



POSITION OF MANDIBULAR JOINT SURFACE IN CENTRIC RELATION

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ABSTRACT

The position of mandible in centric relation is the initial position in prosthodontic rehabilitation. This fact is especially significant today when, due to development of implantology, the use of osseointegrated prostheses is increasingly discussed. The aim of the study is to define if the peak of the articulating surface of mandible in centric relation position is directed towards the zenith of mandibular fossa, or is in the retroposition. The research was conducted on macerated human skulls in anthropometric system, based on objective measuring techniques and methods. The results showed that if the zenith of mandibular fossa is determined according to the vertical line of the Frankfurt horizontal, the peak of the mandibular caput articulating surface is in retroposition. The relation of the lower joint surface to the mandibular fossa zenith is the same on both right and left side. The correlation coefficient demonstrates a high correlation between the sides, highly significant with probability level of $p < 0.01$. If the peak of mandibular fossa is determined according to the vertical line of the Frankfurt horizontal, the peak of the articulating surface of mandibular caput is in retroposition in relation to the peak of the upper jaw surface. This original scientific work will help better understanding of x-ray analysis and understanding of relationship of TMJ surfaces, what is necessary for treatment of TMD and occlusal imbalances.

KEY WORDS: Centric relation (CR), mandibular fossa zenith, retruded position

INTRODUCTION

The occlusion can not be studied separately from the position of the mandible in relation to the base of skull. The position of the articulating surface of mandibular caput in relation to articular facet is of primary significance and it is this position that occlusion depends on. The proper physiological relation of the lower jaw surface to the upper, which belongs to the skull base structures, is referred to as centric relation. Centric relation should be the starting point of all prosthetic interventions (1, 2, 3, 4, 5). There are still controversial attitudes in prosthodontics pertaining to which position of condyles is physiologically suitable as initial in patients with lost intermaxillary relation: is it the position corresponding to the zenith of mandibular fossa, or the retruded one. Gerber believes that, in centric relation position, the condyle peak must be in the zenith of mandibular fossa. The author believed the shape of condyles, different in different persons and even on the left and right side of the same person, to be the cause of mandible not being able to take the physiological position in centric relation (6). On the other hand, the supporters of gnathological theory of occlusion believe that "the most distant retruded upper position of condyles" in articular fossae is the most suitable initial position (7). Gradual changes in attitudes that took place in the recent years can be best illustrated by the changes in the meaning of the term centric relation (CR). In 1994, in the sixth edition of the Glossary of Prosthodontic Terms, centric relation is defined as the maxillomandibular relationship in which the condyles, together with the thinnest avascular portion of their respective disks, articulate with the slopes of the articular eminences in the anterior-superior position. This description is significantly different when compared to the description of "the most retruded mandibular position" given in previous editions of the Glossary. In 1992 Wilkinson reports that there are no sufficient scientific evidence that the simultaneous presence of centric relation and centric occlusion represents the highest physiological form of occlusion. In the past the term centric relation was used to label variations in maxillary relation, so that the use of the term itself was challenged. Still, the consensus was reached that, when extensive prosthetic interventions are indicated and when the support of lateral teeth is missing, centric relation is a suitable, reproducible referent position of mandible (7). The purpose of this study is to define if the peak of the articulating surface of mandible in centric occlusion position is directed towards the zenith of mandibular fossa, or is in the retroposition.

MATERIAL AND METHODS

The sample is comprised of 17 macerated human skulls, included in the research through targeted selection:

- macerated skulls that were congruent (which was, in addition to the verification at the Institute of Anatomy, determined through identification of occlusal contacts. Mandibular caput was in the mandibular fossa.
- the skulls in which the relation of the maxilla and mandible was in class 1 by Angle, with intact dentition and preserved morphological features on dental occlusal surfaces.
- the skulls whose mandibular caput was without anomalies in shape and size.

The research methodology made use of osteometry. Since the research focused on morphological features in the area of articular surfaces and on the mutual relations of such features, whose measures are in the order of magnitude of several square millimeters, high precision in expression of relevant measures was necessary, so that they were measured and expressed in microns. In order to accomplish this, used in the study was a highly precise electronic measuring device for three-dimensional measuring, DEA A001, which gives spatial coordinates X, Y and Z, i.e. their numerical values, for each point of reference on the measured object. The tasks of the study were: 1) to find the highest point on the articulating surface of the mandibular caput; 2) in the position of centric occlusion, to determine the mutual relation of osseous structures of articular surfaces within the joint; to define the posterior-anterior (P-A) position of the mandibular caput articulating surface in relation to the articular facet of mandibular fossa as a fixed component. Therefore, the basic task was to bring the mandible in the position of centric occlusion through occlusal contacts of maxillary and mandibular dentition. At the same time, the study used the method of articular space impression. The impressions were made in silicone imprint material, in accordance with the highly precise method of corrective impression, which ensured the precise impression of the edges of articular surfaces. Thereafter, each skull from the sample was, with mandible brought in the centric occlusion position, placed on the table of DEA device and introduced into its coordinate system. Used as the starting point for adjustment of coordinate systems (of the measuring device and anthropomorphic model) was the Frankfurt horizontal. (According to the international agreement of anthropologists from Frankfurt 1884, the skulls are, when measured, placed in the Frankfurt horizontal plane). The next step was releas-

ing of mandible from the described relation with maxilla and skull base, so that the mandible remained on the table of the measuring device oriented in space in its natural position in relation to the horizontal, sagittal and frontal skull plane. On capitulum on the right and left side of the mandible, there is the imprint whose outer surface contains the negative reproduction of precisely impressed mandibular fossa on the temporal bone in which the other articular surface was (Figure 1). It was in this way possible to make the measured surfaces accessible and to make them a basis for Z coordinate, to which all the measures pertaining to the height of the points of reference will be related. By means of measuring of articular surfaces in the same coordinate system, in the position of centric occlusion, the value of span and precise relation of these surfaces within the joint were established.

RESULTS

The results showed that if the zenith of mandibular fossa is determined according to the vertical line of the Frankfurt horizontal, the peak of the mandibular caput articulating surface is in retroposition. The relation of the lower joint surface to the mandibular fossa zenith is the same on both right and left side. The correlation coefficient demonstrates a high correlation between the sides, highly significant with probability level of $p < 0,01$.

DISCUSSION

The interpretation of results presented in tables provides the answer to the question representing the goal of the research study. Based on establishing of the mutual relation of articulating surfaces within the maxillary joint in the position of centric occlusion (centric occlusion is in centric relation), the results presented in Table 1. show that the peak of the articulating surface of mandibular

caput manifests a deviation in the horizontal plane in relation to the peak of mandibular fossa. The value of the significance of the differences test shows that the differences on the right and left side are highly significant. The measuring and analysis in sagittal plane show that the peak of the articulating surface of mandibular caput is, in relation to the peak of mandibular fossa, in retruded position on both right and left side; on the right side by 1,4618 mm, and on the left by 1,3559 mm (Table 2). The differences between the right and left side are not significant. The deviation of the peak of the mandibular caput articulating surface to retruded position is, in relation to the temporal component of the joint, on both right and left side in statistically high correlation, highly significant with probability level of $p < 0,01$. The results obtained in the course of this study correspond to the attitudes of the authors believing that the retruded position of the lower jaw surface is the physiological position of mandible. The obtained results are contrary to the teachings of Gerber, who warns of the retruded position of condyles as the major cause of disturbances in the maxillary joint area.

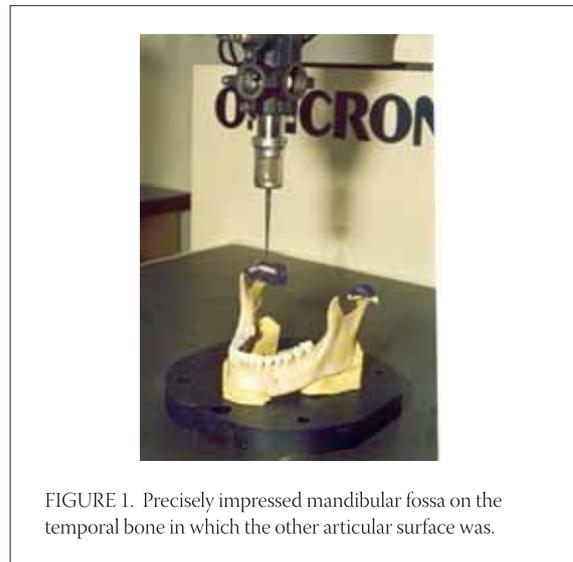


FIGURE 1. Precisely impressed mandibular fossa on the temporal bone in which the other articular surface was.

OBSERVED PARAMETERS	SIDE	STATISTICAL PARAMETERS					Value of t – test of the significance of the differences between sides	Correlation between sides and significance of the correlation
		Number of units in sample (n)	Arithmetic mean (x)	Standard deviation (ox)	Standard error (o)	Coefficient of variation (v)		
Distance of the peak of the MANDIBULAR CAPUT articulating surface in relation to the peak of MANDIBULAR FOSSA by x axis	R	17	1,3624	0,7814	0,1895	0,5735	t = 4,2036 (p<0,01) The differences are highly significant	r = 0,8929 High correlation t = 7,6805 (p<0,01) highly significant
	L	17	0,9798	0,6041	0,1465	0,6166		

TABLE 1. Mean value, significance of the differences, correlational link, strength of the correlational link and significance of the observed parameters' correlation

OBSERVED PARAMETERS	S I D E	STATISTICAL PARAMETERS					Value of t – test of the significance of the differences between sides	Correlation between sides and significance of the correlation
		Number of units in sample (n)	Arith- metic mean (x)	Standard deviation (ox)	Standard error (ox)	Coefficient of variation (v)		
Posterior distance of the peak of the MANDIBULAR CAPUT articulating surface from the MANDIBULAR FOSSA by y axis	R	17	1,4618	0,7106	0,1723	0,4861	t = 1,1725 (p>0,05) The differences are not significant	r = 0,8778 High correlation t = 7,0971 (p<0,01) highly significant

TABLE 2. Mean value, significance of the differences, correlational link, strength of the correlational link and significance of the observed parameters' correlation

CONCLUSION

If the peak of mandibular fossa is determined according to the vertical line of the Frankfurt horizontal, the peak of the articulating surface of mandibular caput is in retroposition in relation to the peak of the upper jaw surface.

REFERENCES

- (1) Suvin M, Kosovel Z. Fiksna protetika, Školska knjiga, Zagreb, 1980.
- (2) Gerber A. Grundsatzreferat zur zahnärztlichen Prothetik. Quintessenz. 1977; 3:101-14.
- (3) Academy of prosthodontics. Glossary of prosthodontic terms. 6th ed. St. Louis: Mosby. 1994; p.59.
- (4) Academy of denture prosthetics. Glossary of prosthodontic terms. 3rd ed. St. Louis: Mosby. 1968; p.16.
- (5) Wilkinson T.M. Equilibration and restorative dentistry. In: Current controversies in temporomandibular disorders (McNeil C., editor), Chicago: Quintessence. 1992; pp.162-165
- (6) Gilboe D.B. Centric relation as the treatment position. J. Prosthet. Dent 1983; 50:685-689.
- (7) Türp J.C., Strub J.R. Prosthetic rehabilitation in patients with temporomandibular disorders. J. Prosthet. Dent. 1996; 76:418-423.