Case Report

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MANAGEMENT OF FRACTURED MANDIBULAR SINGLE COMPLETE DENTURE OPPOSING MAXILLARY NATURAL DENTITION BY THE IMPLEMENTATION OF FUNCTIONALLY GENERATED PATH TECHNIQUE: A CASE REPORT

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ABSTRACT:

The single complete denture is a complex prosthesis that requires a complete understanding of the basics of prosthetic rehabilitation of lost natural dentition. Several difficulties are encountered in providing a successful single complete denture treatment, the most common being repeated fracture of the prosthesis and lack of understanding of occlusal scheme on existing natural dentition. An ideal solution to strengthen the single complete denture bases is to provide metal reinforcement by fabrication of metal based single complete denture and implementation of functionally generated pathway (FGP) technique for registering the occlusal pathways in the functional wax and has been classically described as the "three dimensional static expression of dynamic tooth movement."

This clinical report describes the treatment of a mandibular complete edentulous patient in which occlusion was developed using the FGP procedure and single complete denture was strengthen by complete metallic denture base . The FGP technique utilizes the patient's masticatory system to develop occlusion and has the advantages of being simple, accurate, and reliable. If the FGP technique is properly accomplished, only minor intra oral occlusal adjustments are necessary.

Key words: Functionally generated path technique, chew in technique, metallic denture base, cuspal tracing technique

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, dislodgment, 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 [1-5]. Stansbury described the first functional chew-in technique (1928) for an upper complete denture opposing lower natural teeth, based upon the work of Meyer. 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. The materials and the equipment used were of a very simple nature but the procedure consumed a considerable amount of time[6].

The functionally generated pathways (FGP) of occlusion refer to the registration

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of the paths of movement of the occlusal surfaces of the teeth of one dental arch, to the teeth or occlusion rims of the opposing arch, recorded with the help of a plastic medium[7]. With a proper knowledge and skill FGP is a practical method to obtain harmonious occlusal anatomy with static representation of the opposing cusps dynamic eccentric movements from a centric position in co-ordination with the neuromuscular system. The technique of obtaining such records consists of registering the three-dimensional (3D) occlusal pathways of cusps of posterior teeth in the functional wax, with acceptable condylar and anterior guidance and normal occlusal anatomy[8]. The occlusion achieved with the help of this technique is considered to be in great harmony with controlling factors of occlusion namely, the anterior and condylar guidance, occlusal cusps, and the neuromuscular system. Classically, the FGP occlusion has been described as "3D static expression of dynamic tooth movement," since exact occlusal pathways of posterior teeth are captured three-dimensionally in the functional wax[9]. The technique was introduced by Meyer[10-12] almost 70 years ago, which he termed as the "chew-in" technique, and since then various researchers have refined the procedure. Over the years, the technique has been known by various names such as "functional chew-in technique," "functional bite technique," "generated path technique," and "cuspal tracing technique"[13]. The FGP is highly versatile and has been employed with equal efficacy in fabrication of relatively simple restorations such as a single crown, or more complex full mouth reconstructions. It has also been used in developing occlusion for complete and partial dentures and dental implant restorations[3].

CASE DETAIL

A 52-year-old male patient, reported to the Department of Prosthodontics, with a chief complaint of recurrent fracture of mandibular single complete denture. Intra oral examination revealed complete mandibular edentulous with resorbed anterior region and opposing maxillary natural dentition with missing left molar teeth. Second molar drifted mesialy leaving less space for replacement for missing molar teeth. (Fig: 1) The maxillary occlusal plane was satisfactory with mild supra eruption requiring correction. Patient was not willing for restoration of missing left molar teeth. Mucosa on the mandibular edentulous ridge was firm and healthy (Fig:2). Saliva was of medium consistency and patient was cooperative and philosophical according to House classification. Considering all the factors and history of denture fractures, metallic denture base was planned for mandibular single denture and to improve the harmonious occlusal anatomy by implementation of functionally generated path technique.

Prosthetic Phase:

Primary impression of edentulous mandible was made with reversible impression compound (DPI pinnacle) by

muco - compressive impression technique and impression was poured with dental plaster and primary cast was obtained for construction of special tray. Maxillary impression was made with irreversible hydrocolloid and poured with dental stone to form a diagnostic cast.

The custom tray was prepared with auto polymerizing acrylic resin (DPI) for border moulding and final impression. Border moulding was made using green stick compound (DPI) and zinc oxide eugenol impression material for final impression and poured with dental stone to obtain a Master cast.

Design and fabrication of metallic denture base:

Required block out was done for the master caste. Duplication is done using Agar-Agar hydrocolloid duplicating material and refractory cast was poured. On refractory cast, the pattern wax adapted (0.4 mm casting wax covering the entire residual ridges with retentive beads extends on ridge) and the sprues were attached and invested. The denture base was casted with cobalt chromium metal. After retrieval of the casting, it was finished and electro polishing was done with electro polishing liquid (Fig: 3). Occlusion rim on the mandibular metal denture base was constructed and contoured for adequate lip support and for proper vertical and horizontal overlapping of anterior teeth. Maxillary cast was mounted on a semi adjustable articulator (Hanau Wide Vue) using spring bow ear piece type of face bow whereas mandibular cast was mounted after bite registration was recorded at the established occlusal vertical dimension (Fig:4)Vertical dimension at occlusion and vertical dimension at rest were assessed by phonetic evaluation, measurement of inter-occlusal space and evaluation of facial appearance. Second record base was fabricated with auto polymerizing resin for recording functionally generated path technique.

Recording the functionally generated pathway:

Procedure

The FGP records were planned to record the maxillomandibular relationship. Before recording the FGP, it was confirmed that the temporary record base was firm, stable, and retentive intra orally. It was also examined that there were no interferences in the anterior guidance and the posterior teeth had acceptable occlusal anatomy. Occlusion rim was created on the temporary denture base using hard inlay wax, carding wax and boxing wax, and visible gap was left between opposing teeth and the rim initially. When wax hardens index was removed, checked for vertical dimension on the articulator. Superficial occlusal surface of the wax rim was softened and asked patient to close in centric occlusion to indent the soft wax. It was ensured that all natural teeth were in contact, and the record base was removed when the wax got hardened. Wax was softened again, and the previous exercise was repeated. Now, the patient was instructed to protrude his mandible in forward direction without losing teeth-contact

until the incisors were at edge-to-edge relationship. Similarly, the lateral excursive pathways were also recorded for both right and the left side. The patient was instructed to glide the mandible through all possible excursive movements to ensure capturing all border movements. The wax was repeatedly softened between each biting episode. Once all excursive pathways were recorded, the record was hardened by keeping under the cold water. It was observed that the wax was smoothly carved and shaped by the stylus action of the opposing maxillary cusps (Fig:5). Beading and boxing was done and areas for vertical stops were left exposed, and it was filled with the dental stone to form occluding template (Fig:6).

The counter part of the lower functional occlusal wax path is poured in stone and was mounted on same articulator using another mounting plate. The upper stone occluding path to which the lower teeth are set is thus arrived at automatically and it is in geometric harmony with the condylar paths. The outline of the lower occlusal rim with metallic base was marked and mandibular teeth are set against the stone path in their proper bucco-lingual direction.The cross-linked acrylic resin teeth were selected and arranged, though a perfect balanced occlusion is impossible to achieve in such cases with involvement of natural teeth, a maximum effort was made to get an occlusion which was as close to balanced occlusion, and then progressively modified to exactly fit the occluding template at the established vertical dimension Trial of waxed up mandibular denture (Fig:7) was done followed by acrylization of complete denture with heat polymerizing acrylic resin. Interferences in denture were eliminated by lab and clinical remounting and denture is inserted in patient mouth (Fig:8). The patient was satisfied with the outcome of the denture. Post insertion instructions were given to the patient regarding maintenance and use of the prosthesis. At the 3 and 6months recall visits, no treatment complications were noted

DISCUSSION

The situation in which a patient has become entirely edentulous in one jaw while retaining either all or some of his natural teeth in the others is not uncommon. Neither is it uncommon to find that the successful complete denture for such a patient is often very difficult and on occasions virtually impossible [14]. There are two reasons for this difficulty. The first is related to firmness and rigidity with which the natural teeth are retained in the bone and the magnitude of the force they can resist or deliver without discomfort or displacement. The second reason is related to the occlusal form of the remaining natural teeth, which will of necessity dictate the occlusal form of the denture. The natural teeth may be over-erupted or tilted and their cusps high and sharp. As a result, occlusion and articulation will involve contacting of the inclined planes of the cusps in such a way that the denture will continually be thrust or dragged horizontally on the ridge [15].

According to Koper[16] occlusal problems and denture base fracture seen in single complete denture are the result of one or all of the following: occlusal stress on maxillary denture and underlying edentulous tissue from teeth and musculature accustomed to opposing natural teeth, the position of the mandibular teeth which may not be properly aligned for the bilateral balance needed for stability and flexure of denture base. One of the difficult clinical situations involving a single denture is that of a complete lower denture and upper natural teeth, and it will require some degree of contouring to provide a harmonious occlusion. The reasons for such alteration are mainly due to (1) Unfavorable inclination of the occlusal plane (2) Mal positioned individual teeth which have assumed positions, resulting excessively steep cuspal inclinations, and (3) Wide bucco-lingual width of the natural teeth. The natural teeth are firmly and rigidly retained in the bone and they can resist or deliver greater magnitude of the force without discomfort or displacement. This force has been recorded as high as 198 lb on single molar teeth. This is in sharp contrast with the force which a complete denture, resting simply on the delicate mucosa of the ridge, can resist or deliver. This force has been established as being a maximum static load of 26 lb[15]. Occlusal stress on the mandibulur denture and the underlying edentulous tissue due to forces from teeth and musculature and opposing natural teeth which are improperly aligned may lead to tissue changes of the residual ridge followed by discomfort, occlusal problems and fracture of denture bases. To overcome these problems, two things are necessary. First, full use must be made of every factor which favor success, and no minor error or imperfection which might perhaps have been tolerated in conventional single complete denture construction should be accepted. Second , the forces to which the denture is subject must be reduced as much as possible by appropriate preparation or restoration of the remaining natural teeth so as to provide an acceptable occluding surface[15].

Classification of single complete denture [16]:

•Class 1 - Patients for whom minor, or no, tooth reduction is all that is needed to obtain balance.

•Class 2 - Patients for whom minor additions to the height of the teeth are needed to obtain balance.

•Class 3 - Patients for whom both reductions and additions to teeth are required to obtain balance. The treatment of these patients usually involves a change in vertical dimension of occlusion.

•Class 4 - Patients who present with occlusal discrepancies that require addition to the width of the occluding surface.

•Class5 - Patients who present with combination syndrome.

Heat polymerized dentures are the dominant material for the fabrication of denture bases. These heat polymerized denture base resins present acceptable physical, biologic and esthetic characteristics at moderate expense. However, denture base resins in single complete dentures has been frequently found to fracture under excess masticatory forces. Metal bases have been proved to be a valuable alternative for denture bases opposing natural dentition to strengthen bases and to prevent them from fracture. However, weight of metal can be a problem and to minimize weight, with maximum strength better thermal conductivity, dimensional stability, and lack of bulk with greater strength are the advantages of metallic denture base. Proper palatal contours should be ensured and the resin-metal junction must be carefully positioned and sculpted. Properly designed metal denture bases can aid in conserving the supporting tissues of the denture bearing areas [17].

The FGP technique is highly versatile and has been employed with equal efficacy in fabrication of crown, bridge, complex full mouth reconstructions, complete, and RPDs as well as dental implant restorations. This technique has the distinct advantages of being able to record all dimensions of such border movements at the correct vertical as they are directly influenced by both condylar guidance and anterior guidance [18-20]. The FGP technique can be performed easily excellent results. But it demands great care and meticulous attention to detail with proper knowledge about the technique. It is recognized that the Pankey–Mann philosophy of occlusal rehabilitation was originally a combination of the Monson spherical theory and the Meyer functionally generated path technique, where they attempted to gain bilateral balance in eccentric movements [21-23]. The Pankey–Mann–Schuyler philosophy retains the FGP technique, except that the balancing side contacts are eliminated due to their traumatogenic effect on the masticatory system. If the FGP technique is properly accomplished, only minor intra oral occlusal adjustments are necessary. Besides, the availability of the sophisticated fully adjustable articulators, the FGP still remains a technique that is simple, reliable, and unsurpassed in accuracy. 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. Occlusal paths and cuspal paths generated on mechanical articulators are different from those generated in the mouth. Occlusal paths and cuspal paths generated in the mouth provide records which are in complete harmony with condylar paths and neuromuscular system. Occlusal interferences resulting from processing errors can be eliminated by grinding occlusal surfaces of the teeth to conform to stone cuspal path. Hence a balanced denture which functions harmoniously

with movements of the condyles in the glenoid-fossae is achieved [24].

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 [25]. 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

CONCLUSION

Harmonious occlusion between the mandibular complete denture and the maxillary natural dentition can be obtained by implementing Meyer's functionally generated path technique. The principles and procedures involved in the generated path technique are in harmony with anatomic, physiologic, and neurologic factors involved in occlusion. This technique provides the records which are guided by the automatic nerve control of the muscles of mastication and are in complete harmony. "The human jaw, with all its limitations, with all its interferences, and with all its problems created by habit, makes the best articulator. Consideration should be given to the patient's individual pattern of chewing." Functionally generated path technique utilizes the patient's masticatory system to develop occlusion and has the advantages of being simple, accurate, and reliable.

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FIGURES:

Figure1: intra-oral view maxilla

Figure 2:intra-oral view edentulous mandible

Figure 3: Mandibular Metallic denture base

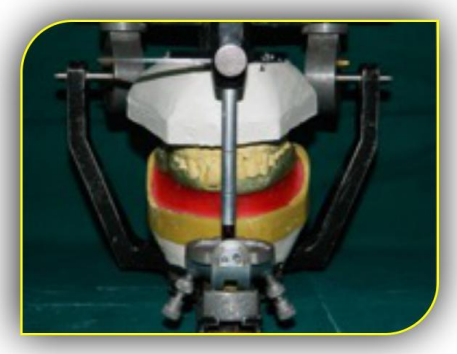

Figure 4: Face Bow transfer and Jaw relation

Figure 5: FGP record

Figure 6: FGP template

Figure 7: Try in Procedure

Figure 8: Final Prosthesis