

Correlation of the Condylar Guidance Obtained by Protrusive Interocclusal Record and Panoramic Radiographs in Completely Edentulous Patients: An in Vivo Study

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ABSTRACT

Aim: The purpose of this study was to evaluate the reliability of programming the articulator using the radiographs and the interocclusal records made during Jaw relation (Arrow point tracing).

Materials and Method: The study comprised of 15 edentulous subjects with well formed maxillary and mandibular ridges, with no signs and symptoms of temporomandibular joint disorders and neuromuscular disorders. Digital Orthopantomograph was taken for all the subjects. The condylar guidance angles were traced on Orthopantomograph for right and left sides and the values were recorded. The protrusive interocclusal records were made at jaw relation stage and at try-in stage using bite registration paste for all subjects. These interocclusal records were used to programme the Semi-adjustable articulator (Hanau Wide Vue) and the condylar guidance values on the right and left sides were recorded. The condylar guidance values so obtained were compared with the values obtained by Orthopantomograph. The condylar guidance values obtained by the various procedures were subjected to independent t-test and Pearson correlation test.

Results: The results showed statistically significant difference between the condylar guidance values obtained from Orthopantomograph (Radiograph) and the condylar guidance values obtained at the stage of jaw relation.

Conclusion: Within the limitations of the study, it can be concluded that the condylar guidance values obtained from the Radiographs were higher than those obtained at the stage of jaw relation recording stage.

Keywords: Panoramic radiography, Edentulous, Jaw relation.

INTRODUCTION

Condylar guidance is defined as the mandibular guidance generated by the condyle and articular disk traversing the contour of the glenoid fossa^{1,2}. Semi adjustable articulators are frequently used in restorative dentistry, particularly in prosthodontics³. However mechanical limitations of the articulator



require a protrusion of at least 6mm so that the condylar guidance can be accustomed^{4,5}.

Gilboa et al determined that the radiographic outline of articular fossa and articular eminence in a panoramic image is the precise representation of equivalent outlines in the skull and can be of value in determining condylar guidance angles⁶. Studies by Zamacona et al⁷, Woefel et al⁵, Preti et al⁸ found variations in Condylar guidance angles ranging from 5 to 55°.

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Kumar PT et al⁹ found an association between condylar guidance angle recorded by protrusive record and panoramic radiographic image in dentulous subjects which indeed helps in programming semi adjustable articulator. However as age advances changes are expected in the condylar morphology due to either pathologic or physiologic causes. Thus the need for study arises to whether condylar guidance angle obtained by protrusive interocclusal record and panoramic radiographic image in completely edentulous patients correlate. The null hypothesis can be framed as no correlation exists between condylar guidance angles obtained from panoramic radiographs to protrusive interocclusal records.

MATERIALS AND METHOD

This study was conducted in the Department of Prosthodontics and Crown & Bridge, K.M.Shah Dental College and Hospital, Vadodara. A pilot study was carried out with 10 patients and the values thus obtained were statistically analyzed and final sample size of 24 patients was selected with the following inclusion and exclusion criteria. Patient's inclusion criterias were: Patient's with favorable maxillary and mandibular ridges, patients who do bilateral and adequate protrusive movement and patients with no clinical signs of TMJ dysfunction like pain, clicking sound, deviation, difficulty in opening mouth. Exclusion criterias were patient's with signs of alveolar bone loss, patient's whose condition contraindicates OPG and patients who refuse to give informed consent for the study. Completely edentulous patients were taken for the study after the inclusion and exclusion criterias were satisfied. Basic information about the study was given to the patient in form of patient information sheet. The information about the patient, clinical procedure and the sagittal condylar guidance values obtained from the Gothic arch tracing and OPGs were recorded in a proforma. A signed informed consent form was obtained.

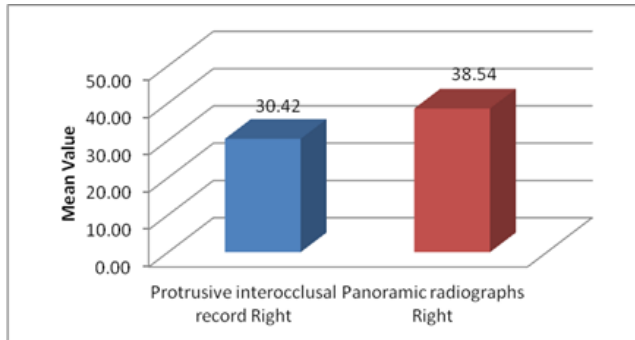
1. Methodology for construction of conventional denture.

Routine techniques for making the primary and final impressions were followed. Primary impressions of maxillary and mandibular arch were made with low fusing impression compound (DPI Pinnacle Function I.C., India). Casts were obtained

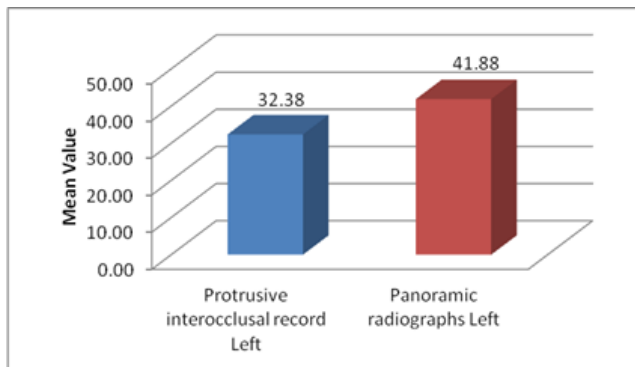
in dental plaster (Kalabhai Karson Mumbai, India). Full spacer was adapted and special trays were fabricated in tray material (M. P. Sai Enterprise, Mumbai). Border molding was done using low fusing impression compound (DPI Pinnacle tracing stick, India) and secondary impression was made with zinc oxide eugenol impression paste (DPI, Mumbai, India), master casts were prepared using dental stone (Type III, Karlok, Mumbai, India). Permanent record bases were fabricated on the master cast with heat cure acrylic resin (DPI, Mumbai, India). Occlusal rims for both maxillary and mandibular ridges were made. Jaw relation recording stages were recorded in conventional manner. Face bow transfer was done using spring bow (Whipmix) and mounting was done on Hanau-wide view articulator using split cast technique. Wax occlusal rims were then converted to impression compound rims by mounting jig. Hight tracers were attached to the rim (Figure 1). Patients were seated in upright position and the permanent record bases with the tracers attached were placed in mouth (Figure 2). Training exercises were conducted and when the patient was efficient in performing mandibular movements tracing plate was prepared and the tracing was recorded (Figure 3). With definite Gothic arch tracing the centric point record was made. Protrusive relation record was made at a standardized distance of 6mm on the centric relation by poly vinyl siloxane material (Jet bite) (Figure 4). Mean value were obtained from 3 protrusive records. Programming of Hanau articulator was done by releasing the lock nuts for adjustments (Figure 5). The protrusive records were seated on the mandibular cast and the maxillary cast was seated on the record. The maxillary articulator was gently manipulated until accurate fit was obtained of the split cast. Values of right and left condylar guidance were tabulated.

2. Methodology for recording and tracing Orthopantomogram.

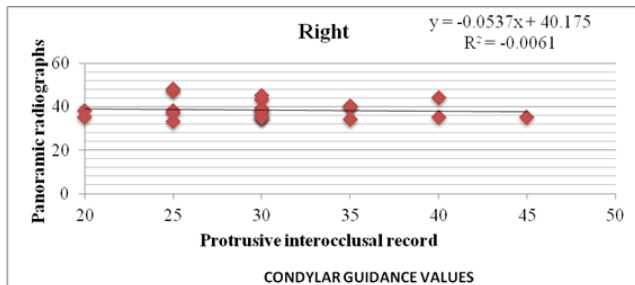
Orthopantomogram of each patient was made with Frankfort horizontal plane parallel to the floor of the mouth. All radiographs were taken by the same operator with same panoramic unit. Radiographs were acquired at 15mA exposure, 86kVp for 10 seconds. Tracings were done, where the glenoid fossa (superior curvature), articular eminence (inferior curvature) and Frankfort Horizontal Plane were outlined.



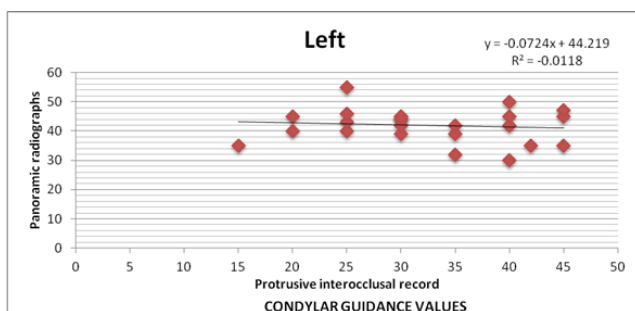
Graph 1: Comparison between condylar guidance values on right side.



Graph 2: Comparison between condylar guidance values on left side.



Graph 3: Linear regression analysis of condylar guidance values on right side.



Graph 4: Linear regression analysis of condylar guidance values on right side.



Fig 1: Tracers attached to compound rims.

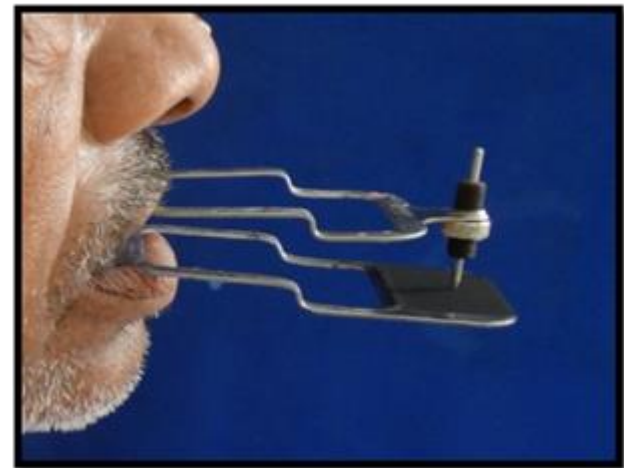


Fig 2: Tracers placed in mouth.



Fig 3: Arrow point Gothic arch tracing.



Fig 4: Three protrusive records



Fig 5: Condylar guidance adjustments.

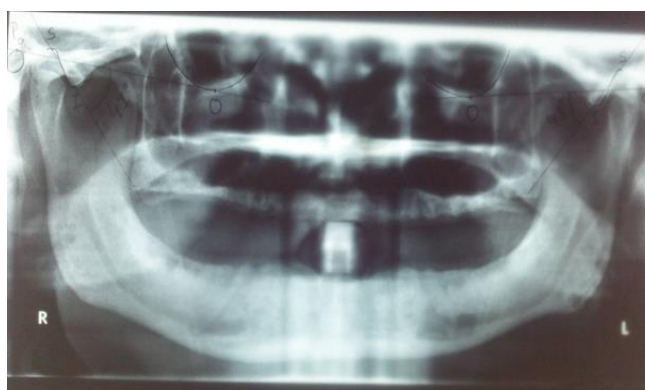


Fig 6: OPG showing condylar guidance angle on right and left side.

The angle formed by joining the height of superior curvature and the height of inferior curvature to FHP was the horizontal condylar guidance angle

(Figure 6). Condylar guidance values were measured on both right and left sides in same manner for all the patients.

RESULTS

Condylar guidance values of both sides for protrusive interocclusal record and panoramic radiographs were tabulated for all 24 patients. The mean values of condylar guidance from protrusive interocclusal record on right side were 30.42 and that on left side were 32.38. The mean values of condylar guidance from panoramic radiographs on right side were 38.54 and on left side were 41.88.

Graph 1 shows the comparison of the protrusive interocclusal record with panoramic radiograph on right side. It depicts that panoramic mean values of condylar guidance is more of panoramic radiographs as compared to protrusive values.

Graph 2 shows the comparison of the protrusive interocclusal record with panoramic radiograph on left side. It depicts that panoramic mean values of condylar guidance is more of panoramic radiographs as compared to protrusive values.

Mean condylar guidance values obtained from protrusive records (right and left) and panoramic radiographs (right and left) were compared for statistical significance using independent t-test. Results yielded a p value for both right and left for panoramic radiographs and protrusive interocclusal records <0.0001 indicating a highly significant difference between them (Table 1).

Pearson correlation was done to obtain correlation between protrusive interocclusal record and panoramic radiographs on right and left side. On right side r value was -0.078 and p value was 0.718 which indicates condylar guidance angles obtained by protrusive interocclusal record and panoramic radiographs are negatively correlated. On left side r value was -0.109 and p value was 0.613 which indicates condylar guidance angles obtained by protrusive interocclusal record and panoramic radiographs are negatively correlated (Table 2).

Table 1: Comparison between condylar guidance angles obtained by panoramic radiographs and protrusive interocclusal records.

	Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t value	p value
Protrusive interocclusal record Right	30.42	24	6.064	1.238	-8.125	5.218	<0.0001*
Panoramic radiographs Right	38.54	24	4.180	0.853			
Protrusive interocclusal record Left	32.38	24	8.556	1.746	-9.500	4.318	<0.0001*
Panoramic radiographs Left	41.88	24	5.690	1.161			

* - statistically significant

Table 2: Pearson's Correlation between condylar guidance values obtained from protrusive interocclusal record and panoramic radiographs on right and left side.

	N	Correlation (r)	p value
Protrusive interocclusal record Right & Panoramic radiographs Right	24	-0.078	0.718
Protrusive interocclusal record Left & Panoramic radiographs Left	24	-0.109	0.613

Linear regression analysis was done on the right side as well as on left side which showed that there is a negative line between both. The condylar guidance value obtained by panoramic radiograph increases when the values obtained by protrusive interocclusal record decreases. The model of regression for right side was hypothesized and equation was obtained $y = -0.0537x + 40.175$ where $y =$ dependent variable (condylar guidance value obtained by panoramic radiographs) and $x =$ constant variable (condylar guidance value obtained by protrusive interocclusal record). Thus by placing values of x , the values of y can be obtained. Correlation coefficient was -0.0061 on right side which means there was negative correlation (Graph 3). The model of regression for left side was hypothesized and equation was obtained $y = -0.0724x + 44.219$ where $y =$ dependent variable (condylar guidance value obtained by panoramic radiographs) and $x =$ constant variable (condylar guidance value obtained by protrusive interocclusal record). Thus by placing values of x the values of y can be obtained. Correlation coefficient

was -0.0118 which means there was negative correlation (Graph 4).

DISCUSSION

Zamacona et al⁷, fully conscious of the problems found by El-Gheriani and Winstanley¹⁰, proposed it was possible to obtain accurate angles of the sagittal condylar path by drawing a tangent to the tracing and measuring it with a conventional protractor. In their study, 3 investigators drew tangents on 3 tracings of each side of 56 totally edentulous patients. Their mean values and standard deviations were similar on each side and were similar to the results of the present study. The differences between the El-Gheriani and Winstanley's¹⁰ study and this study is that they used the ala-tragus line (Camper's line) as a reference and that their subjects were edentulous. The standard deviations were close to those obtained for the wax protrusive registration for this study (right side- 9.25; left side- 6.98). The large standard deviations were due to reading variations from one subject to the other. A remarkable inspection by Zamacona et al⁷ was associated to the angular differences between the left and right sides of their subjects. They found that 44 (78.6%) had a zero- to 10-degree difference, while only 12 (21.4%) had more than a 10-degree difference between right and left sides.

Studies have shown that radiographs either orthopantomogram or lateral cephalogram can be used as a help in settling the sagittal condylar guidance angle in semi adjustable articulators⁷. Iian gilboa et al⁶ accounted a study to discover correlation between articular eminence and the corresponding panoramic radiographs image in

human dry skulls. They accomplished that panoramic radiographs of the sagittal inclination of the articular eminence consistently replicated the eminence inclinations in the human skulls.

Kumar PT et al reported the correlation between condylar guidance angles obtained from protrusive interocclusal records in dentulous patients. They concluded that the protrusive condylar guidance angles obtained by panoramic radiograph may be used in programming semi-adjustable articulators in dentulous patients⁹. However there was no such study evaluating the correlation in edentulous patients. Thus the need for the study was justified.

The mean values between jaw relation recording stage and radiographs on both left and right side were found to be highly statistically significant by using paired t-test ($p < 0.0001$). The results of this study match with that of study done by Shetty S et al³. However higher mean values were found in panoramic radiographs compared to those obtained at jaw relation recording stage by protrusive interocclusal record. Pearson correlation test was done to correlate the condylar guidance values obtained from panoramic and protrusive interocclusal records. It showed that the values were not significant ($p = 0.718$ and $p = 0.613$). Thus the null hypothesis was accepted based on the results of Pearson's correlation test. For prediction of correlation linear regression analysis was thus done which showed negative correlation on both left and right side. Equation was framed for both the sides on the basis of which the condylar guidance values were obtained of panoramic radiographs from condylar guidance values of protrusive interocclusal records. However the validity of the equation was not checked in this study.

The probable reason for increase in the values obtained by radiographs may be due to articulator on condylar guidance values obtained from panoramic radiographs and balancing the occlusion with that. The correlation with the condylar guidance values obtained from lateral cephalogram should also be checked.

CONCLUSION

Within the limitations of the study, it can be concluded that the condylar guidance values

obtained from the radiographs were higher than those obtained at the stage of jaw relation recording stage. However, the values obtained from panoramic radiographs and protrusive interocclusal record did not correlate. On the other hand the values obtained by panoramic radiographs and protrusive interocclusal records on both the sides were negatively correlated.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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