

Evaluation Of Correlation Between Between Incisal Path And Condylar Path With Bilateral Balanced Occlusion

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Abstract

Background: The primary determinants of occlusal equilibrium for complete denture prosthetics are patient's sagittal condyle path (CP) and horizontal incisal path (IP). The relationship involving sagittal CP as well as horizontal IP with appropriate balancing occlusion is one of the research questions that requires attention. All things considered, the shifting of artificial teeth and the resulting alterations are unavoidable and cannot be prevented, but they can be lessened with the right use of current materials and methods

Aim: To investigate the relationship between bilateral balanced occlusion and lateral condylar inclination/ lateral IG and horizontal condylar inclination and during various clinical and laboratory processes.

Methods and Materials: For the study, a random sample of 100 completely edentulous patients was selected at random, with both sexes represented and a mean age of 55. Following the patients' agreement, preliminary data was gathered. Standard methods were used to create the impressions, and Facebow transfer was used to capture the jaw relation. A protractor was used to measure the angle and record the trace of the gothic arch. Extra-oral tracings were used to record the sagittal condylar inclinations, and a protrusive interocclusal record was used to train the semi-adjustable articulator (Arcon).

Results: It was determined that there was a significant statistical relationship between values of sagittal CP, and values of horizontal IP, and symmetric balancing occlusion in two separate age groups. There was a significant association among the waxed up prosthesis on the articulator and the waxed up prosthesis in the mouth of study participants when the relationship among bilateral balanced occlusion, horizontal IP and sagittal CP at various changing phases was analysed. Additionally, there was a good association seen between final prepared prosthesis following selective grinding-articulator (GAEC) and the wax up prosthesis on the articulator.

Conclusion: Waxed-up dentures on articulators, processed dentures on articulators, and processed dentures on articulators after judicious grinding were all demonstrated to have statistically significant relationships in balanced occlusion. In a youthful population of people, balanced occlusion seems to be more predictable.

Keywords: Condylar path, incisal path, bilateral balanced occlusion

Introduction

Oral rehabilitation of completely edentulous subjects requires fabrication of prosthesis which restores patient's functional and esthetical demands. For a complete denture prosthesis to be successful it should be made in harmony with the surrounding oral structures. State of balance or equilibrium is possible when forces acting on the prosthesis results in no motion. Achieving state of equilibrium or balancing should be of paramount importance when considering the forces that act on the artificial teeth and the denture bases, thereby its resultant effect on the movement of the base.^{1,2}

Bilateral balanced occlusion is achieved when there is equilibrium on both sides of the prosthesis due to the simultaneous contact of the artificial teeth in centric and eccentric occlusion. For the establishment of plane of equilibrium, a minimum of three contacts is required; with an increase in the number of contacts, the extent of equilibrium also increases. During functional movements, the bases will shift, tip and torque on their foundation if occlusion of the denture is not balanced bilaterally.^{3,4}

It's going to become loose and effortlessly unseated during tooth separation. This shifting of denture foundation is most likely to damage the supporting tissues, causing pain and inflammation that could hasten bone resorption. When performing physiological movements, a conventional complete prosthetic made with symmetrical balanced connections helps to keep the denture in place. Additionally, additional actions including swallowing, bruxing, times of tension, and closing motions to reseat the prosthetic place greater emphasis on symmetrical synchronized occlusion. Bilateral balancing dentures are offered to patients, who do not disturb the dentures' usual static, stable, and retentive positions. For every particular patient, balancing occlusion offers the key mechanical characteristic needed to meet the needs of accepted biologic as well as physiologic notions.^{5,6}

The primary determinants of occlusal equilibrium for complete denture prosthetics are patient's sagittal condyle path (CP) determined as horizontal condylar inclination and horizontal incisal path (IP) determined as lateral condylar inclination or lateral incisal guidance [IG]). The relationship involving sagittal CP as well as horizontal IP with appropriate balancing occlusion is one of the research questions that requires attention. All things considered, the shifting of artificial teeth and the resulting alterations are unavoidable and cannot be prevented, but they can be lessened with the right use of current materials and methods. Also, it is necessary that the established balanced occlusion in the articulator should be improved or at least maintained in the patients' mouth at various interrelated transformation stages between clinical and laboratory procedures.^{7,8} Therefore, it is deemed important to carry out this current investigation to investigate the relationship between bilateral balanced occlusion and lateral condylar inclination/ lateral IG and horizontal condylar inclination and during various clinical and laboratory processes.

Materials and Methods

Source of Data

There were one hundred totally edentulous patients.

Criteria for inclusion

Completely edentulous individuals who are intellectually capable are required for inclusion.

Participants between the ages of 40 and 70.

Participants without any generalised motor impairments.

Participants with a sufficient interarch distance.

Exclusion Standards

Patients with impaired neuromuscular coordination;

Patients with temporomandibular joint problems.

People who have skeletal or facial deformities.

For the study, a random sample of 100 completely edentulous patients was selected at random, with both sexes represented and a mean age of 55. Following the patients' agreement, preliminary data was gathered. Standard methods were used to create the impressions, and Facebow transfer was used to capture the jaw relation. A protractor was used to measure the angle and record the trace of the gothic arch. Extra-oral tracings were used to record the sagittal condylar inclinations, and a protrusive interocclusal record was used to train the semi-adjustable articulator (Arcon).

At the try-in stage, double-sided blue and red coloured articulating paper (BAUSCH) of 40 microns in thickness was used to check the number of contacts in centric relation and eccentric positions (protrusive and lateral excursive movements) on the articulator and in the patient's mouth. The teeth were arranged with the best possible balanced occlusion. The process was repeated with the processed dentures on the articulator before and after selective grinding as well as during the implantation of the prosthesis in the patient's mouth following acrylization. By placing the paper on both sides of the articulator and tapping it while it was in the centric position, blue articulating paper was used to identify the centric contacts. The number of contacts made was then recorded on each tooth.

The frequency of contacts for the mandibular and the maxillary arches were totaled. The eccentric contacts were then marked with the red articulating paper. The red articulating sheet was first placed on both sides, after which the articulator was closed in the centric position and shifted towards the right lateral location until the cusp tips of the maxillary and mandibular canines on the same side made contact.

Now, the centric contacts were marked with blue articulating paper to distinguish them from the eccentric contacts, and the number of contacts on the working and balancing sides were noted.

The marks were removed, and the procedure was performed again to capture the contacts with the corresponding movements in the left side lateral posture and protrusive orientations. The same process was applied to document all interactions made throughout the various laboratory and clinical phases.

Student's t tests were used in the statistical analysis to compare the groups, and Karl Pearson coefficient correlation procedure was used to determine the link. The analysis was performed using the statistical programme SPSS version 17.0, and a p-value of 0.05 or less was regarded as significant.

Results:

A total of 100 study participants who needed complete dentures were included in current study. According to the study's findings, the mean values of sagittal CP reportedly was 31.49° for people aged between 40 years and 55 years and 33.69° for people aged between 56 years to 70 years, with 32.81° being the mean value for people aged between 40 year to 70 years. In the age range range of 40 years to 55 years, the average horizontal IP was 16.81°; in the age range of 56 years to 70 years, it was 17.15°; and in the age range of 40 years to 70 years, it was 16.15°. The mean of the horizontal IP values and left side and right side sagittal CP varied according to the mean values. When

the mucosa's resilience was evaluated, 25% of the patients revealed refractory mucosa, while the remaining 77% shown typical mucosa resilience.

11 percent of the individuals had severe IG, 41% had shallow IG, while 51% had medium IG, according to the results of the IG assessment. A positive association was found seen between mean sagittal CP as well as the overall interactions (centric as well as eccentric) inside mouth of patient when the ultimate manufactured denture was compared. Mean values of horizontal I.P. (lateral CG-average) demonstrates a p value of 0.10 and coefficient of correlation values (r values) of 0.24 for the cumulative contact points (centric as well as eccentric) in final prepared dentures, while mean sagittal CP values (horizontal CG-average) had demonstrated a p value of 0.10 and correlation coefficient values (r) of 0.36.

It was determined that there was a significant statistical relationship between values of sagittal CP, and values of horizontal IP, and symmetric balancing occlusion in two separate age groups (Table 1). There was a significant association among the waxed up prosthesis on the articulator and the waxed up prosthesis in the mouth of study participants when the relationship among bilateral balanced occlusion, horizontal IP and sagittal CP at various changing phases was analysed. Additionally, there was a good association seen between final prepared prosthesis following selective grinding-articulator (GAEC) and the wax up prosthesis on the articulator (Table 2).

Table 1: Relationship between the horizontal incisal path and the sagittal condylar path in two different age groups with balanced bilateral occlusion

Age Group			Average horizontal IP (lateral CG-average)	Final prosthesis balanced occlusion total no. of contacts
40-55	Average sagittal CP (horizontal CG-average)	N	40	40
		r	1.211	0.68
		p	< 0.05	0.004
	Average horizontal IP (lateral CG- average)	N		40
		r		0.081
		p		0.68
56-70	Average sagittal CP (horizontal CG-average)	N	60	60
		r	0.96	0.04
		p	< 0.021	0.91 (NS)
	Average horizontal IP	N		60

	(lateral CG–average)	r		0.04
		p		0.101 (NS)

Table 2 Relation between sagittal condylar path and horizontal incisal path with bilateral balanced occlusion at various transforming stages in the articulator and patients' mouth

		WD articulator total	WD mouth total	DAEC total	GAEC total
Average sagittal CP (Horizontal CG–average)	N	100	100	100	100
	r	0.37	0.19	– 0.005	0.054
	p	0.07 (NS)	0.18(NS)	0.97 (NS)	0.71 (NS)
Average horizontal IP (lateral CG–average)	N	100	100	100	100
	r	0.32	0.18	– 0.03	0.02
	p	0.14 (NS)	0.21(NS)	0.86 (NS)	0.87 (NS)
WD articulator total	N		50	50	50
	r		0.77	0.42	0.68
	p		<0.001	0.002	<0.001
WD mouth total	N			50	50
	r			0.21	0.54
	p			0.14	< 0.001
DAEC total	N				0.66
	r				< 0.001
	p				100

Discussion

A complete denture prosthesis must be created in harmony with the nearby oral structures in order to be successful. When forces operating on the prosthesis are ineffective at causing motion, a state of balance or equilibrium may exist. When taking into account the forces acting on the denture bases and artificial teeth, as well as how these forces affect the movement of the base, achieving a condition of balance or balancing, should be of the utmost importance. When both sides of the prosthesis are in balance due to the artificial teeth's synchronous contact in both centric and eccentric occlusion, this is known as bilateral balanced occlusion.^{9,10}

The patient's sagittal condyle path (CP), which is determined by the horizontal condylar inclination, and horizontal incisal path (IP), which is determined by the lateral condylar inclination or lateral incisal guidance [IG] are the main determinants of occlusal equilibrium for complete denture prosthetics. One of the major concerns that has to be

addressed is the interaction between horizontal IP with proper balancing occlusion and sagittal CP. All things considered, the shifting of artificial teeth and the alterations that come from it cannot be avoided and cannot be stopped, but they can be mitigated with the proper application of modern tools and techniques.^{11,12}

Additionally, it is essential that the patients' mouth's established balanced occlusion be improved or at the very least maintained during numerous connected transformation stages between clinical and laboratory tests. 13,14 In order to better understand the association between bilateral balanced occlusion and lateral condylar inclination/lateral IG and horizontal condylar inclination as well as during various clinical and laboratory procedures, the current work is considered relevant.

According to the study's findings, the mean values of sagittal CP reportedly was 31.49° for people aged between 40 years and 55 years and 33.69° for people aged between 56 years to 70 years, with 32.81° being the mean value for people aged between 40 year to 70 years. In the age range range of 40 years to 55 years, the average horizontal IP was 16.81°; in the age range of 56 years to 70 years, it was 17.15°; and in the age range of 40 years to 70 years, it was 16.15°. The mean of the horizontal IP values and left side and right side sagittal CP varied according to the mean values. When the mucosa's resilience was evaluated, 25% of the patients revealed refractory mucosa, while the remaining 77% shown typical mucosa resilience.

11 percent of the individuals had severe IG, 41% had shallow IG, while 51% had medium IG, according to the results of the IG assessment. A positive association was found seen between mean sagittal CP as well as the overall interactions (centric as well as eccentric) inside mouth of patient when the ultimate manufactured denture was compared. Mean values of horizontal I.P. (lateral CG-average) demonstrates a p value of 0.10 and coefficient of correlation values (r values) of 0.24 for the cumulative contact points (centric as well as eccentric) in final prepared dentures, while mean sagittal CP values (horizontal CG-average) had demonstrated a p value of 0.10 and correlation coefficient values (r) of 0.36.

The mean values horizontal IP and mean values horizontal CP have a statistically vital connection with symmetrical balancing occlusion in edentulous people in the 40 years to 55 years old age group, according to the findings of the current research. Therefore, it may be said that younger age groups of humans are more susceptible to symmetrical balanced occlusion than older ones. This may be attributed to the fact that in younger subjects, mandibular motions and learned muscle control are more steady. Furthermore, older people have a little bit of difficulty controlling and performing decisive lateral motions since their neuromuscular coordination declines with age.

According to Shah et al study 's findings, condylar inclination declines with age. The current study, however, found that condylar inclinations only slightly increase with age. Additionally, readings for the horizontal condylar revealed a tendency to decline with age.³ Contrarily, the current investigation revealed a rise in values of horizontal condylar inclination with ageing, which is consistent with Prasad et al⁶, Katsavrias et al⁵, and Baquaien et al⁴ results. The mean CG values found in this investigation are almost identical to those from Jose de Santos and colleagues research employing wax records.

A minimum of three interactions are needed to establish an equilibrium plane; as the number of contacts rises, so does the extent of the equilibrium. If the occlusion of the denture is not balanced bilaterally, the bases will shift, tip, and torque on their foundation during functional motions.^{15,16} Denture will easily and subsequently get loose due to tooth separation. This shifting of the denture's base is most likely to harm the tissues that support it, resulting in pain and inflammation that can speed up bone resorption. A traditional complete prosthesis built with symmetrical balanced connections helps to retain the denture in place when engaging in physiological activities. The importance of symmetrical synchronised occlusion is also increased by additional events including swallowing, bruxism, periods of stress, and closure motions to reseal the prosthetic. Patients who do not alter the dentures' typical static, stable, and retentive postures are supplied bilateral balancing dentures. Balancing occlusion provides the essential mechanical

characteristic required to satisfy the requirements of acknowledged biologic as well as physiologic conceptions for every specific patient.^{17,18}

Even while the harmonious occlusion of the final prosthetic inside the mouth of patienty is what concerns, it is crucial that painstaking consideration be taken during different phases of denture production in the laboratory in order to accomplish exact same thing.¹⁹At various shifting stages of denture manufacture, the current study also concentrates on the connection among sagittal CP, horizontal IP, and symmetrical balanced occlusion.²⁰Waxed-up dentures on articulators, processed dentures on articulators, and processed dentures on articulators following selective grinding all showed statistically significant relationships in balanced occlusion.

Conclusion

Waxed-up dentures on articulators, processed dentures on articulators, and processed dentures on articulators after judicious grinding were all demonstrated to have statistically significant relationships in balanced occlusion. In a youthful population of people, balanced occlusion seems to be more predictable.

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