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THE TEMPOROMANDIBULAR JOINT IN PATIENTS WITH IMMEDIATE UPPER DENTURES

by

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The adaptability of bone to changes in the magnitude and direction of stress are manifested in resorptive and appositional remodelling. The readiness with which these structural changes occur makes bone an extremely plastic tissue (*Orban,* 1949).

The changes in the temporomandibular joint that follow loss of some or all of the teeth have been dealt with by various authors, although usually in connection with clinical symptoms such as impairment of hearing and pain in the temporomandibular joint region. The prosthetic literature discusses the possible modification of the joint with respect to its effect on the inclination of the condyle path. In 1934 *Steinhardt* proposed that the inclination of the condyle path decreases with age and that this is indirect evidence of harmonious reconstruction of the joint as a result of attrition of the occlusal surfaces of the teeth. It would then be expected that such remodelling of the joint would be still more marked where all the teeth have been lost and a denture is being worn, and it is commonly held that such changes in the dentition are followed by a flattening of the tuberculum articulare (*Hennicke,* 1960; *Rehm,* 1947; *Rosenthal,* 1952; *Schröder,* 1925; *Turner,* 1942).

It is, however, hard to discern the grounds for the numerous statements on the remodelling of the temporomandibular joint. Only a few anthropological studies have been reported, and in those the information has been incomplete and difficult to interpret.

This paper reports an attempt to establish by radiographic examination whether in fact there is any such modification of the fossa mandibulae and tuberculum articulare; the study was performed on a small group of patients and radiographic examinations were performed at an interval of 10 years.

CASE SERIES

The 15 patients for the present study comprise part of a group of 25 subjects for an investigation of certain changes in tissue structure following extraction of all the upper teeth and insertion of a full upper denture. They were the first 15 of the larger group to be given treatment.

The 15 selected patients fulfilled the requirements for the primary investigation, namely they should be in good health, have all or some of their teeth present in both jaws but be in need of full upper dentures; there should be no severe periodontal disease, nor should they have worn dentures previously.

The age and sex distributions are shown in Table 1 and the denture treatment is indicated in Table 2. All the upper teeth were extracted, and any indicated extraction and conservative therapy in the mandible were performed.

Table 1

Age and sex distribution (1952—53)

Age	♂	♀	Total
31—40	3	1	4
41—50	4	1	5
51—60	2	4	6
Total	9	6	15

Table 2
Form of denture treatment

Treatment	♂	♀	Total
Full upper and lower dentures	2	3	5
Full upper and partial lower dentures	4	2	6
Full upper denture and conservative therapy in the lower jaw	3	1	4

The procedure for the treatment has been described elsewhere (*Hedegård* 1962). Radiographs of the temporomandibular joint region were taken as described below just after the extractions and again 10 years later. In the latter case only 12 of the 15 patients could be included; one patient had died and two had left the city.

METHOD

To ensure that the radiographs should be as far as possible comparable they were taken with the head in a cephalostat. The film-focus distance, 75 cm, was fixed and the projection was easily reproduced. This was such that the central ray passed through the ear-rod nearer the film on which it was incident at an angle 25° above the horizontal. This projection provides a radiograph in which the fossa and tuberculum articulare are clearly depicted.

The features of interest in the radiograph were the height of the tuberculum and the inclination of its dorsal surface. These were determined in the following manner (Fig. 1). On the radiograph a line was drawn tangential to the tuberculum and the auditory meatus at their lowest points. Parallel to this line another was drawn tangential to the mandibular fossa at its highest point. From this point a line was drawn perpendicular to the parallel lines. The intercept of the perpendicular on the parallel lines was taken as the height (L) of the tuberculum.

The dorsal inclination of the tuberculum was determined by

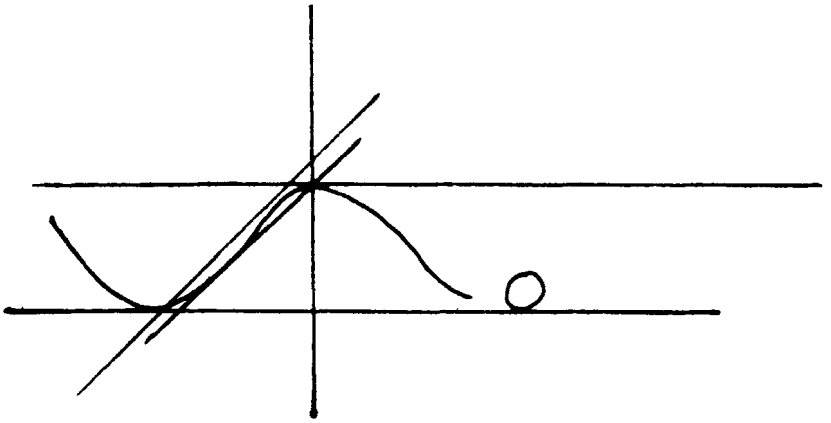

Fig. 1.

two angles. A line was drawn from the intersection of the perpendicular and the upper parallel line tangential to the tuberculum at its most dorsal point. The angle formed by this line and the parallel lines (V_1) is one measure of the inclination of the tuberculum. The other measure (V_2) is represented by the angle between the parallel lines and a line as nearly coincident as possible with the dorsal surface of the tuberculum. L was measured with dividers and ruler to an accuracy of ± 0.1 mm. V_1 and V_2 were measured with protractor to an accuracy of ± 0.5°.

Error of the method

Errors in the registration may be incurred through discrepancies between the compared radiographs and inaccuracies in measurement and drawing in the final registration. Earlier investigations dealing with similar problems by, among others, *Nevakari* (1956) and *Lindblom* (1960) have shown that the error of the method is relatively small. A limited study of the error of the method was performed as an intra-subject duplicate determination on 6 pairs of radiographs taken at intervals of a few

days. As Table 3 shows, the errors incurred in measuring the distance L are small, those for the angle V_1 are somewhat larger but acceptable and those for angle V_2 large, as would be expected since one of the lines forming this angle is drawn in relation to a curved surface.

Table 3

Radiograph pair	Differences		
	L	V_1	V_2
1	+ 0.4 mm		
2	— 0.3	—2.1	+ 1.5
3	— 0.1	+ 1.5	— 4.0
4	+ 0.7	— 0.5	+ 1.5
5	+ 0.4	+ 0.5	— 2.0
6	— 0.3	— 0.5	+ 1.0
$\bar{d}$	+ 0.13 mm	+ 0°.25	+ 0°.5
s_d	0.43 mm	1°.6	3°.1
s_m	0.29 mm	1°.1	4°.2

$$s_d = \sqrt{\frac{\Sigma (d - \bar{d})^2}{n-1}} \qquad s_m = \sqrt{\frac{\Sigma d^2}{2n}}$$

RESULTS

All the measurement values are reported in Table 4. The differences between the respective corresponding values were then analysed statistically. The analysis was performed on the material as a whole and on the material divided into the groups: right joint, left joint, female and male. There were neither significant differences for the series nor within the individual groups (Tables 5—7). The means and ranges of the differences are of the same magnitude as those obtained in the study of the error of the method.

Table 4

Principal table

Case	Primary examination						Follow-up examination					
	Right joint			Left joint			Right joint			Left joint		
	L	V_1	V_2	L	V_1	V_2	L	V_1	V_2	L	V_1	V_2
A.K. ♂	12.6	37.5	50.0	12.3	46.0	49.5	12.2	35.0	48.0	11.9	46.5	49.5
G.B. ♂	10.3	31.0	37.5	9.1	46.0	48.0	10.2	32.0	35.0	10.3	46.5	52.0
A.A. ♀	10.5	43.5	52.5	9.2	43.5	49.0	9.7	44.0	51.0	10.4	45.5	51.0
K.A.L. ♂	11.6	43.0	51.0	10.3	49.5	50.0	11.9	44.0	49.5	11.3	47.0	51.0
K.-A.J. ♂	9.4	44.0	51.5	9.6	48.0	57.0	11.6	46.0	49.0	11.1	50.5	60.0
J.J. ♂	11.2	49.0	55.0	10.8	47.5	52.0	10.1	49.5	56.0	11.4	49.5	52.0
E.P. ♀	10.9	47.0	51.0	11.0	45.0	53.0	10.2	45.5	50.0	10.7	45.0	51.0
B.E. ♂	10.8	51.0	52.5	10.7	52.5	65.5	10.9	48.5	51.0	10.7	50.0	63.0
G.L. ♀	11.1	55.5	60.0	10.2	47.5	59.5	11.2	58.0	66.0	10.3	48.0	61.5
T.M. ♂	10.0	42.5	47.0	10.0	40.5	44.5	10.5	45.0	48.0	9.6	40.0	46.5
B.K. ♀	9.5	36.0	48.0	11.5	42.5	49.0	9.5	35.0	48.0	12.1	42.0	49.5
G.T. ♂	11.3	47.0	49.5	11.1	51.0	52.0	11.6	47.5	48.5	11.7	50.5	54.0

Table 5

The distance L (mm)

Group	$d \pm \sigma \bar{d}$	s_d
Total	—0.19 ± 0.15	0.73
Right	—0.03 ± 0.20	0.71
Left	—0.35 ± 0.13	0.46
Women	+0.06 ± 0.15	0.29
Men	—0.32 ± 0.26	0.73

Table 6

The angle V_1 (°)

Group	$d \pm \sigma d$	s_d
Total	—0.23 ± 0.57	2.83
Right	—0.17 ± 0.96	3.36
Left	—0.06 ± 0.73	2.56
Women	—0.02 ± 0.55	1.57
Men	—0.21 ± 0.90	3.61

Table 7

The angle V_2 (°)

Group	$d \pm \sigma \bar{d}$	s_d
Total	—0.19 ± 0.74	3.63
Right	+0.63 ± 0.80	2.80
Left	—1.0 ± 1.35	4.68
Women	—0.25 ± 0.97	2.77
Men	—0.16 ± 1.07	4.28

DISCUSSION

There is no reason to suspect a distortion of the results of the study as a result of the reduction in the series from 15 to 12 patients during the 10-year follow-up period.

Changes in the structure of the temporomandibular joint would of course be expected in a series of this type. Even with the treatment with immediate dentures and subsequent careful corrections the fact remains that the loss of all the maxillary teeth and the wearing of a denture considerably alters the mandible's pattern of movement and hence the conditions governing reconstructive processes dependent on the function.

The results of the study indicate that major changes in the fossa mandibulae and the tuberculum articulare did not take place during the 10-year period. They are thus in contradiction to the theory that gross changes follow loss of all the upper teeth and the insertion of a denture. The radiographic method did not, however, permit an analysis of any small and local changes; nor did it enable the intrastructural state of the bone to be examined. In fact, the study was not concerned with these aspects, but with well defined anatomic changes.

The case series was fairly homogeneous. The greatest difference in the depth of the mandibular fossa in the material was

3.2 mm. It may be mentioned that one of the authors has found considerably larger differences between the patient groups with different intermaxillary relations (*Lundberg* 1963). Except for one patient (G.B) there appeared to be small differences between the right and left sides for the distance and the angle V_1.

There seemed to be no differences between the sexes as regards the factors studied.

Although the method applied may be regarded as an approximate one as regards the sources of error, which are unavoidable, the follow-up period of 10 years was so long that even quite small but continuous changes would have been discernible. It would thus seem justified to conclude that within the population, radiographic changes in the gross anatomy of the temporomandibular joint do not appear even a decade after all the upper teeth have been extracted and an immediate denture has been inserted.

SUMMARY

It is commonly held that gross changes in the dentition causes remodelling of the temporomandibular joint. Thus loss of all teeth in one or both jaws is supposed to be followed by a flattening of the tuberculum articulare.

The present paper reports a radiographic study on any such modification of fossa mandibulae and tuberculum articulare of a small group of immediate denture patients, 15 in all, with an observation period of 10 years. Radiographs of the temporomandibular joint region were performed with a special technique just after the extraction and again 10 years later.

The features of interest in the radiograph were the height of tuberculum and the inclination of its dorsal surface. These were determined in a manner outlined in Fig. 1. The analysis was performed on the material as a whole and on the material divided into the groups: right joint, left joint, female and male.

There were no significant differences either for the series or within the individual groups. These results of the study indicate that major changes in the fossa mandibulae and the tuberculum articulare did not take place during the 10-year period.

RÉSUMÉ

L'ARTICULATION TEMPORO-MANDIBULAIRE CHEZ LES PATIENTS PROTEURS DE PROTHÈSES IMMÉDIATES DU HAUT

Il est généralement admis que des changements importants survenant dans la denture causent un remodelage de l'articulation temporo-maxillaire. Ainsi, à la suite de la perte de toutes les dents de l'un des maxillaires ou des deux, il se produirait un aplatissement du condyle du temporal.

Le présent article rend compte d'une étude radiographique portant sur toute modification de ce genre subie par la cavité glénoïde et par le condyle du temporal chez un petit groupe de patients traités par prothèse immédiate. Le groupe comprenait en tout 15 patients et la période d'observation s'est étendue sur 10 ans. Des radiographies de la région de l'articulation temporo-maxillaire ont été exécutées suivant une technique spéciale immédiatement après l'extraction des dents et renouvelées au bout de dix ans.

Les traits présentant un intérêt sur les radiographies étaient la hauteur de condyle du temporal et l'inclinaison de sa face postérieure. Ils ont été déterminés suivant une manière indiquée à la fig. 1. L'analyse a été faite sur le matériel pris dans son ensemble et sur le matériel divisé en groupes: articulation du côté droit, du côté gauche, sujets du sexe féminin et du sexe masculin.

Il n'existait pas de différences significatives, ni entre les séries, ni à l'intérieur des groupes particuliers. Ces résultats indiquent qu'il ne s'est produit de modification importante ni dans la cavité glénoïde ni dans le condyle du temporal pendant la période de 10 ans.

ZUSAMMENFASSUNG

DAS KIEFERGELENK BEI PATIENTEN HIT IMMEDIATPROTHESEN IM OBERKIEFER

Man nimmt im allgemeinen an, dass Veränderungen im Gebiss eine Umformung des Kiefergelenks zur Folge haben. Somit ist man der Ansicht, dass totaler Zahnverlust in einem oder beiden Kiefern eine Abflackung des tuberculum articulare nach sich zieht.

Diese Veröffentlichung präsentiert eine Röntgenstudie des Kiefergelenkes von einer aus 15 Immediatprotese tragenden Patienten bestehender Gruppe, die während einer Zeitdauer von 10 Jahren unter fortlaufenden Kontrolle stand.

Es wurde eine Röntgenaufnahme des Kiefergelenkes mit specieller Technik unmittelbar nach totaler Extraktion genommen, worauf eine zweite nach 10 Jahren erfolgte.

Auf den Röntgenaufnahmen wurde die Höhe des tuberculum articulare und die Neigung dessen dorsaler Fläche gemessen. Die statistischen Analysen des ganzen Materiales erfolgten auch unter Berücksichtigung bestimmter Gruppen wie: rechtes und linkes Kiefergelenkes, Frauen und Männer.

Die Analysen ergaben keine signifikanten Unterschiede während dieser 10jährigen Periode. Das Resultat der vorliegenden Studie erweist somit, dass grosse Veränderungen an fossa mandibulae und tuberculum articulare nach totalem Zahnverlust nicht einmal nach 10jährigen Kontrollperiode nachweisbar waren.

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