preoperative view of maxillary arch, B) Short overdenture copings in situ, C) Border molding and final impression of maxillary arch

Radiographic_examination of a case revealed that teeth 13 and 23 were endodontically treated. Other findings associated were grade 1 recession present with mandibular anterior teeth but none of the teeth were mobile.

Considering patient's clinical and radiographic findings, different fixed and removable treatments options were proposed to the patient. Amongst the treatment options given, the patient opted for maxillary tooth supported overdenture with metal occlusal surfaces against his natural mandibular teeth. Patient's written informed consent was obtained before proceeding to the treatment procedure.

Short copings as overdenture attachment:

For the planned maxillary tooth supported overdenture fabrication procedure, primary impressions were made for maxillary and mandibular arch using with irreversible hydrocolloid impression material (Alginex, India) and poured with dental stone (Kalabhai, India) and primary casts were obtained. Tentative jaw relation was recorded, and evaluation of space was done to decide the type of copings to be used as an overdenture coping.as available space was 8mm from occlusal plane to ridge, short copings were planned as overdenture copings.

As 13 and 23 were already endodontically treated, post space preparations were done maintaining four mm post length and cham-

fer finish line cervically for metal copings. Patterns for short copings were fabricated with tapered buccal wall and parallel mesial and distal walls. Casted copings were cemented using zinc phosphate cement (Figure 1B).

Metal framework fabrication:

Border moulding of maxillary arch was carried out using a green stick compound (DPI, India) and final impression was made with polyvinyl siloxane elastomeric impression material (3M ESPE, Germany) (Figure 1C). Beading and boxing of final impression was done, and Master cast was obtained. Working cast was obtained by duplicating master cast on which pattern for metal framework was designed. Incisive papilla was relieved, four tissue stops were given and was kept short of posterior palatal seal area to allow adjustability of the posterior palatal seal (Figure 2A). Pattern was casted and metal denture base was obtained. Intraoral trial of metal framework was done for fitting and extension (Figure 2B).

On this metal denture base maxillary record base was fabricated in autopolymerising acrylic resin using dough method (DPI-RR cold cure acrylic resin, India) followed by wax occlusal rims made using modelling wax (MAARC, India). Modelling wax occlusal rim was adjusted for adequate lip support; aesthetics, phonetics was evaluated and adjusted to establish the desired vertical dimension of the occlusion (VDO). Facebow transfer was done to orient the maxillary cast followed by recording an accurate centric relation at an acceptable vertical dimension of occlusion (Figure 2C). Maxillary and mandibular casts were then mounted on Hanau Articulator.

Recording of Functional generated path and stone core fabrication:

On the same mounted master cast additional record base was fabricated and occlusal rim was made using impression compound. It was kept 2 mm short in height in anterior region and in the posterior region established VDO was maintained by extending the impression compound ridge into the central sulci of the opposing mandibular teeth, occlusion rim was reduced until the buccal and lingual cusps of the mandibular teeth do not touch the occlusion rim. Posterior width of occlusal rim was kept twice of buccolingual width of molar teeth (Figure 3A and 3B).

For recording functionally generated path, recording wax was added to the full width and length of the impression compound occlusal rim [3]. It was inserted in the patient's mouth and patient was guided to close into centric relation position. Vertical dimension was re-evaluated as per previous measurements. To record simulated functional movements in the wax the patient was instructed to protrude about 6 mm from retruded position. Lateral excursive movements were recorded by instructing to slowly move the jaw to one side then back into the centric position and similarly on other side. Before considering the record as a final record, the movements were repeated several times (Figure 3C).

To transfer the final record to an articulator, the opposing mandibular cast was removed. The generated wax path record with compound rim was placed on the master cast, boxing was done carefully, and mounted on the articulator using minimal-expansion dental stone. Thus, the stone core was obtained (Figure 3D).

The wax residues were cleaned from the stone core. Teeth setting was completed against the stone core (Figure 3E). The try-in of same was done where aesthetics, vertical dimension and phonetics for patient were assessed.

To minimise the wear of resin teeth against natural dentition, metal occlusal surfaces were given on maxillary posterior teeth. For which, posterior acrylic teeth were modified to receive metal occlusal surface. One mm shoulder finish line overall with proximal grooves for retention of castings was given on each posterior tooth (Figure 4A). Inlay casting wax was used to make patterns on these modified teeth to

Figure 2: A) Wax pattern for metal framework, B) Intraoral metal framework trial, C) facebow record

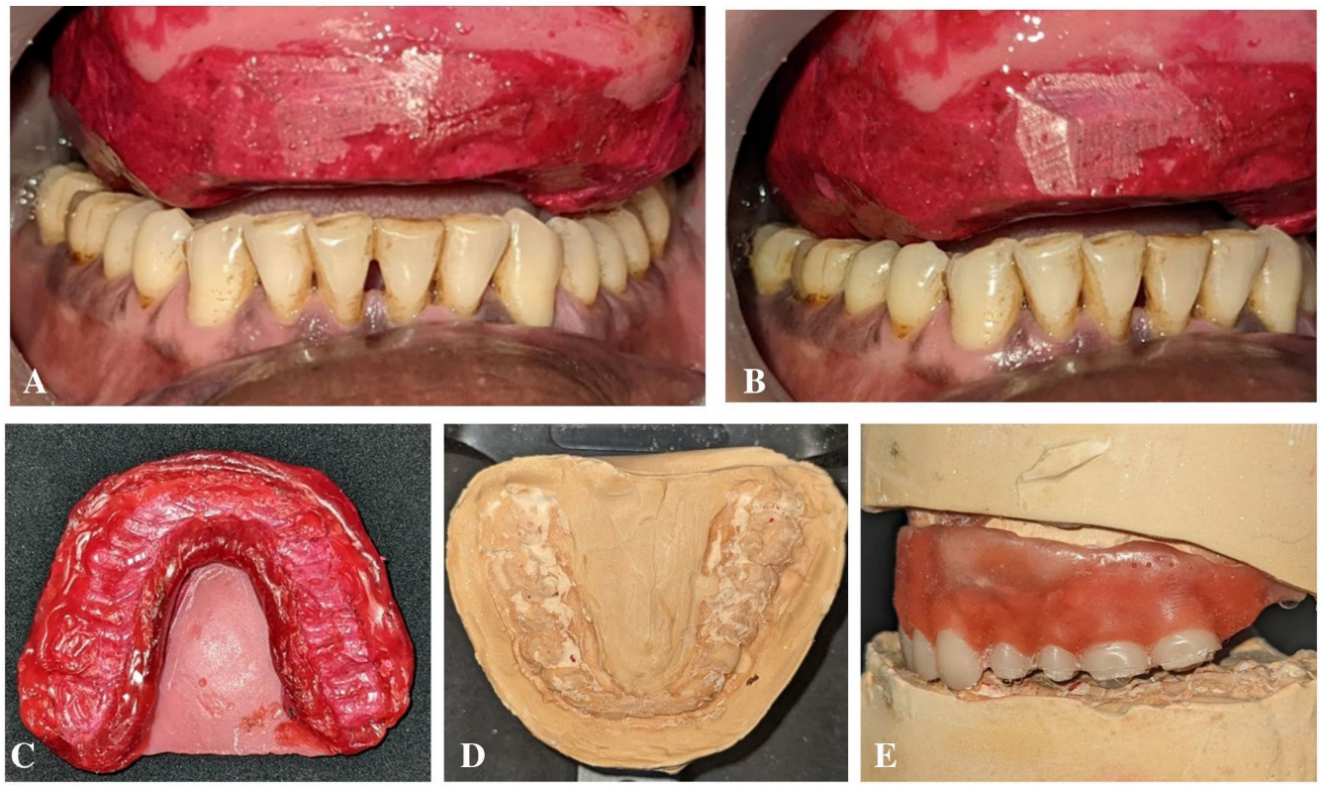

Figure 3: A) Impression compound occlusal rim fabricated on a record base with anteriorly 2 mm space, B) Posteriorly compound ridge extending into mandibular sulci to maintain VDO, C) recorded Functionally generated path, D) Stone core, E) completed teeth setting with modified acrylic teeth

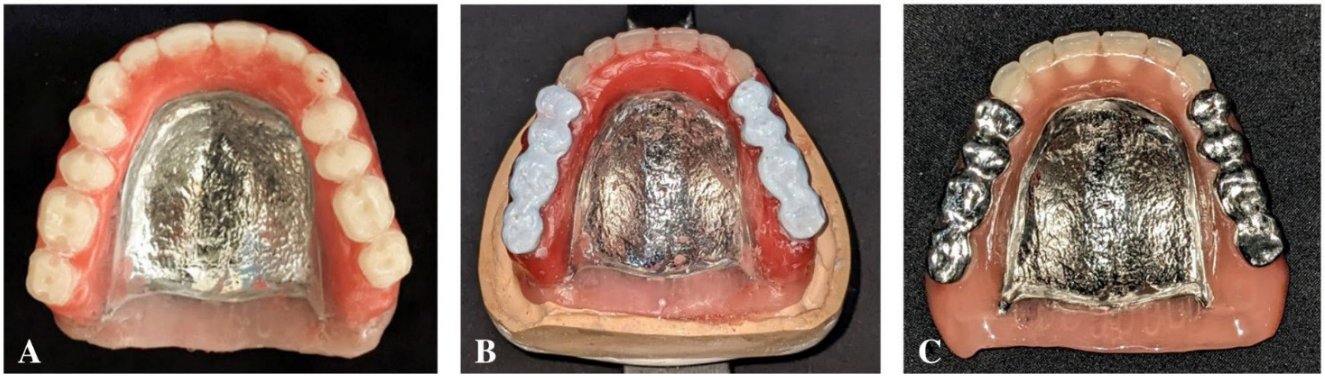

Figure 4: A) Modifications done on acrylic denture teeth with shoulder finish line and proximal grooves for retention, B) casting wax used for making patterns of metal occlusal surfaces and its occlusion adjusted using stone core, C) cemented finished and polished metal occlusal surfaces

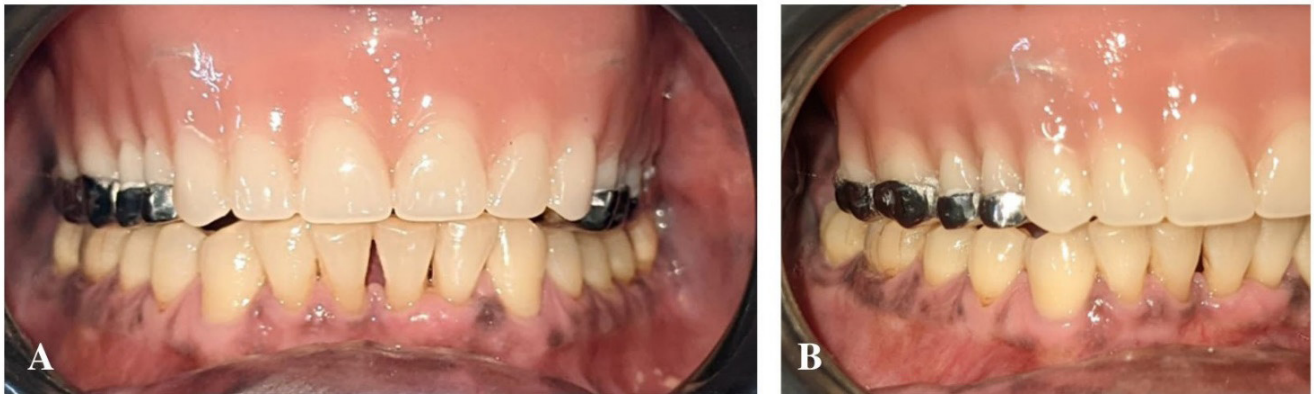

Figure 5: Final metal-based denture insertion with metal occlusal surface A) frontal view, B) right lateral view

Figure 6: Pre-operative and Post-operative Extraoral View right lateral view

fit that generated path as recorded in the stone core. Any premature or interfering contacts were removed and maximum bilateral balanced occlusion in the centric and eccentric movements with smooth lateral excursive movements was obtained as per the generated path (Figure 4B).

The patterns were casted in nickel free base metal alloy. Casted metal occlusal surfaces then tried for fitting on the modified acrylic teeth during which vertical dimension with trial denture base was assessed, if any required correction as per the stone core was done. Polished metal occlusal surfaces were cemented using resin-modified glass ionomer cement (Figure 4C).

Conventional complete denture processing using heat cure acrylic resin (Triplex, Ivoclar Vivadent) was carried out. Final processed denture was finished and polished.

During denture insertion, occlusion was evaluated in centric and eccentric position and denture (Figure 5A and 5B) and oral hygiene instructions were given to patient. Patient was recalled after 24 hours, 1 week and 1 month. The patient reported comfortable and satisfactory chewing efficiency with the denture (Figure 6).

Discussion

Successful use of complete denture by patients depends on different factors of which three mains are retention, stability, and support. But amongst that too, stability is considered as the most important component [4]. Sharry has stated, "single dentures represent a vigorous challenge to the practicing dentist. In no other complete denture treatment are there so many factors that tend to negate the forces of retention and stability" [5]. Hence, achieving harmonious balanced occlusion is important for a stable complete denture.

When natural teeth oppose a complete denture, it is almost always required some amount of recontouring to achieve a harmonious occlusion. It is because of three reasons as given by Ellinger which are: 1) unfavourable the inclination of the occlusal plane, 2) malposed individual teeth with excessively steep cuspal inclines, and 3) too wide the buccolingual width of the natural teeth [6].

Meyer's proposed Generated path technique or functional chew-in technique also called cuspal tracing technique is a highly versatile method for constructing occlusion for removable as well as fixed dental restorations. It is a method of developing accurate occlusal relationships on a simple instrumentation and recording the patient's own functional jaw movements to form a three-dimensional opposing stone core or template. Although this record looks unusual, it represents the dynamics of mandibular movement and eliminates the need of a programming of an articulator depending on eccentric movements [1]. Occlusion achieved by this technique is in great harmony with patient's guidance and neuromuscular control and needs minor postoperative intraoral adjustments [7].

As suggested by Rudd and Morrow, this technique is notably suitable for tooth-supported complete dentures i.e., overdenture as stability offered to record bases due to tooth support helps in recording jaw relationships accurately [3]. The method is contraindicated when the desired jaw movements and the necessary record base stability cannot be achieved, insufficient denture space, and the poor neuromuscular control is present [2]. By using the tooth supported base we could achieve enhanced stability to denture bases while recording functional path. This method also helped provide accurate occlusal patterns and saved chair side time as very few occlusal adjustments were required during denture insertion [2].

Single complete denture often poses a problem of midline fracture. According to Koper, this can be due to one of the following reasons: a) occlusal stress from teeth and musculature accustomed to opposing natural dentition, and b) improperly aligned position of the mandibular teeth, which may not offer bilateral balance for stability, and c) flexure of the denture bases [5]. Hence metal based denture base was fabricated as maxillary single complete overdenture was opposed by natural dentition. In addition, metal-based denture offers several different advantages such as better thermal conductivity, dimensional stability, and lack of bulk with greater strength [1].

Wear of occlusal surfaces of denture teeth over a period is common phenomenon which results in altered vertical dimension, decreased

masticatory efficiency etc [8]. Hence use of wear resistant denture teeth such as porcelain teeth or teeth with cast metal occlusal surface or use of silver amalgam fillings in occlusal contact areas of teeth can be incorporated [8]. Since porcelain teeth are expensive and causes wear of natural teeth and silver amalgam fillings incorporate only fossa region, we used cast metal occlusal surfaces which entirely covered occlusal surface. Use of metal occlusal surfaces has its disadvantages such as increased weight of prosthesis, mechanical interlocking with acrylic teeth and altered aesthetics. As patient was expecting better functional efficiency and was less concerned about his aesthetics, cast metal occlusal surfaces were fabricated.

Conclusion

This case report describes the use of functionally generated path technique that utilizes the patient's own jaw movements to develop a bilaterally balanced occlusion. When carefully recorded it accurately records occlusal pattern and saves chair side time as very minimal adjustments required post-insertion. Additional lab step is required but is essentially simple, accurate, and reliable.

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