

A Comparative Evaluation of Condylar Guidance Value from Radiograph with Interocclusal Records made During Jaw Relation and Try-in: A Pilot Study

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Abstract 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) and Try-in stage. 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 (Bitrex- vinyl polysiloxane) 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 statistical analysis. 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 and also between Orthopantomograph and condylar guidance values obtained at the stage of Try-in. Condylar guidance values obtained from the Radiographs were higher than those obtained at the stage of Jaw relation and at the stage of Try-in. However, we notice that the mean condylar guidance values obtained at the stage of Try-in were nearer to the mean condylar guidance values obtained on the Radiographs.

Keywords Condylar guidance · Programming · Orthopantomograph · Jaw relation · Try-in

Introduction

Semiadjustable articulators are commonly used in restorative dentistry, especially in prosthodontics for their simplicity in handling and programming [1]. Programming of an articulator is a process of customizing the angulations and settings of the instrument such that it would simulate the anatomy and movements of the temporomandibular joint of the patient [2–5]. Thus it serves as a patient in the absence of the patient. An analogue of the condylar guidance on an articulator is considered to be a necessary requisite in prosthodontics. Condylar guidance is described as the mandibular guidance generated by the condyle and articular disc traversing the contour of the glenoid fossae or, synonymously, as the mechanical form located in the upper posterior region of an articulator that controls movement of the mobile member [6, 7]. The guidance inclination in semiadjustable articulators is set either by individual protrusive or lateral interocclusal registrations [3, 7–9, 11].

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In the edentulous subjects the interocclusal records can be made at different stages, either during jaw relation (Arrow point tracing) or after teeth arrangement (Try-in). These records are used to determine the condylar guidance values/angles for the individual. The ultimate aim is to aid in fabricating a prosthesis that is in harmony with the patient's functional range of movements. Whether the interocclusal record made during jaw relation or try-in has any influence on the condylar guidance angles is not known.

The outline of the articular eminence of the temporal bone may be seen on a panoramic radiograph. These images provide composite sagittal representations of the skeletal structures. The outline of the eminence can be used in setting the condylar guidance inclination in semiadjustable articulator [7].

Objectives

To determine the condylar guidance values using:

- Radiograph (Orthopantomograph)
- The interocclusal records made at the stage of Jaw relation (Arrow point tracing)
- The interocclusal records made at the stage of Try-in

To compare:

- The value of condylar guidance recorded by Radiograph (Orthopantomograph) and Jaw relation (Arrow point tracing).
- The value of condylar guidance recorded by Radiograph (Orthopantomograph) and at Try-in.

Inclusion Criteria

- Completely edentulous subjects
- Well formed ridges

Exclusion Criteria

- Subjects with signs and symptoms of temporomandibular joint disorders and neuromuscular disorders

The ethical committee clearance was obtained for the study.

Materials and Methods

Materials

Hanau Wide Vue Semiadjustable Articulator

Interocclusal records made using bite registration material (Bitrex- vinyl polysiloxane)
Digital OPG (Planmeca Dimax)
Aluwax

Study Method

15 completely edentulous subjects reporting to the Department of Prosthodontics, V.S. Dental College and Hospital, Bangalore were selected for the study. The subjects were informed about the procedures to be performed and a consent form was signed.

In this study the condylar guidance values/angles were obtained using radiograph (Orthopantomograph), interocclusal records made during jaw relation and try-in. The condylar guidance values obtained by using interocclusal records were compared with radiograph values.

Radiographic Determination of Condylar Guidance Values

Digital Orthopantomograph were taken for 15 subjects with normal exposure (Fig. 1). Orthopantomograph tracings were done, where in the Glenoid fossa (Superior curvature), Articular eminence (Inferior curvature) and the Frankfurt Horizontal Plane (FHP) were outlined. The angle formed by the line joining the height of superior curvature and the height of inferior curvature to Frankfurt horizontal plane will be the horizontal condylar guidance angle, for that subject (Fig. 2). The condylar guidance values were recorded for the right and left sides.

Determination of Condylar Guidance Values Using Interocclusal Records

Interocclusal Record at the Stage of Jaw Relation (Arrow Point Tracing)

Making of Interocclusal Records Preliminary impression of the edentulous arches were made using impression compound and were poured using dental plaster. Custom impression tray was fabricated on the preliminary cast using autopolymerizing acrylic resin. Border molding was carried

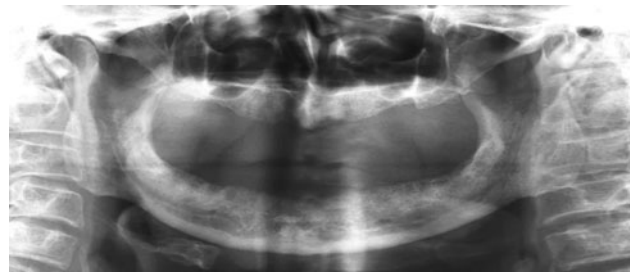


Fig. 1 Orthopantomograph

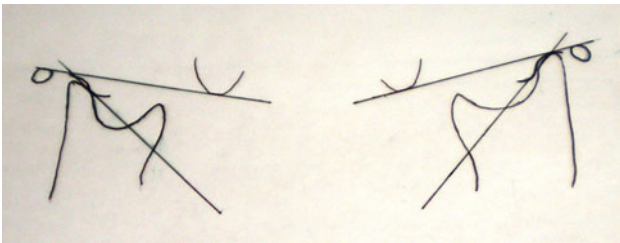


Fig. 2 Tracing of Orthopantomograph

out using low fusing impression compound (green stick compound) and secondary impressions were made using zinc oxide eugenol impression paste. The impressions were poured in type III dental stone.

Jaw relation was recorded using conventional methods. Face bow transfer was done and the maxillary cast was oriented to the articulator. The mandibular cast was then related to the maxillary cast with a centric relation record and was attached to the mandibular member of the articulator. Tracers were attached to the maxillary and mandibular occlusal rims (Fig. 3).

The subjects were seated in up-right position and the temporary record bases with the attached recording devices were placed on maxillary and mandibular ridges. Training exercises were conducted. When the subjects were proficient in executing the mandibular movements, the tracing plate was prepared to record the tracing. When definite arrow point tracing with a sharp apex was made, the subjects were asked to retrace the mandible to centric relation (Fig. 4). The bite registration material was injected between the occlusal rims and allowed to set (Fig. 5).

From the apex of the arrow point tracing the distance of 6 mm was measured on the protrusive tracing and was marked. The subjects were instructed to protrude till this point and the protrusive interocclusal records were made (Fig. 6).

Programming the Articulator The horizontal condylar adjustments were freed by releasing the locknuts. The



Fig. 3 Tracers attached to the maxillary and mandibular occlusal rims



Fig. 4 Arrow point tracing

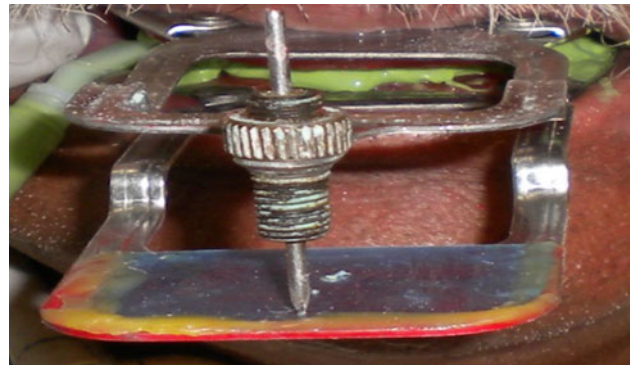


Fig. 5 Interocclusal record at centric relation



Fig. 6 Interocclusal record at 6 mm protrusion

protrusive records were seated on the mandibular cast and the maxillary cast was seated on the record. The maxillary articulator member was gently manipulated into position using precise fit of the maxillary split cast to determine the condylar guidance angulation (Fig. 7). The condylar guidance values/angles were recorded for the right and left sides.

Interocclusal Record at the Stage of Try-in

Making of Interocclusal Records After verification of the jaw relation i.e., try-in procedure, interocclusal records were made. During the process of the study it was observed that, it was difficult to stabilize the jaws at 6 mm protrusive position till the interocclusal records were made. To



Fig. 7 Precise fit of maxillary split cast

overcome this, wax indentations were first made on the articulator at 6 mm protrusion and these records were used to train the subjects and hold the jaw in a desired protrusive position.

After try-in procedure, the trial dentures were placed on the articulator and the lower member of the articulator was moved forward approximately 6 mm and then closed in that position. The horizontal relation of the lower to upper anterior teeth and the relationship of the upper and lower midlines were observed carefully. The locknuts were tightened in that position.

Aluwax was immersed in a water bath of 54 °C for 30 s and was placed on the posterior teeth of mandibular trial denture. The upper member of the articulator was pressed into the warm wax to approximately a third of its depth. The wax record was chilled thoroughly (Fig. 8).

Both the trial dentures were placed in the subject's mouth and the subjects were trained to close and hold the jaw in these indentations. After satisfactory training of the subject, the wax records were relined using bite registration paste, the records were held intraorally till the material sets (Figs. 9 and 10).

Programming the Articulator The trial dentures were placed on the articulator and programming was done using the interocclusal records. The maxillary articular member was gently manipulated into position using precise fit of the maxillary split cast to determine the condylar guidance angulation. The condylar guidance values/angles were recorded.



Fig. 8 Alu wax record made on articulator at 6 mm protrusion



Fig. 9 Making of interocclusal records at the stage of try-in



Fig. 10 Interocclusal records

Results

The condylar guidance values obtained were subjected to statistical analysis. Condylar guidance values between jaw relation and radiograph as well as between try-in and radiograph were compared for the right and left sides, as represented in Tables 1 and 2 respectively. Figures 11 and 12 are the graphical representation of the mean condylar guidance value on right and left side respectively.

Discussion

Studies have shown that Radiographs (orthopantomograph, Lateral cephalogram) can be used as an aid in setting the sagittal condylar guidance angle in semi adjustable articulators. Ilan Gilboa and Harold S had done a study to determine the correlation between the anatomic shape of the articular eminence and the corresponding panoramic radiographic image in human dry skulls. They concluded

Table 1 Comparison of condylar guidance values between Jaw relation and radiograph as well as between try-in and radiograph on *Right Side*

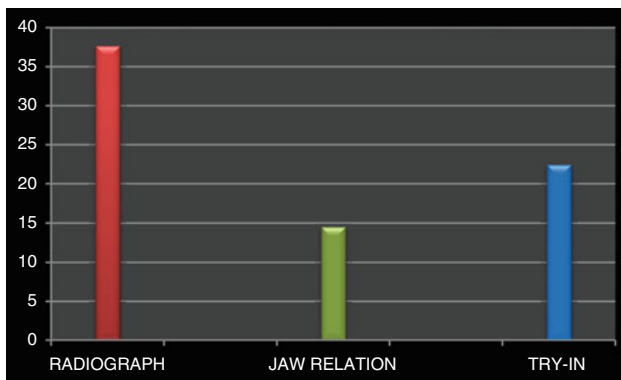
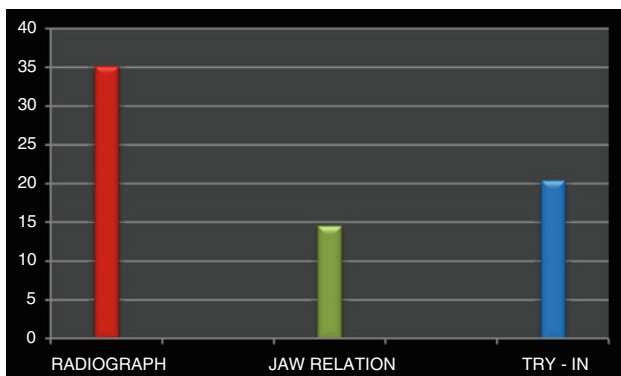
Method	Mean	SD	Mean difference	t	P value
Jaw relation	12.73	11.08	-24.400	-7.667	<0.001*
Radiograph	37.13	5.40			
Try- in	24.00	11.83	-13.133	-3.911	<0.001*
Radiograph	37.13	5.40			

* Significant difference

Table 2 Comparison of condylar guidance values between Jaw Relation and Radiograph as well as between Try-in and Radiograph on *Left Side*

Method	Mean	SD	Mean difference	t	P value
Jaw relation	13.47	9.87	-21.667	-7.648	<0.001*
Radiograph	35.13	4.79			
Try- in	21.67	10.63	-13.467	-4.471	<0.001*
Radiograph	35.13	4.79			

* Significant difference

**Fig. 11** Mean condylar guidance value on *Right side***Fig. 12** Mean condylar guidance value on *Left side*

that the panoramic radiographic image of the sagittal inclination of the articular eminence consistently replicated the eminence inclinations in the human dry skulls [7].

Vassilis K. Vergos and Aris-Petros D. Tripodakis evaluated four recording materials (polyether, polyvinyl siloxane, acrylic resin, and wax) for their ability to accurately record, maintain, and reproduce the vertical interocclusal relationship using metallic apparatus, representing the opposing arches. It was observed that the interocclusal recording materials produced small vertical discrepancies ranging from 24 to 74 μm . The lowest discrepancy was displayed by polyvinyl siloxane and polyether, and the greatest was displayed by wax [10].

This study was undertaken to determine and compare the condylar guidance values/angles made at the stage of Jaw relation (Arrow point tracing) and at the stage of try-in with the values obtained from the radiographs.

The mean condylar guidance values recorded on the right side are represented in Table 1. The difference in mean condylar values between jaw relation and radiograph was found to be statistically significant ($P < 0.001$). Higher mean condylar value was found in radiograph compared to jaw relation. Similarly, the difference in mean condylar values between try-in and radiograph was found to be statistically significant ($P < 0.001$). Higher mean condylar value was found in radiograph compared to try-in. However, we notice that the mean condylar value recorded during try-in is nearer to the mean condylar value recorded from radiograph.

The mean condylar guidance values recorded on the left side are represented in Table 2. The difference in mean condylar values between jaw relation and radiograph was found to be statistically significant ($P < 0.001$). Higher mean condylar value was found on radiograph compared to jaw relation. Similarly, the difference in mean condylar values between try-in stage and radiograph was found to be statistically significant ($P < 0.001$). Higher mean condylar value was found in radiograph compared to try-in. However, we notice that the mean condylar value recorded in try-in is nearer to the mean condylar value recorded in radiograph.

From the statistical analysis it was observed that higher mean condylar values were obtained from the radiographs as compared to the values recorded during jaw relation and try-in.

Limitations

- Sample size
- Radiographic distortion

Conclusion

Within the limitations of the study it was observed that:

1. The condylar guidance value/angle is influenced by the stage at which the record is made.
2. The condylar guidance value/angle obtained from the radiographs was higher than those obtained during jaw relation and try-in.
3. However, the mean condylar guidance values recorded during try-in were nearer to the mean condylar value recorded on radiograph.

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