ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

*International Journal of Dental Science and Innovative Research (IJDSIR)*

*IJDSIR : Dental Publication Service*

*Available Online at: www.ijdsir.com*

*Volume – 6, Issue – 2, March - 2023, Page No. : 140 - 146*

# Use of Occlusal Plane Analyzer in Dentate and Edentate Individuals to Measure Deviation from Ideal Occlusal Plane

[1]Dr. Shah Darshan Jaydip, Department of Prosthodontics and Crown and Bridge, Tamilnadu Government Dental College and Hospital, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, India.

[2]Dr. Meenakshi. A, Department of Prosthodontics and Crown and Bridge, Tamilnadu Government Dental College and Hospital, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, India.

[3]Dr. Kishor Kumar M. K, Department of Prosthodontics and Crown and Bridge, Tamilnadu Government Dental College and Hospital, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, India.

[3]Dr. Aishwarya Rani R, Department of Prosthodontics and Crown and Bridge, Tamilnadu Government Dental College and Hospital, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, India.

**Corresponding Author:** Dr. Meenakshi. A, Department of Prosthodontics and Crown and Bridge, Tamilnadu Government Dental College and Hospital, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, India.

**Citation of this Article:** Dr. Shah Darshan Jaydip, Dr. Meenakshi. A, Dr. Kishor Kumar M. K, Dr Aishwarya Rani R, "Use of Occlusal Plane Analyzer in Dentate and Edentate Individuals to Measure Deviation from Ideal Occlusal Plane", IJDSIR- March - 2023, Volume – 6, Issue - 2, P. No. 140 – 146.



**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

## Abstract

For partially edentate patient, simplest and most accurate method of occlusal plane establishment is through the use of Broadrick occlusal plane analyzer. With idea of replacing the missing structure in a manner they were present, the same method used for partially edentate and dentate patients, may have potential to be used for completely edentate patients. Dentate and edentate Indian subjects were selected as per predetermined criteria. For dentate individuals, maxillary and man dibular full arch impressions were made; casts were prepared and mounted in arcon semiadjustable arti culator using facebow. Occlusal analysis was carried out with custom made occlusal plane analyzer and deviation of existing occlusal plane to that of the occlusal plane established by Broadrick occlusal plane analyzer was measured. For edentate patients, mandibular occlusal plane was established by considering anatomical landmarks; anteriorly corner of mouth, in the middle part lateral border of tongue and at the posterior end retromolar pad. The differences between anatomically established occlusal plane and theoretically idealocclusal plane were measured. For dentate group of the individuals the differences between existing occlusal plane and ideal occlusal plane were not significant statistically and clinically.For edentate subjects, the

anatomically established occlusal plane had close resem blance to the ideal occlusal plane established by Broa drick occlusal plane analyzer method.

**Keywords:** Broadrick occlusal plane analyzer, facebow transfer, interocclusal record, occlusal plane

**Aims**

To evaluate validity of Broadrick Occlusal Plane Analyzer method for Indian dentate population and to apply this method for determining the appropriate occlusal plane for complete denture patients

**Settings and Design**

Cross sectional study

**Methods and Material**

Ear piece type face bow (bio-art), semi adjustable articulator (arcon articulator – bio-art a7 plus), customized occlusal plane analyzer, compass, digital vernier caliper

**Statistical analysis used**

One-way ANOVA

**Introduction**

The configuration of the occlusal plane is one example of nature's beautiful and intricate designs. The dynamics of function play out so precisely with the arrangement of teeth.

All components of this complex design are functionally interrelated. Any alteration in one aspect of this design can have deleterious effects in another.

According to GPT occlusal plane has been defined as [1]

1. The average plane established by the incisal and occlusal surfaces of the teeth.

Generally, it is not a plane but represents the planar mean of the curvature of these surfaces.

2. The surface of wax occlusion rims contoured to guide in the arrangement of denture teeth.

3. A flat metallic plate used in arranging denture teeth.

4. The first part of the definition is related to dentulous cases while remaining two parts describe occlusal plane for edentulous cases.

The 3 most commonly used methods for establishing an acceptable plane of occlusion are

1. Direct analysis on natural teeth through selective grinding

2. Indirect analysis of facebow – mounted casts with properly set condyler path

3. Indirect analysis using Pan key-Mann-Schuyler (PMS) method with the Broderick Occlusal Plane Analyzer (BOPA) [2]

The PMS technique using Broadrick Occlusal Plane Analyzer provides a simple and practical method to assist in determining the preliminary occlusal plane on diagnostic casts

Theoretically, plane established by Broadrick Occlusal Plane Analyzer method has been considered as ideal occlusal plane dentulous and partially edentulous individuals.

The plane established by Broadrick occlusal plane analyzer method can be important guide for establishing plane in complete denture cases if anatomically established plane and plane established by Broadrick occlusal plane analyzer method coincide to each other.

**Subjects and Methods**

**Selection criteria**

| | Group 1 (dentate) | Group 2 (edentate) |
|---|---|---|
| No. Of sample | 10 | 10 |
| Age group | 20-25 | 60-75 |
| Gender | Male and female | Male and female |
| Gender | Male and female | Male and female |

Table 1: sample size

**Inclusion criteria**

Dentate – all teeth from 2nd molar to 2nd molar should be present, bilateral class 1 with normal horizontal and vertical overlap

Edentate – class 1 ridge

**Preparation of occlusal plane analyser**

Method followed by Sumit Bedia et al [2] was followed with some modification. The supporting rod of the articulator was duplicated in aluminium. A piece of stainless steel was preparing d in 10cm height and 11cm width was screwed and fixed with the rod. The metal piece is exactly placed in the middle of the upper member. Graph paper was pasted on both sides of the metal.

Figure 1: mounting of mandibular cast

**Method of collection of data for dentulous subjects**

Impression is made and cast is poured, face bow transfer is done, maxillary cast was mounted on a semi adjustable articulator, interocclusal record was made and mandibular cast was articulated in centric relation record. Maxillary cast from upper member and supporting rod was removed. Customized occlusal plane analyser was attached to the upper member of the articulator.

The anterior survey point was the incisal tip of the lower canine tooth and posterior survey point was anterior most point of condylar element of the articulator [3]. From these two points arc of 4 inch were made towards the upper member, the intercept of these arcs was used to determine the centre of the circle. This derives theoretically ideal occlusal plane.

The distance between two curves, namely existing occlusal plane and theoretically ideal Broadrick occlusal plane, were measured at four points with digital vernier caliper.

Point 1 – buccal cusp tip of left mandibular 1st premolar

Point 2 – buccal cusp tip of left mandibular 2nd premolar

Point 3 – mesiobuccal cusp tip of left mandibular 1st molar

Point 4 – mesiobuccal cusp tip of left mandibular 2nd molar Where the deviation outside the existing curve a positive notation was given, negative notation was given if it lies inside. If derived curve was inside the established curve, autopolymerising acrylic stent was fabricated on the occlusal surface of the posterior teeth and derived curve was scribed on the surface of stent. Where no deviation was detected a value of zero was awarded. Results were tabulated.

Figure 2: occlusal analysis.

Figure 3: occlusal analysis

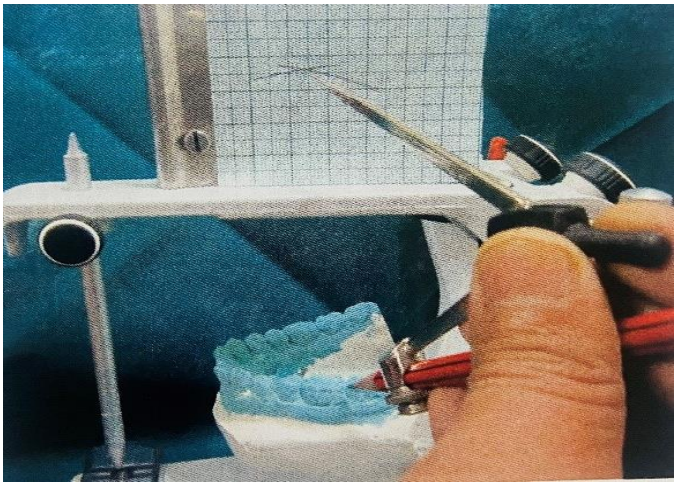

Figure 4: occlusal analysis

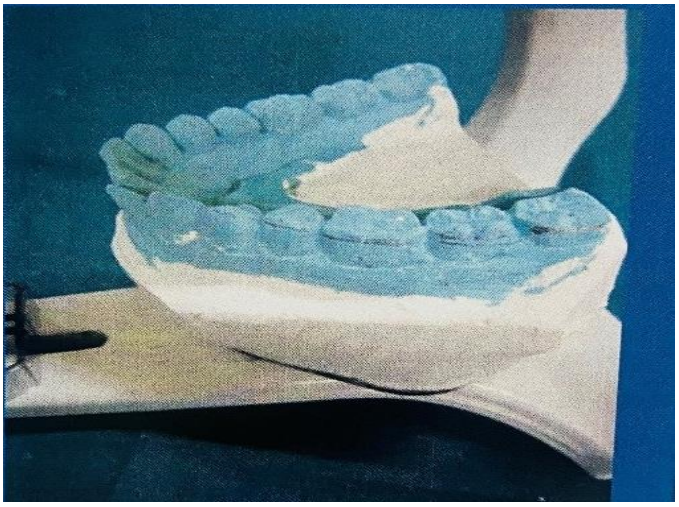

Figure 5: derived theoretically ideal occlusal plane

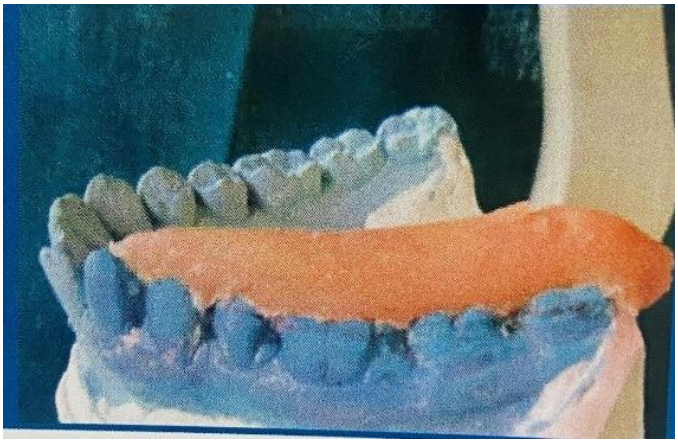

Figure 6: stent for derived plane above the existing occlusal plane


Figure 7: measurement of deviation using digital vernier caliper

**Method of collection of data for edentulous subjects**

Primary and secondary impressions are made. Record bases and wax occlusal rims fabricated.

**Establishing occlusal plane by anatomical method**

First occlusal plane is established in mandibular rims by following method advocated by Zarb and Bolander [4]. Anteriorly the plane was established in level with the lower lip and the corner of the mouth. Posteriorly at the level of lateral border of the tongue. At posterior end, the plane was maintained at the level of anterior two third of retro molar pad. Then maxillary occlusal rim was altered in such a way that both bite rims would contact each other evenly.

Face bow transfer done and maxillary cast is mounted on the articulator. The mandibular cast was mounted on the articulator according to centric jaw relation. Teeth setting is done and wax trial was approved after con side ring phonetics, esthetics, vertical dimension, freeway space and other parameters.

**Occlusal plane analysis**

Maxillary cast alond with trial denture was removed from the upper member. Supporting rod of the articulator was removed and customised occlusal plane analyser was attached to the upper member.

The anterior survey point was the incisal tip of the lower canine prosthetic tooth and the posterior survey point was the anterior most point of condylar element of the articulator. From these two-point arc of the 4 inch were made towards the upper member of the articulator and occlusal plane analysis was done similar to the dentate part of the study.

The distance between two curves, anatomically established occlusal plane and theoretically ideal Broad rick occlusal plane, were measured at four points were buccal cusp tip of mandibular left first premolar, buccal cusp tip of mandibular left second premolar, mesio buccal cusp tip of mandibular left first molar, mesio buccal cusp tip of mandibular left second molar.

Where the deviation was outside the existing curve a positive notation was given, if inside a negative notation was given. If the derived curve was inside the established curve, autopolymerising acrylic stent was fabricated on the occlusal surface of the posterior teeth and derived curve was scribed on the surface of stent. Where no deviation was detected a value of zero was awarded. Results were tabulated.

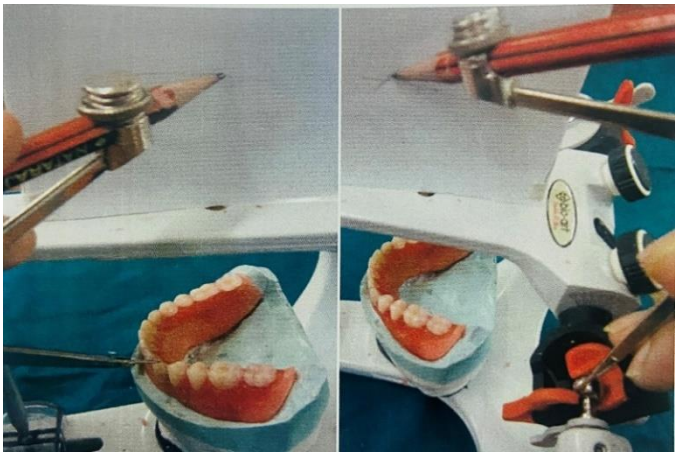

Figure 8: occlusal analysis

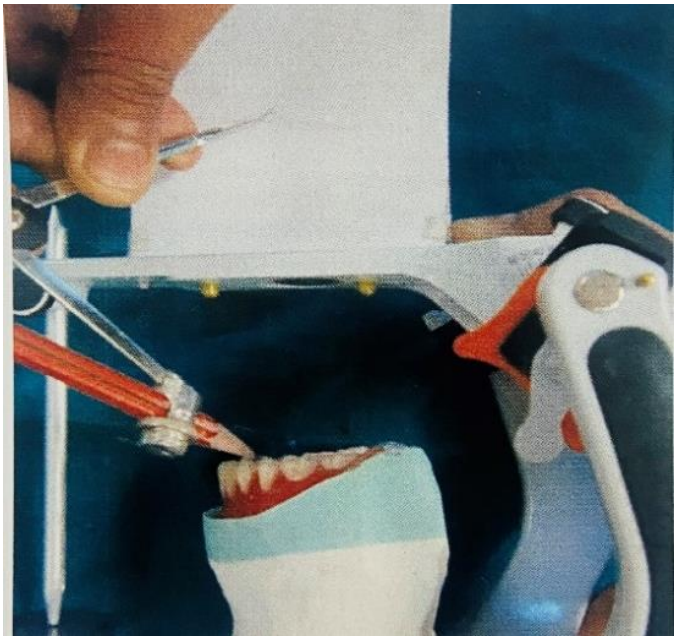

Figure 9: theoretically ideal occlusal plane.

**Results**

| | POINT 1 | POINT 2 | POINT 3 | POINT 4 |
|---|---|---|---|---|
| Pt1 | 1.14 | 1,53 | 2.03 | 1.78 |
| Pt2 | 0.71 | -0.43 | -1.19 | -1.33 |
| Pt3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Pt4 | 0.49 | 0.73 | 1.36 | 1.13 |
| Pt5 | 0.0 | 0.0 | -0.25 | -0.62 |
| Pt6 | 1.03 | 1.32 | 0.46 | 0.0 |
| Pt7 | 0.58 | 0.93 | 0.37 | -0.77 |
| Pt8 | 0.0 | 0.51 | 0.76 | 0.49 |
| Pt9 | 0.39 | 0.56 | 0.76 | 1.12 |
| Pt10 | -0.27 | -0.70 | -0.88 | -0.88 |

Table 2: Basic values obtained for differences between existing occlusal plane and theoretically ideal Broadrick occlusal plane in dentate patients

| | POINT 1 | POINT 2 | POINT 3 | POINT 4 |
|---|---|---|---|---|
| Pt1 | -0.52 | -0.75 | -1.28 | -1.43 |
| Pt2 | 0.58 | 1.24 | 1.72 | 1.35 |
| Pt3 | 1.16 | 1.59 | 1.76 | 1.97 |
| Pt4 | 0.29 | 0.55 | 0.68 | 0.46 |
| Pt5 | 1.25 | 1.57 | 1.82 | 2.12 |
| Pt6 | -0.27 | -0.69 | -0.85 | -1.16 |
| Pt7 | 0.35 | 0.76 | 1.16 | 0.83 |
| Pt8 | 1.32 | 1.75 | 1.66 | 1.27 |
| Pt9 | 0.26 | 0.45 | 0.83 | 1.15 |
| Pt10 | -0.45 | 0.00 | 0.52 | 0.76 |

Table 3: Basic values obtained for differences between anatomically established occlusal plane and theoretically ideal Broadrick occlusal plane in edentate patients

| POINT | MEAN | SD |
|---|---|---|
| Point 1 | 0.41 | 0.47 |
| Point 2 | 0.45 | 0.73 |
| Point 3 | 0.34 | 0.98 |
| Point 4 | 0.09 | 1.02 |

Table 4: Mean and standard deviation values for dentate group for observations made at Predetermined points.

| POINT | MEAN | SD |
|---|---|---|
| Point 1 | 0.40 | 0.69 |
| Point 2 | 0.65 | 0.91 |
| Point 3 | 0.80 | 1.10 |
| Point 4 | 0.73 | 1.19 |

Table 5: Mean and standard deviation values for edentate group for observations made at Predetermined points

1. The deviation of existing occlusal plane of dentate individuals from theoretically ideal Broadrick occlusal plane was found to be non-significant clinically and statistically.

2. The anatomically established occlusal plane for edentate patient had geometry which was in close resemblance to the geometry of theoretically ideal Broadrick occlusal plane.

**Conclusions**

Within the limitation of the present study it can be concluded that

1) The Broadrick occlusal plane analyzer method of establishing occlusal plane is valid for the Indian population

2) The Broadrick occlusal plane analyzer may have potential to be used in fabrication of complete denture for establishing posterior occlusal plane.

The further study should include large sample size with anatomical variations and should consider clinical applicability and related aspects for the proposed method

**Discussion**

For dentate group of the present study, after tabulating the data obtained from the observations, mean values for the differences of the planes at specific point were obtained. The values for the Point1, point 2, Point 3, and Point 4 were 0.41, 0.45, 034, and 0.09, respectively. For each point Standard deviations were 0.47, 0.73, 0.98, and 1.02. The values were not significant clinically. The statistical analysis by One- way ANOVA indicated p value of 0.777 which was statistically non-significant. This indicated that the existing occlusal plane of the individuals under study had not showed clinically and statistically deviation from the theoretically ideal Broadrick occlusal plane. Hence it was considered that clinically, the existing occlusal plane of the dentate individual is similar to the theoretically ideal Broadrick occlusal plane.

For edentate group of the study, the statistical analysis of the tabulated data showed mean values for Pointl, point 2, Point 3, and Point 4 as 0.40, 0.65, 0.80 and 0.73,

respectively. The Standard deviations were 0.69, 0.91, 1.10 and 1.19, respectively. The p value of 0.811 was obtained by using One-way ANOVA. The differences between two planes obtained from the observations made during study were not significant clinically. By statistical analysis indicated p value of 0.811 which was statistically non-significant.

There is lack of documentation regarding use of Broadrick occlusal plane analyzer for completely edentulous patients in the literature reviewed. To the best of author's knowledge there is no literature to propose the use of Broadrick occlusal plane concept for edentate patients. Due to lack of literature, there is no comparable data to substantiate the results obtained in the study.

**References**

1. Bedia SV, Dange SP, Khalikar AN. Determination of the occlusal plane using a custom-made occlusal plane analyzer: a clinical report. J Prosthet Dent. 2007 Nov;98(5):348-52.

2. Lynch CD, McConnell RJ. Prosthodontic management of the curve of Spee: use of the Broadrick flag. J Prosthet Dent. 2002 Jun;87(6):593-7.

3. Zarb- Bolander. Prostho dontic Treatment for Eden tulous Patients - Complete Dentures and Implant-Supported Prosthesis (12th edition). Saunders Co. 2004.

4. The glossary of prostho dontic terms. J Prosthet Dent. 2005 Jul; 94 (1):10-92