



Original Research Article

Optimizing occlusal plane determination with a custom-built broadrick plane analyser

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Abstract

Aim: The study aimed to determine appropriate occlusal curve for patients and compare the clinical curves with ideal occlusal curves.

Objective: Assessment of the significance of deviations in occlusal curves between patients with missing posterior teeth and those with complete dentition.

Materials and Methods: The study comprised of oral examination of 52 subjects. Followed by obtaining study models of their dentition which were articulated on a semi adjustable articulator and the occlusal curve was assessed using custom built occlusal plane analyser. The deviations from the plane were noted and to this data paired t- tests was applied and results were formulated.

Results: A significant difference ($P < 0.05$) in deviations between clinical and ideal patients was seen.

Conclusion: The appropriate use of Broadrick flag method ensured accurate determination of occlusal plane which is crucial for the functional and aesthetic success of posterior restorations.

Keywords: Broadrick plane analyser, Occlusal plane, Occlusion, Rehabilitation.

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1. Introduction

One of the most important decision-making procedures that prosthodontists have to handle is the definition of an occlusal plane in view of the replacement of missing or malpositioned posterior teeth. Accurate measurement of the 3D arch curve should be well considered during design, taking into account Spee and Wilson Curves, together with the placement of teeth. Traditionally, the occlusal plane analyser aids the practitioner in establishing an initial mandibular occlusal plane on diagnostic casts, which guides the contouring of definitive restorations and tooth preparation.¹⁻³

Changes in the Spee curve due various tooth movements is termed as pathological and indicates towards correction by restorative means to prevent potential occlusal interferences.⁴ research suggests that if that were to occur due to such interferences it will result in abnormal activity of mandibular elevator muscles.⁵ due to this problem there is remodelling of curve of spee to position related to the condyle promoting

posterior disclusion on protrusive mandibular movement, so that the condylar guidance becomes greater than the curve of spee.^{6,7}

The broad rick flag is a useful aid in balancing the curve constructions with the anterior condylar guidance, as it offers potential for posterior teeth disclusion against an anteriorly superior posterior mandible. Efficient use of this depends upon proper functional and esthetic positioning of mandibular incisors. Therefore, purpose of this study was to establish optimal individualized occlusal curve.

2. Materials and Methods

2.1. Study design

Impressions of complete dentition were made using alginate impression materials and study models were obtained. Articulation of models was done on a semi adjustable articulator with a face bow transfer. Using the Broadrick flag method, the occlusal plane analyser was adapted to create an

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ideal occlusal plane. Survey points were located on dental landmarks, and deviations were noted for analysis.

2.2. Sampling design, method and size

Sample of study was calculated to be 52 using the formula for case control study design which was divided equally for cases and controls with 80% power of study and 95% confidence interval.

2.3. Inclusion criteria

Students from Seema Dental College and Hospital, Rishikesh, and patients of age more than 18 years were included for the study.

2.4. Exclusion criteria

Abutment teeth used in removable and fixed partial denture.

2.5. Materials

The materials used in the study are listed as follows

1. Alginate impression material (Dentsply zelgan advanced impression material)
2. Dental stone
3. Custom occlusal plane analyser
4. Wide Vue Hanau semi adjustable articulator
5. Arbitrary face bow
6. Dental plaster

2.6. Methodology

Impressions of maxillary and mandibular dentition made of all the subjects. Face bow record was made and transferred to a semi adjustable articulator (**Figure 1**) and articulation was done. Occlusal plane analyser mounted on an upper articulator member from Broadrick with the help of flag method (**Figure 2**). Measurements were made at survey points. Anterior and posterior survey points were correctly placed and central survey point was obtained which was the bisector of anterior and posterior survey lines (**Figure 3**). Taking central survey point as the centre a 4-inch radius was drawn through the buccal surfaces of mandibular teeth (**Figure 4**). The curve was compared to the existing curve and deviations from it were noted as positive and negative (**Figure 5**). Paired t-test was used to compare the deviations with control group and results were formulated using 0.05 as the level of significance.



Figure 1: Face bow record

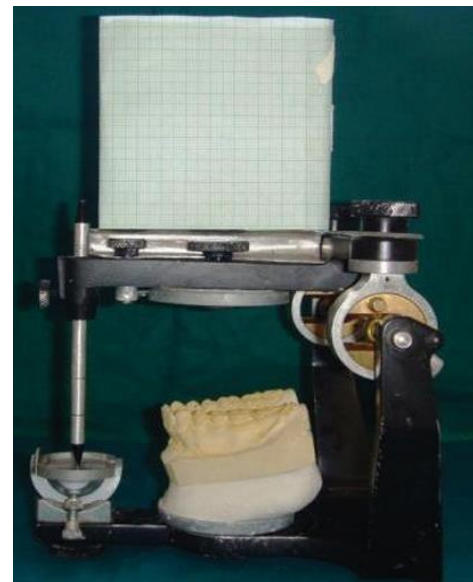


Figure 2: Custom made occlusal plane analyser attached to the articulator



Figure 3: Central survey point

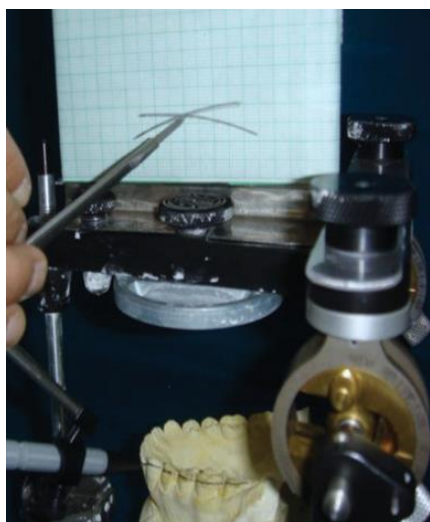


Figure 4: Marked curve on mandibular teeth



Figure 5: The deviation outside the curve was given a positive notation and a negative notation was given for the deviation inside the curve

3. Results

A marked deviation from the curve was noted in subjects while minimal in the control group (**Table 1** and **Table 2**).

Statistically significant ($P < 0.05$) results were obtained and suggested that there was significant difference in the deviation from Broadrick curve between the control and subject (**Table 3**).

Table 1: Deviation in control group

S. No.	2 nd Premolar	1 st Molar	2 nd Molar	Mean
1.	0.5	0.5	0.5	0.5
2.	0.5	1	1	0.833333
3.	0.5	1	0.5	0.666667
4.	1	1	0.5	0.833333
5.	1.5	0.5	0.5	0.833333
6.	1	1	0.5	0.833333
7.	1.5	1	1	1.166667
8.	1.5	1	0.5	1
9.	1	1.5	1	1.166667
10.	1	1.5	1	1.166667
11.	0.5	0.5	0.5	0.5
12.	0.5	1	1	0.833333
13.	0.5	1	0.5	0.666667
14.	1	1	0.5	0.833333
15.	1.5	0.5	0.5	0.833333
16.	1	1	0.5	0.833333
17.	1.5	1	1	1.166667
18.	1.5	1	0.5	1
19.	1	1.5	1	1.166667
20.	1	1.5	1	1.166667
21.	1	1	0.5	0.833333
22.	0.5	1	0.5	0.666667
23.	0.5	0.5	1	0.666667
24.	0.5	1	0.5	0.666667
25.	1	1	1	1
26.	1.5	1	1	1.166667

Table 2: Deviation from Broadrick curve in Subject group

S. No.	2 nd Premolar	1 st Molar	2 nd Molar	Mean
1.	1	1.5	0.5	1
2.	1	1.5	0.5	1
3.	0.5	-1	-1	-0.5
4.	-0.5	-1.5	-0.5	-0.83333
5.	-2	-1.5	-2.5	-2
6.	-2	-0.5	-1.5	-1.33333
7.	1	-1	0.5	0.166667
8.	3	1	0.5	1.5
9.	3	0.5	0.5	1.333333
10.	2	0.5	0.5	1
11.	1	1.5	0.5	1
12.	1	1.5	0.5	1
13.	0.5	-1	-1	-0.5
14.	-0.5	-1.5	-0.5	-0.83333
15.	-2	-1.5	-2.5	-2
16.	-2	-0.5	-1.5	-1.33333
17.	1	-1	0.5	0.166667
18.	3	1	0.5	1.5
19.	3	0.5	0.5	1.333333
20.	2	0.5	0.5	1
21.	1	0.5	0.5	0.666667
22.	0.5	0.5	0.5	0.5
23.	-0.5	1.5	-1	0
24.	-2	1.5	-0.5	-0.33333
25.	-2	-1	-2.5	-1.83333
26.	1	-1.5	-1.5	-0.66667

Table 3: Mean and Standard deviation of Broadrick occlusal curve of control and subjects

Group	Control Group	Subject Group
Mean	0.8804	0.0385
SD	0.2140	1.1322

4. Discussion

In prosthodontics and restorative dentistry, the Broadrick technique is indispensable in guiding the correct curve of spee. The curve is an important consideration in the attainment of a harmonious occlusion and for the longevity of dental restorations. The technique works as a template to transfer the diagnostic data from articulator into the dentition so as to replicate the designed occlusal scheme when the treatment is instituted.

The Broadrick curve is highly valued for the ability to identify the position of center of curve of spee, which is critical for establishing an optimal occlusal plane. However, the position of this curve is not static; it may need to be adjusted based on esthetic and functional requirements specific to each patient. The length of the curve can be adjusted according to the individuals' anatomic traits. A retrognathic jaw would not require a radius of four inch as it might result in a flatter curve which would result in posterior occlusal interferences.⁸

The results demonstrate a marked deviation from the occlusal curve in the subject group, while the control group shows minimal deviation. The subjects exhibited a mean deviation of 0.0385 with a standard deviation of 1.1322, significantly larger than the mean of control group of 0.08804 and a standard deviation of 0.2140. These values showed a statistically significant difference between the two groups. This suggests that the subjects deviate more from the Broadrick curve compared to the controls which indicates towards the potential clinical relevance in occlusal evaluation. The deviation from the occlusal curve in subjects suggest altered occlusal relationships and these findings highlight the importance of evaluating occlusal curves in prosthodontic and restorative treatment planning.

Wichmann et al. explored the impact of using a Broadrick Flag on patients with different occlusal schemes. Their findings were in accordance with this study which corroborated that application of custom radius of curve enhanced the occlusal balance in class 2 and class 3 skeletal relationships.⁹

B.W Small et al presented a report in accordance with the study, which stated that occlusal plane determination can have a profound effect on the success of a prosthesis, fewer the posterior interferences fewer the problems encountered associated with teeth, muscles and temporomandibular joints.¹⁰

H.L Craddock et al studied the of proximity of ideal occlusal curve to existing occlusal curve in dentate patients. The concluding remarks were in accordance to this study, finding it precise to determine the occlusal plane.¹¹

K.N Jagadeesh et al studied the reliability of Broadrick flag method in determination of occlusal curve in Indian population. They also concluded that it is a reliable method for occlusal plane determination in Indian population.¹²

Banasar et al studied the accuracy of Broadrick flag occlusal plane analyzer using two different posterior survey points. The results showed no statistical difference between two reference points in the partially edentulous side but statistical variation was found among the levelling of the curve of spee.¹³

In patients with a class 3 skeletal relationship a four-inch radius is said to create a steep posterior curve. Hence, a larger radius is might be necessary to achieve the results. The center of the curve can be adjusted anteriorly or posteriorly along the arc which is fixed which is crucial for ensuring that the mandibular anterior teeth remain functionally appropriate. Precise application of Broadrick flag technique can give accurate patient specific prosthesis that enhance both functions and esthetics.^{14,15}

5. Conclusion

Determining the occlusal plane is essential for the success of restorative dental cases, reducing the problems associated with the stomatognathic system. An occlusal plane analyser with simple modifications aids in diagnostics and treatment planning. Its optimum utilization facilitates meeting functional and aesthetic requirements. With experience, dentists can seamlessly integrate this tool into their practice.

6. Source of Funding

None.

7. Conflict of Interest

None.

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