The human mandibular intercondylar angle measured by computed tomography

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Accepted 27 May 1999

Abstract

In axial computed tomography it is possible to measure the intercondylar angle at the intersection of the longitudinal axes of the condyles. Published values ränge from 131 to 165°. This angle was determined here in two groups of patients with (n = 22) and without (n = 12) temporomandibular joint dysfunction. A third group of children (n = 12) aged 4-9 years was included to investigate any age-related change in the angle. In the group of healthy individuals, a ränge of 105 to 165° was found, with a mean intercondylar angle of 139°. In the group with temporomandibular joint dysfunction the mean angle was 143° with a ränge from 85 to 170°. No statistically significant relation could be shown between intercondylar angle and joint dysfunction. In the group of children the mean angle was 138° with values ranging from 90 to 180°. No significant differences could be demonstrated among the groups. The absolute value of the intercondylar angle seems to be independent of factors such as sex, age and functional disorders of the joint.

Keywords: Cephalometry; Mandibular condyle; Temporomandibular joint; Tomography, X-ray computed; TMJ dysfunction

1. Introduction

It is assumed that the anatomical shape of the gle-noid fossa and the mandibular condyle influences the mobility of the lower jaw. In addition, the orientation of the longitudinal axis of the condyle may have a similar effect. The anatomy and morphology of the temporomandibular joint depends on the requirements of the chewing process. It varies among different species depending on the diet and type of mastication (Schumacher, 1961).

Functional disorders of the stomatognathic System are related frequently to muscular and parafunctional activity (Mew, 1997; Schulte, 1983). The temporomandibular joint can be remodelled due to functional load (Mew, 1997). Therefore, it is possible that the intercondylar angle can change in patients with temporomandibular joint dysfunction by altering the shape of the condylar process (Hüls, 1981; Schulte, 1983). According to Hüls et al. (1981) there is a significant correlation between the type of functional disorder and asymmetries in the orientation of the condyle‘s longitudinal axis on both sides. Anatomical, radiological and clinical examinations usually relate to a lateral view of the joint. Morphology in the horizontal plane is seldom con-

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Table 1
Age and sex distribution of patients

	n	Male	Female	Age in years		
				Min.	Max.	Average
All patients	46	16	30	4	70	35.2
Patients with functional disorders of the joint	22	9	13	18	70	43.5
Healthy controls	12	4	8	18	64	48.4
Children	12	3	9	4	9	6.7

sidered. Computed axial tomography of the skull shows both condyles (Kretschmann and Weinrich, 1992) and their horizontal relation. This can be charac-terized by the intercondylar distance and angle.

The method of measuring intercondylar angles in computed tomography is described by Hüls (1981) and Hüls et al. (1981). Using this method, others have measured the intercondylar angle for a variety of pur-poses (Spitzer et al., 1984; Christiansen et al., 1986; Hackney et al., 1989; Maxwell et al., 1995; Sanroman et al., 1997).

Our aims now were to (1) compare the intercondylar angles in patients with and without temporomandibu-lar joint dysfunction using axial computed tomography; (2) follow changes in the intercondylar angle with age.

2. Materials and methods

The investigation was performed retrospectively on 46 patients who had undergone axial computed tomography in a canthomeatal plane. The scans had been taken for a variety of clinical reasons by other depart-ments, mostly for diagnosis of ear, nose and throat pathology.

Participants were divided into three groups: (i) patients with functional disorders of the temporoman-dibular joint; (ii) healthy adults who acted as a control group; (iii) children.

Except for the children, a Standard clinical and radiographical examination was performed to elicit functional disorders of the stomatognathic System. If these were identified, the patient was included in the dysfunctional group. These criteria were based on the ‚functional Status of the DGZMK (DGZMK = Deutsche Gesellschaft für Zahn-, Mund-und Kieferheilkunde, equivalent to ‚German Dental Association‘).

Twenty-two patients had functional disorders and the control group comprised 12 individuals. The third group consisted of 12 children who ranged from 4 to 9 years of age. There is a rest period between infantile growth and the later phase of adolescent growth. All of these children were in a similar stage of skull devel-opment (Table 1).

On a computed tomograph showing both condyles in a comparable cross-section, the lateral and medial poles were marked. This allowed the longitudinal axis to be determined and the intercondylar angle to be measured (Figs. 1,2).

The distribution of the measured values was checked in each group by the t-test. The F-test was used to check for significant differences in the range of values in the groups (SPSS for Windows, 1997).

3. Results

In the group of dysfunctional patients, the mean intercondylar angle was 143° (SD 21.46°, range SS-170°). In the control group the mean angle was 139° (SD 17.42°, range 105-165°). The mean intercondylar angle in the group of children was 138° (SD 24.44°, range 90-180°). A Kolmogorov-Smirnow test with

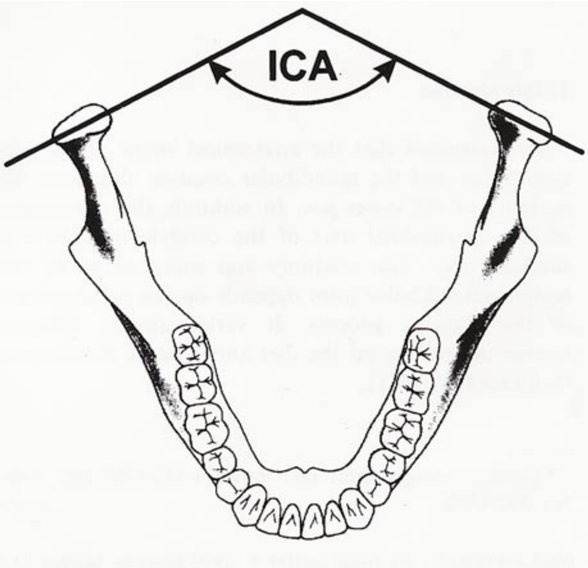

Fig. 1. Scheme of the intercondylar angle (ICA).

Fig. 2. Axial CT for measurement of the intercondylar angle.

Lillefors correction showed a normal distribution of the values in all three groups (SPSS for Windows, 1997). No relation to age could be found (Fig. 3).

Using the r-test, no significant difference could be demonstrated between the control group and the group of patients with temporomandibular dysfunction (p — 0.647). Similarly, the t-test failed to show a difference between the control group and the group of children aged 4-9 years (p = 0.872). An F-test did not show significant differences in the scatter of values (p = 0.361 or p = 0.278). No sex-related differences could be proved (p = 0.717).

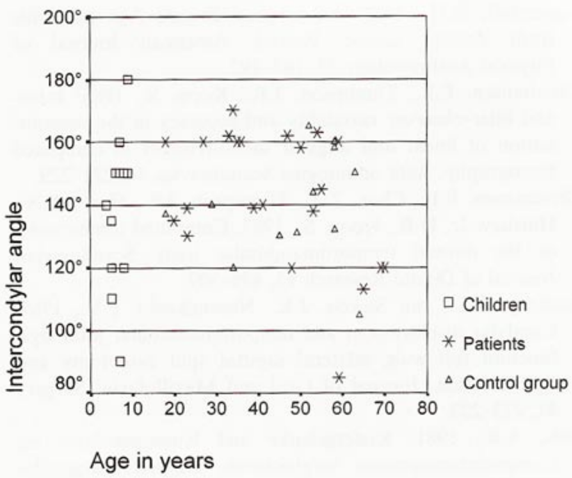

Fig. 3. Intercondylar angle by age.

4. Discussion

Our initial hypothesis could not be confirmed: the intercondylar angles measured from computed tomo-graphic scans were not different from controls in the group of patients with temporomandibular joint dysfunction. The mean angles were 139° for healthy controls, 143 for the patients with the functional disorders and 138 for the children. These values were in agreement for these reported in similar radiological assessments (Table 2). The SD of 17.42° (healthy controls), 24.52 (patients with functional disorders) and 24.44° (children) did not allow further statistical analy-sis. We found no correlation between age and intercondylar angle.

Functional disorders of the stomatognathic System are frequently related to hypertonicity of the lateral pterygoid muscle during bruxism. The lower muscle belly is inserted into the anterior aspect of the condylar neck. Schulte (1983) postulated that a high muscle ten-sion could lead to an alteration in the shape of the condyle, thus rotating the condyle along a vertical axis. Due to this fact, the intercondylar angle in patients with temporomandibular joint dysfunction would be smaller than in the rest of the population (Hüls et al., 1981).

Hüls at al. (1981) and Schulte (1983) found that functional disorders of the joint and neuromuscular system may lead to asymmetry between the condyles. Where lateral parafunctional activity can be demonstrated by clinical examination, changes in the bone density can be shown in the contralateral condyle

Table 2
Intercondylar angles in published accounts

Author	Intercondylar angle[a]	n	Method of measurement
Christiansen et al. (1987)	129–132°	53	Computed tomography
Hackney et al. (1989)	124.5° SD 18.23°	15	Measurement on submentovertex radiograph
Hüls (1981)	142°	25	Computed tomography
Sanroman et al. (1997)	145.50–146.05°	34	Computed tomography
Schumacher (1984)	150–165°	not given	Measurement with elongation of the condylar axis
Spitzer et al. (1984)	125–169° 148° average	18	Computed tomography
Tillmann et al. (1987)	150–165° Great variation, often greater angles	not given	Without precise description of the method used (standard book)
Yale et al. (1961)	166–132° 153° average	25	Anatomical preparation

[a] For comparison partial angles were converted into intercondylar angles.

(Hüls et al., 1981). In a mandible from the Bronze Age, an extreme adaptation in the form of an exostosis has been described. This was related to the insertion of the lateral pterygoid (BiggerstafT, 1971) and can be explained as a reaction to a muscular force.

Various investigators have determined the angles between the longitudinal condylar axis and a trans-verse straight line (Spitzer et al., 1984; Christiansen et al., 1987; Sanroman et al., 1997) or between the longitudinal condylar axis and a sagittal straight line (Hüls, 1981) to get two half angles, one on each site. Due to asymmetries of the skull it is difficult to determine correctly these reference lines and the above-mentioned partial angles. Therefore, the intercondylar angle was measured directly in this study; perhaps the determi-nation of half angles would have other results.

In the group of patients with functional disorders two extreme angles were noted. The largest was 170° and the smallest 85°. In a 9-year-old child an angle of 180° was recorded and in another child of 7 years an angle of 90°. One of the computed tomographs showed another morphological feature: condyles of a triangular shape instead of the more usual oval form. In this instance the intercondylar angle was 105°. It is assumed that the healthy human temporomandibular joint has a range of shapes. Moreover, it has such a large degree of freedom of movement that it can com-pensate for these different shapes.

In summary, we conclude that the intercondylar angle has a similar Variation in patients with temporomandibular joint dysfunction as in controls. A relation to age and sex is not evident.

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