

RESTORING CURVE OF SPEE BY BROADRICK OCCLUSAL PLANE ANALYSER FOR A SUCCESSFUL REHABILITATION -A STUDY

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Abstract

Creating a functional and esthetic rehabilitation of occlusion is extremely rewarding for the dentist as well as for the patient. It is very important to re-establish proper occlusal plane for teeth replacement to prevent harmful sequelae to the stomatognathic system. **Aim:** To compare the amount of deviation of occlusal plane in subjects having missing posterior teeth with normal one. **Methodology-** Impressions were made for 40 patients and models were articulated in a 'Hanau' semi adjustable articulator. A custom made Broadrick Flag was fabricated and used to measure the deviation of the occlusal plane from an ideal one. **Result-** Measurements were recorded and 'paired t test' was done. A statistically significant difference $p < 0.05$ was found in the deviation. **Conclusion-** It can be concluded that the Broadrick flag method should be used in determining an appropriate occlusal curve for individuals with deranged occlusal planes for precise prosthetic or restorative treatment.

KEYWORDS

Broadrick flag, Occlusal curve, Semi adjustable articulator.

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INTRODUCTION

The demand of prosthetic rehabilitation is increasing day to day with the increase in life expectancy. The goal of dentistry is to increase the life span of the functioning dentition of an individual. In striving to achieve its goal, dentistry uses its knowledge, skill, and all the resources at its dispersal in both maintenance of work and rehabilitation¹.

If the patient has missing or mal-aligned posterior teeth and that need to be replaced, it is important that these teeth should be positioned in the most ideal position to achieve proper occlusion. The objective of a treatment plan is to restore the dentition to a healthy functional condition². In the normal natural dentition, there exists an anteroposterior curve is called 'Curve of Spee'. An ideal Curve of Spee is aligned so that a continuation of this arc would extend through the condyles³. The anatomic curve established by the occlusal alignment of the teeth, as projected on to the median plane, beginning with the cusp tip of the mandibular canine and following the buccal cusp tips of the premolar and molar teeth, continuing through the anterior border of the mandibular ramus, ending with the anterior most portion of the mandibular condyle. Curve of Spee was originally described by Ferdinand Graf Spee, anatomist, Germany, in 1890, this curve exists in the sagittal plane and is best viewed from a lateral aspect ; it permits total posterior disocclusion on mandibular protrusion, given proper anterior tooth guidance. Spee located the center of the curve along "a horizontal line through the middle of the orbits behind the crista lachryma posterior".

Spee's idea was advanced in 1920 by George Monson. Based on anthropological observations, Monson described a 3-dimensional sphere that passed through the incisal edges and occlusal surfaces of the mandibular teeth. It is not usually noted that while Spee described a curve of approximately 2.5-inch radius (6.5-7.0 centimetres). But Monson proposed the widely accepted curve of 4-inch radius⁴. Spee noted that it would be possible to locate the center of the curvature "by reconstruction and measurement with the compass."

The Curve of Spee may alter in situations due to rotation, tipping, and extrusion of teeth. Restoration of the dentition to such an altered occlusal plane can introduce posterior protrusive interferences. Such interferences have been shown to cause abnormal activity in mandibular elevator muscles. On the basis of electromyographic activity only when posterior disocclusion is obtained by an appropriate anterior guidance, the elevating activity of the temporal and masseter muscles can

be reduced⁵. This can be avoided by reconstructing the curve of Spee to pass through the mandibular condyle, which has been demonstrated to allow posterior disocclusion on mandibular protrusion⁶. As the angle of condylar guidance is greater than curve of Spee, posterior disocclusion is achieved⁷. The Broadrick flag permits construction of the curve of Spee in harmony with anterior and condylar guidance allowing total posterior tooth disocclusion on mandibular protrusion⁴. In 1963, Dr. Lawson Broadrick developed an instrument⁸ to provide a guide for the most suitable position and orientation of the posterior occlusal scheme where the natural Curve of Spee has been deranged. This instrument is commercially marketed as the 'Broadrick Occlusal Plane Analyser', often referred to as the 'Broadrick flag'. The Broadrick flag now has been adapted to several articulator systems, including Hanau (all models), Denar, Jensen (Artex-under development), and Kavro (Protar)⁹. Because of its high cost and less availability, custom made Broadrick Occlusal Plane Analyser (BOPA) provides an easy and practical method to determine an occlusal plane that will fulfil esthetic and functional occlusal requirements.

AIMS AND OBJECTIVES

To compare the amount of deviation of occlusal plane in subjects having missing posterior teeth with normal one.

MATERIALS AND METHODS

Instrument description (BOPA):- This simple modification to the semi-adjustable articulator does not hamper the holding function of an upper mounting plate while in use with the BOPA. The articulator can be used in the usual manner, without the occlusal plane analyser attached, and without the need of further alteration to the maxillary retention

screw assembly¹².

A study was conducted with a total of 40 subjects, out of which 20 cases were completely dentate(GROUP-A) and remaining 20 cases were partially edentulous(GROUP-B) in their posterior teeth region. All the cases were selected randomly from the department of oral medicine and radiology of Haldia Institute of Dental Sciences and Research of an age group of 25 to 50 years. Subjects having generalized attrition and malocclusion were excluded from this study.

For all the subjects impressions of both maxillary and mandibular arches were made with irreversible hydrocolloid (Algitec, DPI) and casts were prepared. Articulation done after proper face bow transfer and using interocclusal records. Then custom made BOPA was attached to the upper member of Hanau Semi-adjustable articulator and maxillary casts were unmounted from articulator. The anterior survey point (distal slope of mandibular canine) and posterior survey point (distobuccal cusp of mandibular last molar and where no molar teeth is present the anterior inter section with the condylar shaft) were determined.(Fig.-2)

An arc with a four-inch radius was drawn on the paper that is attached to the flag with a compass pointed on the anterior survey point and another arc of same radius was drawn by pointing the compass on the posterior survey point. These two arcs bisect at a point, which is the occlusal plane survey point. Then a 4-inch radius arc (broadrick curve) was drawn through the buccal surfaces of the mandibular teeth by placing the point of the compass on the occlusal plane survey point. Where the deviation was outside the drawn line a positive notation was given; if the deviation was inside the curve, a negative notation was given. Measurements in the second premolar region and the second molar region were

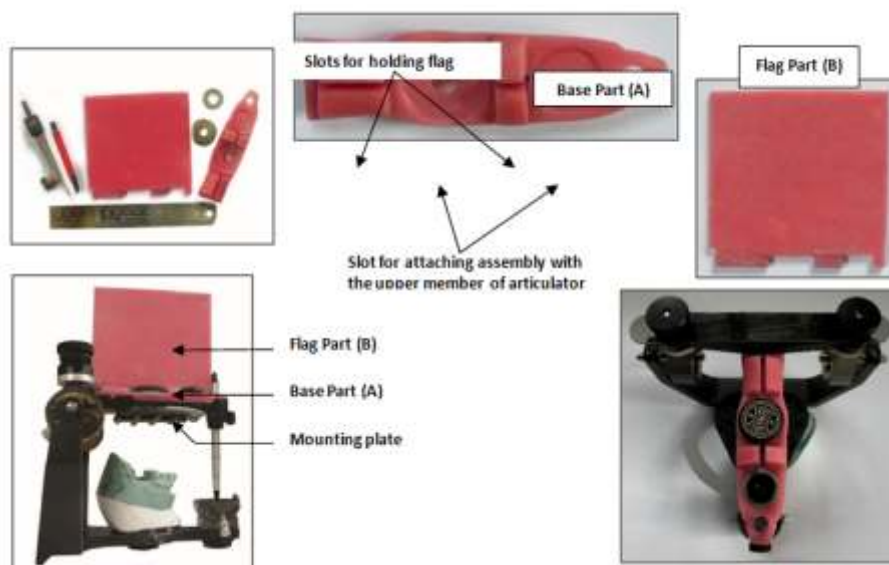


Fig-1: parts of a custom made BOPA



Fig-2: Reference points

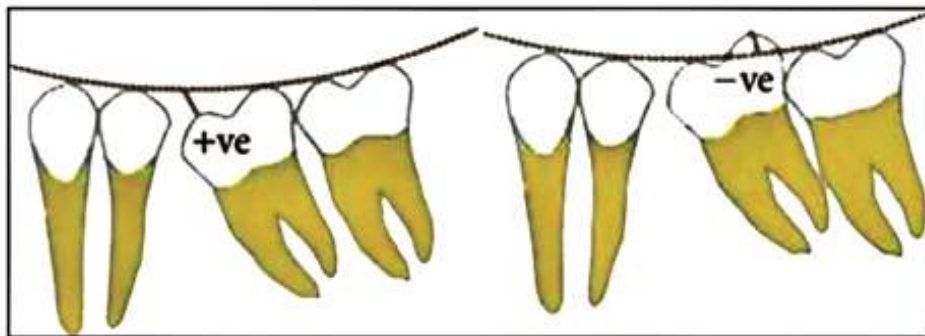


Fig-3: Procedures of drawing

tabulated and paired t-tests were used to compare the findings between these two groups. (fig-3)

RESULTS

Deviation from the Broadrick curve was found very minimum in the DENTULOUS group and marked deviation is noted in subjects who had missing posterior teeth (Tables 1 and 2). There is a statistically significant difference (P <0.05 level) noted (Table 3).

DISCUSSION

The Broadrick flag is a useful tool in prosthodontic and restorative dentistry, as it identifies the most likely position of the center of the curve of Spee. However, this position should not be regarded as fixed or immutable. Esthetics and

function plays a considerable demand on the design of the occlusal plane.

Compromise can be achieved by altering the length of the radius of the curve. In patients with a retrognathic mandible, a standard 4-inch curve would result in a flat posterior curve, causing posterior protrusive interferences. Such “low” mandibular posteriors would also lead to extrusion of the opposing maxillary teeth. If the maxillary posterior teeth were to be restored to this low occlusal plane, the crown-to-root ratio would be less than ideal. Hence, a 33/4-inch curve is more appropriate when a class II skeletal relationship exists. Conversely, a 4-inch curve would create a steep posterior curve in patients with a class III skeletal relationship, leading to further posterior interferences. A 5-inch radius would be more suitable in this situation⁴.

The center of the curve also may be varied to achieve the same effect. The center should always lie

In second premolar region

SL NO	GROUP A	GROUP B
1	0.5	1.5
2	0	1
3	0.5	1.5
4	1	2
5	1	2
6	1.5	-1
7	0.5	2
8	0	1
9	1.5	-2
10	1	3
11	1	-1.5
12	0	2
13	0	2
14	0.5	2
15	1	-1
16	0.5	1.5
17	1	1
18	1.5	1.5
19	0.5	1.5
20	0	2
Mean	0.675	1.650
standard deviation	0.520	0.516

In second molar region

SL NO	GROUP A	GROUP B
1	0.5	3
2	1	-2
3	0	2.5
4	1	3
5	0.5	-1.5
6	1	-1.5
7	0.5	2.5
8	0.5	-0.5
9	0	1
10	1	1
11	1	2.5
12	0	2
13	0.5	-2
14	1	3
15	0.5	1
16	0.5	-2
17	0	-1.5
18	0	1.5
19	0.5	2.5
20	1	-0.5
Mean	0.550	1.850
standard deviation	0.394	0.796

MEAN
DEVIATION OF
OBSERVATION
Datan are
represented as :

Mean Value ± Standard Deviation

PREMOLAR	Group A	0.675±0.520
	Group B	1.650±0.516**
MOLAR	Group A	0.550±0.394
	Group B	1.850±0.796**

**Datan are significant at both 1% and 5%

A statistically significant difference p<0.05 was found in the deviation of these two groups.

along the long arc drawn from the anterior survey point, but it may be moved in an anterior or posterior direction from the intersection of this arc with that drawn from the posterior survey point. This alteration will not affect the position of the anterior survey point, an important fact when the position of the mandibular anterior teeth is esthetically and clinically suitable.

Needles^{6,7} noted that to ensure posterior disclusion on mandibular protrusion, the curve should extend through the condyle. When the PSP is located, the level and orientation of the distal molar tooth may not always be suitable. Should this be the scenario, it follows that the PSP may be taken as the anterior border of the condyle, represented by the most anterior point on the condylar element on the articulator. Care should be taken to ensure that the angle of the condylar guidance is not less than the curve of Spee, as this would introduce posterior protrusive interferences.⁴

The centre of the curve also may be varied to achieve the same effect. The centre should always lie along the long arc drawn from the anterior survey

point, but it may be moved in an anterior or posterior direction from the intersection of this arc with that drawn from the posterior survey point. This alteration will not affect the position of the anterior survey point, an important fact when the position of the mandibular anterior teeth is esthetically and clinically suitable. Therefore with a little experience and training this aids the clinician for the definitive restorations as well as a guide for the actual tooth preparations¹¹.

Though Sehgal M et al¹³(2013) concluded that:

- There is no need for time consuming technique and complicated equipments.
- Laboratory procedures are simple and controlled to an extremely fine degree by the dentist.
- All posterior occlusal contours are programmed by and are in harmony with both condylar border movements and a perfected anterior guidance.

In 2012 Chaturvedi S, et al¹⁴ used a custom made BOPA with Dentatus articulator for full mouth rehabilitation. In 2014 Rao Y, et al¹⁵ also appreciate

that to increase vertical dimension of occlusion and perform Full Mouth Rehabilitation where BOPA has performed as an important role. Further in 2015 Ramin Negahdari et al¹⁶ used BOPA for full mouth rehabilitation of severely worn out dentition.

CONCLUSION

The tilt of the curve of Spee increases the crush shear ratio of the force produced on food between the posterior molars. The parallel tilt of superficial masseter maximizes the efficiency with which this muscle contributes to the crush component of the bite force in the sagittal plane¹⁷. The simple modification procedure enables the practitioners to use an occlusal plane analyzer as a diagnostic tool with a widely used semi-adjustable articulator, which therefore had no such available accessory. Treatment planning does not receive adequate attention either in dental education or in dental practice. This may be due to the fact that a comprehensive treatment plan has not been considered essential. The average dentist approaches the patient with the idea that his economic status is such that he cannot afford rehabilitation of the mouth. It must be remembered that each tooth must function both as an individual and as a part of a collective unit; this makes each tooth an important factor in the function of the entire mouth. When the function of one tooth is lost, the function of the other teeth is impaired. When we have impaired function, we lose the support of bone structure around the teeth because of the lack of physiologic function which stimulates the soft and hard tissues. Therefore, it is important that every effort be made to rehabilitate any lost tooth in order to prevent any further destructive changes from taking place. The Broadrick flag was indicated to assess and, if necessary, redesign the level and orientation of the occlusal plane. With use of the Broadrick flag, the prosthodontist can predictably produce high-quality restorations in harmony with the anterior and condylar guidance and avoid the introduction of possibly harmful sequelae to the patient.

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