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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF THE EFFECT OF THREE DIFFERENT INTER-OCCLUSAL RECORDING MATERIALS ON HORIZONTAL CONDYLAR GUIDANCE VALUES IN TWO DIFFERENT SEMI ADJUSTABLE ARTICULATORS WITH REFERENCE TO CONDYLAR GUIDANCE VALUES OBTAINED BY LATERAL CEPHALOMETRIC TRACING

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ABSTRACT

Background: Many techniques have been discussed to record horizontal condylar inclination and transfer it to an articulator, but the most popular and commonly used technique to determine horizontal condylar inclination is use of inter-occlusal protrusive records. Considering, this study was planned to evaluate the effect of three different inter-occlusal recording materials on horizontal condylar guidance values in two different semi adjustable articulators with reference to condylar guidance values obtained by lateral cephalometric tracing.

Materials and Methodology: For the study, 15 patients of age 18-24 years were selected with full complement of dentition. (n=15). Maxillary and mandibular impression were made ans two pairs of cast were made. Mounting was done for respective artiulators. Three protrusive inter-occlusal records were made with each material. The semi-adjustable articulators were programmed to obtain the readings of horizontal condylar inclination of both the right and left side. The cephalograms were traced and the horizontal condylar guidance values were obtained.

Results: The results of the studies showed that, Arcon articulators have better level of accuracy of recording HCG than that of non-arcon articulators. Polyvinyl siloxane and polyether material exhibit better level of accuracy of recording HCG in both arcon and non arcon articulators. Alu wax is not recommended material with either of the articulators.

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INTRODUCTION

Horizontal condylar inclination is one of the important parameter which has to be recorded in patient and transferred to articulator in order to geminate the jaw movements. (Sharma *et al*., 2011) Horizontal condylar inclination is usually obtained with the protrusive inter occlusal record and lateral condylar inclination can be calculated either from horizontal condylar inclination using Hanau formula or with individual lateral records. Inter-occlusal protrusive records are most promising and user-friendly technique toset the horizontal condylar movements. (Curtis, 1989; Ecker *et al*., 1984; Santos *et al*., 2003) Different types of interocclusal recording material and semi adjustable articulators used together gives varying degree of reproducibility of condylar inclination. (Gross *et al*., 1990; Michalakis *et al*., 2004; Missltien *et al*., 1973; The glossary of prosthodondonticterms, 2005) The resistance of the materials should be as minimal as possible so that the displacing of mandible during bimanual manipulation is avoided. At the same time rigidity of the material should be enough rigid with very less dimensional change. This clinical study was done to comparatively evaluate the three commonly employed inter-occlusal record material namely Alu wax, polyvinyl siloxane and polyether in obtaining horizontal condylar inclination values in two semi adjustable articulators namely Hanau Wide-Vue(arcon) and Hanau H2 (nonarcon)semi-adjustable articulators and their correlation to the horizontal condylar guidance values obtained by calculation in lateral cephalogram. Digital cephalogram was used to obtain individual horizontal condylar guidance values, which was taken as a standard for critical comparison with two groups. (Prasad *et al*., 2012)

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MATERIALS AND METHODOLOGY

The samples were randomly selected and sample size for the study was 15 patients of age 18-24 years with full complement of dentition. The study was conducted after taking informed consent of the patients. The sample selection was done on following criteria:

Inclusion criteria: (Fig.1)

1. Angle's class one molar relation with no occlusal interferences.
2. Third molar if present should be in ideal occlusion.

Good oral hygiene and periodontal health
Fifteen students from Dr.D.Y.Patil Dental College and Hospital, Pimpri were selected for study according to the inclusion and exclusion criteria.

Obtaining horizontal condylar values in articulators

One set of impression was made using light body material (3M ESPE), Neusus Germany and putty consistency poly vinyl siloxane impression material (3M ESPE), Neusus Germany. The impression was poured in Type IV Gypsum product (Kalabhai) according to the manufactures instructions and guidelines. Two sets of casts were poured from same impression. Bases were made for both the set of casts. Split cast were prepared with both the maxillary casts. Face bow record was made for the patient using Facebow (HANAU^{TM} Spring Bow, Fort Collins. U.S.A.) for both the articulator i:e; Hanau Wide-Vue semi-adjustable articulator(Whip Mix Corporation, Fort Collins. U.S.A.) and Hanau H2 semi-adjustable articulator (Whip Mix Corporation, Fort Collins. U.S.A.) according to the user's instruction manual. Face bow transfer was made for both the articulators namely Hanau H2 and Hanau Wide Vue. These were assigned as Group B and Group C respectively. The mandibular casts were mounted in maximum inter-cuspation with maxillary cast by hand articulation A protrusive jig was prepared using acrylic resin with 6mm of protrusionand checked in patients mouth. This procedure was followed to standardize 6mm of protrusion in all subjects. Three sets of protrusive bite were made using three different inter-occlusal recording materials namely Aluwax (M.P Sai), Polyether (Ramitec), Polyvinyl siloxane(Jet Bite) with the jig placed inraorally. The obtained records were used to program the articulator and horizontal condylar guidance was obtained from each records. The mean of these recording were used for analysis.

Obtaining horizontal condylar guidance with lateral cephalogram

Two lateral cephalograms were made:

- In maximum inter-cuspation.
- In protrusion of 6mm.

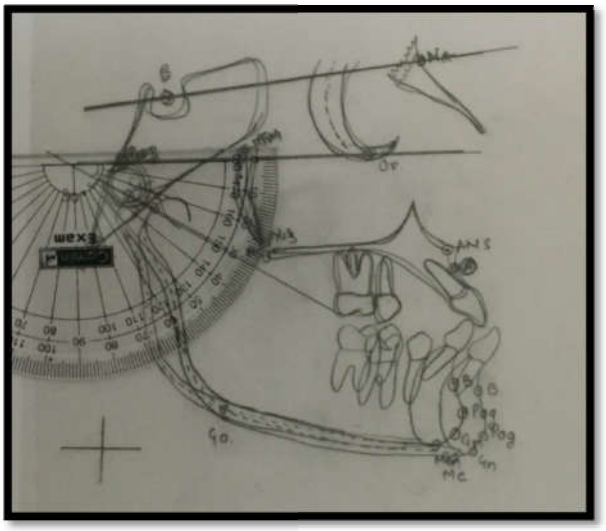
Tracing were done for lateral cephalogram in maximum inter-cuspation and in protrusion. These two tracings were overlapped, using S-N plane.

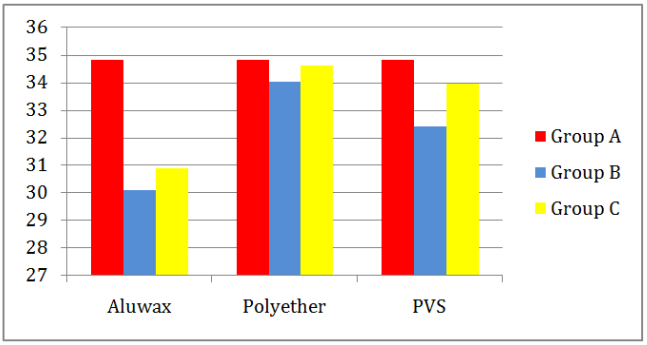
The angle between the Frankfort plane and the tangent derived from C and C^0 gave the Horizontal condylar guidance (FIG 1).

RESULTS

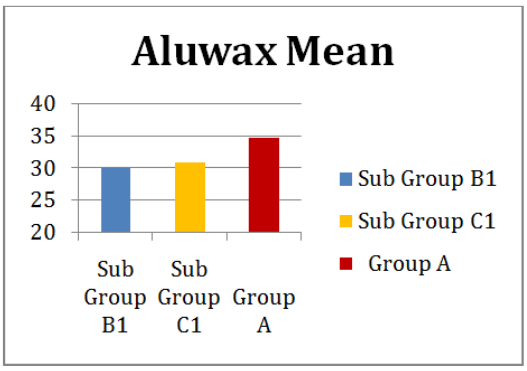
Group analysis was done using one way ANOVA test (Table 1, 3,5,7 and graph1,2,3,4) and inter group comparision was done using usingPost Hoc Tests (Bonferroni) (Table 2,4,6,8) and level of significance I,e; (P)was calculated.

Groups were assigned as following:

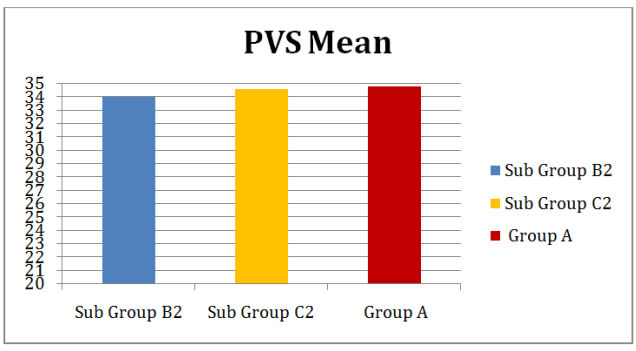




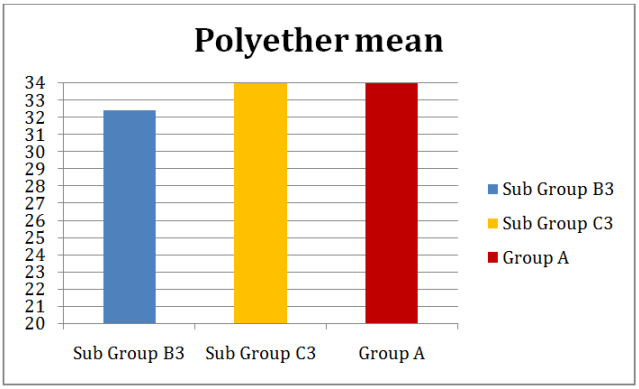
Graph 1:Comparison of means of three different materials using two different articulatorsand control group using One way ANOVA



Graph 2: Comparison of means of two different articulators with control group using Aluwax materials by applying One way ANOVA



Graph 3: Comparison of means of two different articulators with control group using PVS materials by applying One way ANOVA



Graph 4: Comparison of means of two different articulators with control group using poly ether materials by applying One way ANOVA

Table 1. Comparison of means of two different articulators with control group using Aluwax materials by applying Post Hoc Tests (Bonferroni)

Aluwax	(J) Group	Mean Difference (I-J)	P value
Group B1	Group C1	.8333	1.000
	Group A	-3.9222*	.004
Group C1	Group B1	-.8333	1.000
	Group A	-4.7556*	.000
Group A	Group B1	3.9222*	.004
	Group C1	4.7556*	.000

Table 2. Comparison of means of two different articulators with control group using PVS materials by applying Post Hoc Tests (Bonferron)

PVS	(J) Group	Mean Difference (I-J)	P value
Group B2	Group C2	-.6111	1.000
	Group A	-.8111	1.000
Group C2	Group B2	.6111	1.000
	Group A	-.2000	1.000
Group A	Group B2	.8111	1.000
	Group C2	.2000	1.000

Table 3. Comparison of means of two different articulators with control group using Polyether materials by applying Post Hoc Tests (Bonferroni)

Polyether	(J) Group	Mean Difference (I-J)	P value
Group B3	Group C3	-1.5556	.581
	Group A	-2.4222	.132
Group C3	Group B3	1.5556	.581
	Group A	-.8667	1.000
Group A	Group B3	2.4222	.132
	Group C3	.8667	1.000

Table 4. Comparison of means of two different articulators with control group using Polyether materials by applying One way ANOVA

Polyether	N	Mean	Std. Deviation	F	P value
Group B3	45	32.444	6.1582	2.126	.123
Group C3	45	34.000	5.7009		
Group A	45	34.867	5.0209		
Total	135	33.770	5.6933		

Group A –Horizontal Condylar Guidance values obtained by lateral cephalogram tracing.

Group B - Horizontal Condylar Guidance values obtained in Hanau H2 articulator.

Group C- Horizontal Condylar Guidance values obtained in Hanau Wide vue articulator.

Sub groups were assigned as following:

B1- Horizontal Condylar Guidance values obtained in Hanau H2 with aluwax bite record.

B2 - Horizontal Condylar Guidance values obtained in Hanau H2 with poly vinyl siloxane bite record.

B3- Horizontal Condylar Guidance values obtained in Hanau H2 with polyether bite record.

C1- Horizontal Condylar Guidance values obtained in Hanau Wide vue with aluwax bite record.

C2- Horizontal Condylar Guidance values obtained in Hanau Wide vue with poly vinyl siloxane bite record.

C3- Horizontal Condylar Guidance values obtained in Hanau Wide vue with polyether bite record.

DISCUSSION

The mandibular condylar path is the path travelled forward and downward by the condyles in the temporomandibular joints during various mandibular movements, and is peculiar to each individual. (Sharry, 1983) Horizontal condylar guidance is one of the very important factors, which governs the simulation of mandibular movements in articulator. In this clinical study, comparison is done between 3 different inter occlusal recording medium on reproducibility of Horizontal Condylar Guidance in hanau H2 (non-arcon) and hanau wide vue (arcon) semi-adjustable articulators. Lateral cephalometric recording for Horizontal Condylar Guidance were done by tracing first in maximum inter-cuspation and then in protrusion. These two tracings were overlapped, using S-N plane. On overlapping the points C and C^0 were joined. The angle between the Frankfort plane and the tangent derived from C and C^0 gave the Horizontal condylar guidance. The angle at which the condyle moves away from a horizontal reference plane is referred to as condylar guidance. (Muller *et al*., 1991) The study by, Goyal *et al* concluded that the mean difference in the sagittal condylar guidance values obtained from nonarcon and arcon articulators show a low level of reproducibility. The study by, Sharma *et al*. (2004) concluded that polyether and poly vinyl siloxane inter cocclusal recording material exhibited very minimal variation in Horizontal Condylar Guidance values in both articulators. Wax exhibited wide variation with both the articulators. The results obtained in this study were tabulated and subjected to statistical analysis. Mean difference of Horizontal Condylar Guidance values between Group A and B1 has statistically significant difference (P= 0.004). This shows that alu wax does not reproduce Horizontal Condylar Guidance values in Hanau H2 articulator with as much accuracy as that of Horizontal Condylar Guidance obtained from lateralcephalometric tracings (Table 1). Mean difference of Horizontal Condylar Guidance values between Group A and B2 has no statistically significant difference (P=1.00). This shows that PVS reproduces Horizontal Condylar Guidance values in Hanau H2 articulator with similar degree of accuracy as that of Horizontal Condylar Guidance obtained from lateralcephalometric tracings (Table 2). Mean difference of Horizontal Condylar Guidance values between Group A and B3 has no statistically significant difference (P=1.30). This shows that polyether reproduces Horizontal Condylar Guidance values in Hanau H2 articulator with similar degree of accuracy to as that as Horizontal Condylar Guidance obtained from lateralcephalometric tracings (Table 3). The litrature shows that the protrusive condylar

guidance registration using waxes show greater variation which ranges upto 10^0 between articulators. PVS exhibit greatest resistance to compression, polyether and PVS produces lowest vertical discrepancy in mounted casts. (Michalakis *et al*., 2004; Lassila, 1986; Breeding *et al*., 1994)

Mean difference of Horizontal Condylar Guidance values between Group A and C1 has statistically significant difference (P=0.00). This shows that alu wax does not reproduces Horizontal Condylar Guidance in Hanau Wide vue articulator with as much as accuracy as that of Horizontal Condylar Guidance obtained from lateral cephalometric tracings (Table 1). This could be due to high co-efficient of thermal expansion of wax and thermo plastic nature of material. Mean difference of Horizontal Condylar Guidance values between B1 and C1 has no statistically significant difference (P=1.00). This shows that Horizontal Condylar Guidance values derived from Hanau H2 and Hanau Wide vue using alu wax, as interocclusal material does not have significant change (Table 1). Mean difference of Horizontal Condylar Guidance values between B2 and C2 has no statistically significant difference (P=1.00). This shows that Horizontal Condylar Guidance values derived from Hanau H2 and Hanau Wide vue using PVS as interocclusal material is reliable (Table 4). Mean difference of Horizontal Condylar Guidance values between B3 and C3 has no statistically significant difference (P=0.05). This shows that Horizontal Condylar Guidance values derived from Hanau H2 and Hanau Wide vue using polyether as interocclusal material is reliable (Table 4). The mean of B3 and C3 are 32.4 and 34.0 respectively which has no statistical significance, but mean of C3 is more closer to mean of Group A I:e; 34.8. This shows Hanau Wide vue gives more accurate reproducibility when ployether is used as interocclusal recording material, than that of Hanau H2 semi-adjustable articulator. The accurate gemination of the mandibular movements could be due to exact representaion of articular design to temporomandibular joint. Alu wax is not clinically acceptable material and this could be due to high co-efficient of thermal expansion of wax and thermo plastic nature of material. (Millstem *et al*., 1983)

The litrature shows that the protrusive condylar guidance registration using waxes show greater variation which ranges upto 10^0 between articulators. (Michalakis *et al*., 2004; Lassila, 1986; Breeding *et al*., 1994) Muller *et al*, concluded polyether and PVS produces lowest vertical discrepancy in mounted casts, which is greatest by wax. (Muller *et al*., 1990) BS Saluja mentioned that elastomers are easy to manipulate and have almost little resistance to closure, the consistency to that it setsturns it easy to trim without distortion, and with good reproducibility of tooth structures. (Balvinder *et al*., 2013) Goyal *et al*. concluded Hanau Wide vue gives more accurate reproducibility than that of Hanau H2 semi-articulator,the accurate gemination of the mandibular movements could be due to exact representaion of articular design to temporomandibular joint. (Goyal and Goyal, 2011) The results of the study supported the observations of previous studies done by Goyal *et al*. and Sharma *et al*. that alu wax is least reliable inter-occlusal recording material and arcon articulators are more reliable semi-adjustable articulators. This study can be carried out with other considerations like articulators of different companies, different anterior reference points and with increased number of patients.

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