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An Insight In to Functionally Generated Pathway: A Review Article

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Review Article
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ABSTRACT

The functionally generated path technique is a different method to achieve occlusal harmony in the oral cavity. Other than using an articulator to simulate the movement of the mandible, this technique utilizes a tracing. This is made directly in the mouth to capture the pathways travelled by the opposing cusps during mandibular function. This article discusses the functionally generated path technique in detail.

Keywords: Functionally Generated Pathway, Double Casting Procedure, Fixed Partial Denture, Twin Stage Occluder.

Introduction

The functionally generated path (F.G.P.) is a static representation of the opposing cusp's dynamic eccentric movements from a centric position to realize optimal articulation and occlusal harmony. The F.G.P. technique can record such eccentric movements at the correct occlusal vertical dimension (O.V.D.), as the eccentric movements are influenced by both the anterior guidance and the condylar guidance.[1]

The conventional construction technique is unsuccessful in producing a prosthesis that can be inserted without intra-oral occlusal adjustment. The functionally generated path technique uses a different approach to achieve occlusal harmony between restoration and other teeth in the mouth.

This system uses a tracing made within the mouth to capture the pathways traveled by the opposing cusps during mandibular function.[2]

History

McCollum and Stuart, in 1955, described the Gnathological concept. Incisal guidance is an independent entity and is independent of condylar guidance. On the side, they stated the condylar path or posterior guidance is a fixed entity.[3]

Von Spee, in 1890 described the vertical overlap ''overbite'' of the cuspids, which was overlooked entirely. In 1915, he gave the masticating functions of the teeth, and he was the first to describe the scheme of canine-protected occlusion.

Meyer, in 1959 discussed the “functional occlusal path” as the harmonious relationship between the occlusal and cuspal paths, the condylar paths, and the neuromuscular system. Pankey and Mann adapted the principles discussed by Meyer to describe a “functionally generated path” record in the fabrication of maxillary restorations.[4]

Dawson stated that the lateral eccentric movements of the mandibular posterior dentition are established by an anterior determinant and a posterior determinant. When understood and appreciated, the F.G.P. technique is a simple and practical method for achieving harmonious occlusal anatomy of restorations with the anterior determinant/anterior guidance and the posterior.[5]

Uses

The F.G.P. technique has been used for

- Oral rehabilitation cases[5]
- Single-unit indirect restorations
- Tooth-supported fixed dental prostheses
- Implant-supported FDPs.[6]
- Complete dentures
- Computer-aided design/computer-aided manufacturing (CAD/CAM) restorations.[7]

Dawson and Shilling burg et al. Note the following prerequisites for the use of the F.G.P.:

1. Presence of optimal occlusion.
2. Correct anterior guidance.
3. Absence/elimination of posterior interferences.
4. Adequate opposing occlusal surfaces capable of generating a functional path: no significant rotations, no carious lesions, no deficient restorations.[2,7]

Functionally Generated Path Technique:

Armamentarium for functional tracing:

- Petrolatum
- Cotton-tipped applicator
- Cavity varnish
- Tacky wax
- P.K.T. waxing instruments

- Bunsen burner
- Die fabricant
- Mounting stone
- Spatula
- Plaster bowl
- Sable brush
- Functional index try
- Custom impression tray
- Impression material
- Mixing pad
- Syringe
- Bite registration frame
- Bite registration paste
- Die stone
- Di-lock tray
- Twin stage occluder /verticulator.[8](Fig 1)

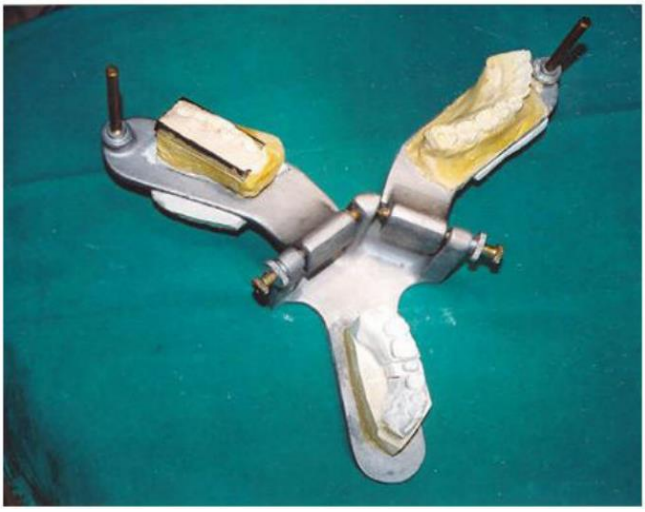

Figure.1 Twin Stage Occluder of HANAU used for F.G.P.

The twin stage occluder is a hinge articulator that will articulate the functional core and anatomical against the same die model. While using F.G.P. in a single tooth, the pattern is waxed directly against the functional core of the mouth.

The pattern should contact the functional model and should not interfere when the mouth is closed. The contact of the waxed incline can be checked with the white shoe polish against the functional core if the group function of the restored working inclines is desired.

When the models are closed, the entire incline surface will be marked with white polish. Working excursion contact should be maintained by preserving enough of the white-coated incline to ensure good group function.[9]

Procedure for Functionally Generated Path Technique

- The occlusal reduction for the preparation teeth should be made.
- The tooth should be stabilized with a softened stick compound. The same compound is formed as a broader occlusal table to receive the functional wax before any proximal reduction occurs.
- The functional wax is softened and stuck to the prepared occlusal table using a flame. The occlusal portion is lubricated with saliva.
- The patient is asked to close the mouth into centric relation and perform all possible excursions. Then the wax is checked to make sure it is firmly anchored to the base and that the base itself is stable.
- A creamy mix of Fast Setting Stone is mixed and poured into the F.G.P. indentations. And the stone is extended to at least one tooth on either side of the prepared tooth. Sufficient thickness should be present in the stone so that it can be removed without leakage after it hardens. A wooden tongue blade is used, and it works well to carry additional stone to the teeth and is removed easily.
- The hardened stone is set aside. Initially, the preparation is performed. And the impression of the prepared tooth is taken, with all teeth that will be covered with the stone functional core. An opposing model is not necessary.[10]

Advantages

- The precise method of fabricating accurate occlusal contours.
- Simple and inexpensive.
- Minimum chair side time during try-in and cementation phase.
- Records all dimensions of border movements at the correct vertical dimension.[9,11]

Disadvantages

- The operator should have a good knowledge of occlusion and of mandibular movements.
- The occlusal details are not similar to the ideal anatomical configuration, although the surface is functionally ideal.
- This technique cannot be used in cases with short clinical crowns.
- This technique cannot be used in cases of attrited teeth.
- Patients lacking proper neuromuscular control cannot be selected for this technique.
- In patients having disharmony in occlusion and T.M.J. dysfunction, the F.G.P. technique is destined to fail.
- Good laboratory support is a basic requirement.[11]

Double Casting Method

- Wax pattern was made with 1-mm occlusal clearance, and retentive beads of wax were placed on the prepared tooth. These beads aid in the retention of the pattern resin during functional generation of the occlusal morphology (Figure.2).
- The base casting was obtained, and it was sandblasted and checked for accuracy of fit on the model and in the mouth.
- We ensure that the base casting had adequate occlusal clearance and proper fit on the prepared teeth before generating the occlusal morphology. The occlusal morphology is generated using pattern resin following the technique described by Dawson.[12]
- Pattern resin was mixed and is applied on the occlusal surface of the metal coping with retentive beads. The patient was instructed to close the mouth in Maximum inter cuspal Position and

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performed the left lateral, right lateral, and protrusive movements in succession, ending in the M.I.P. (Figure.4).

- With the help of an acrylic trimmer, the excess pattern resin was trimmed off. The occlusal surface was then examined for any exposure to the metal. And if this was present, the metal in the area was trimmed, pattern resin was added in that area, and the movements were performed once again.[13]

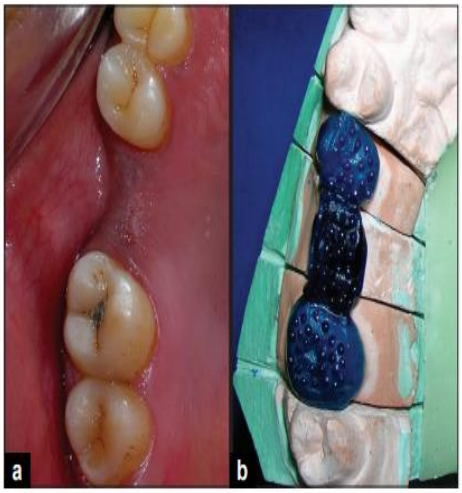

Figure: 2a) Pre-treatment appearance
(b) Wax pattern with retentive beads

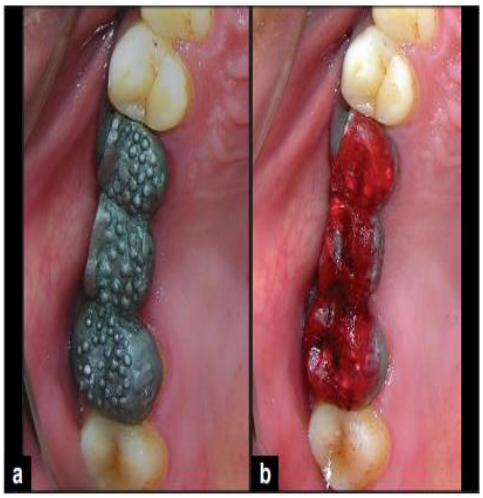

Figure: 3a) Base casting
(b) Generated path recorded

Complete Dentures

- Two sets of rims were constructed one is the occlusal wax rims and the compound rims and transferred to the semi-adjustable articulator.
- Modeling compound occlusal rims balancing is generated in soft carding wax in the patient's mouth. functional wax paths of the upper and lower occlusal rims with there are stapled together and seated on the lower cast.[14]
- The functional occlusal wax path is poured in stone. The outline of the upper occlusal rim is marked, and the upper teeth are arranged against the stone path in their proper bucco-lingual direction, and the upper denture is processed.
- The articulator with the upper denture is closed against the soft compound in centric relation. The imprints of the upper teeth are generated on the modeling compound at the chosen vertical dimension.
- A soft generating wax is melted over the lower compound rim. With a few lateral, protrusive excursions of the patient's mandible, the counterpart of the occlusal surfaces and the incisal edges of the upper denture teeth in function are generated automatically in wax, and the wax is shaped by the teeth.[15]

Removable Partial Denture:[16,17]

- Softened inlay wax was added to the rim constructed on the metal framework during try-in, and the framework was placed intraorally. (Figure.4)

- Mandibular excursive movements are made, and this is transferred to the definitive cast, and the arrangement is made.

Figure: (4a) Denture frame work with inlay wax attached **(b)** fgp recorded[16]

Conclusion

F.G.P. is a concept capable of producing very accurate results and demands care and meticulous attention to detail. This technique reduces adjustment time during the final restoration. Recently F.G.P. has also been used for the fabrication of implant-retained fixed partial dentures.[10] The F.G.P. technique is simple and can produce excellent results. It also demands meticulous attention and great care to detail. It is often overlooked by clinicians Because of its simplicity and is not used more often.

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