THE SHAPE OF CORPUS MANDIBULAE BASED ON TRANSVERSAL SECTIONS

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The body of the lower jaw is greatly variable as is the whole mandible, so to say with various authors (H. Virchov, Aleš Hrdlička, K. Yamazaki, etc.). Different are, which is a well-known fact, the height and thickness and the shape of mandibular body concerning the diverse segments of corpus mandibulae.

Therefore there is a chance to get by transversal sectioning of the mandibular body at different levels sections apt for studying from definite points of view. They yield notions about the outline, height, thickness and area of these sections. Another important factors, i.e. differences in the sex, age and function (dependent on presence or absence of teeth) multiply these aspects not yet satisfactorily studied anatomically and anthropologically. Still today, there holds good the statement of Török (1898), that "the mandible is a destitute stepchild of anthropometry".

We have proceeded consequently to the study of mandibular body by a method not yet, as it seems, practised. This method consists in transversal sectioning of mandibular body according to the levels of septa interalveolaria and at places that correspond to these in the edentulous jaws. Metrically were studied: a) height and breadth dimensions of these sections including the computation of respective height--breadth indexes, b) through a planimeter was measured the area of these sections, c) finally an attempt was made to distribute according to the outline of sections the mandibular body and its parts into some types.

METHOD OF INVESTIGATION

Hemimandibles of the adult Czech people living in the last 100 years were studied. Heterogenous material implies population, which is approximately the today Czech or Central European population.

78 hemimandibles of 47 males and 31 females can be classified as follows:

Mandibles quite dentigerous

a) complete set of teeth (I_1—M_3): 11 men, 1 woman.
Age of men: 22, 22, 22, 25, 25, 25, 29, 33, 48, 49, 53 years.
Age of the woman: 24 years.

b) denture I_1—M_2: 2 men, 3 women.
Age of men: 30, 36 years.
Age of women: 22, 23, 48 years.

Mandibles with a partial defect of teeth: 29 men, 20 women.
Age of men: 22, 25, 25, 27, 27, 28, 31, 32, 33, 33, 33, 36, 36, 38, 39, 39, 39, 41, 42, 43, 45, 47, 51, 52, 53, 54, 54, 77, 90 years.
Age of women: 19, 22, 23, 24, 25, 25, 26, 27, 30, 31, 32, 38, 39, 44, 48, 60, 64, 65, 66, 72, 72, 84 years.

Edentulous mandibles: 5 men, 7 women.
Age of men: 72, 72, 73, 74, 76 years.
Age of women: 62, 67, 69, 75, 75, 80, 83 years.

Sections of the mandible were practised through singular septa interalveolaria of the median sagittal plane and septum distally from the last molar inclusively, in every case perpendicular to the base of jaw. On account of material scarcity there was impossible to cut the mandubular bodies. Jaws were impregnated by the Czechoslovak stomatological irreversible hydrocoloidal substance (alginate) „Elastic".

The impression substance was prepared in the prescribed manner. Corpus mandibulae was then wrapped up by this matter, that exceeded the median sagittal plane and distally reached the ramus mandibulae. After the substance became solid, it was cut at the teeth eventually at the alveolar arch, taken off and severed segmentally at the level of the septa interalveolaria (inclusively the median sagittal plane anteriorly and the septum distally of third molar posteriorly). These sections were reconstructed in such a manner that their cut margins got above in contact. Sections were then carefully drawn on paper without any deformance. So 9 sections were taken of every hemimandible. In the case of missing or of infraocclusion of the third molar the situation of its distal septum was determined by way of trial at the plane corresponding to the hinder side of M_3. Were any teeth missing, the section was designed too, but it was not taken into consideration because of the uncertainty of recession of the alveolar part. In the edentulous jaws one was forced to determinate the sections by way of trial, but with a sufficient accuracy by determining relative spaces as in the case of the full set of teeth. Although even here we could estimate the decrease of the alveolar part as an unequal one, there was considered recession quite regularly. The jaws were ones of the old people edentulous already for a long time judging by the shape of mandibles.

PERSONAL OBSERVATIONS

The hemimandibles were studied according to the sex and age in singular groups, i.e. mandibles with

full sets of teeth (I_1—M_3, I_1—M_2), mandibles with a partial defect of teeth and edentulous jaws. On the sections there was to ascertain: in the due groups (1) height, (2) breadth, (3) height-breadth index, (4) area of section. Last but not least, there was made an attempt of (5) determination of the shape of singular sections.

Material was arranged into two groups: (1) mandibles with a full and a partial set of teeth, (2) edentulous mandibles.

I. MANDIBLES WITH A FULL SET OF TEETH

(I_1—M_3, I_1—M_2), and jaws with partial defect of teeth. In the latter there were measured only the parts with a well-preserved alveolar part.

1) Height of mandibular body in the septa interalveolaria.

Among the anthropological measures we made use only of the Martin's measure No. 69 (1), belonging to the height of the mandibular body as a distance of the arcus alveolaris to the base of mandible on the level of mental foramen. Other official measures are lacking.

Average heights in men:

in the median sagital plane
30,— mm (min 20, max. 38) — 38 cases
in the septum between I_1—I_2
29,7 mm (min 19, max. 39) — 38 cases
in the septum between I_2—C
29,8 mm (min. 21, max. 37) — 40 cases
in the septum between C—P_1
29,7 mm (min. 22, max. 37) — 39 cases
in the septum between P_1—P_2
29,7 mm (min. 22, max. 36) — 37 cases
in the septum between P_2—M_1
25,4 mm (min. 22, max. 35) — 33 cases
in the septum between M_1—M_2
27,8 mm (min. 19, max. 34) — 21 cases
in the septum between M_2—M_3
25,7 mm (min. 20, max. 35) — 29 cases
in the septum distally from M_3
25,7 mm (min. 20, max. 34) — 24 cases

Cf. graph Fig. 1 above.

Average heights in women:

in the median sagital plane
26,3 mm (min. 18, max. 31) — 17 cases
in the septum between I_1—I_2
26,1 mm (min. 18, max. 31) — 17 cases
in the septum between I_2—C
25,8 mm (min. 18, max. 32) — 22 cases
in the septum between C—P_1
25,6 mm (min. 19, max. 32) — 23 cases
in the septum between P_1—P_2
24,9 mm (min. 20, max. 32) — 23 cases
in the septum between P_2—M_1
27,4 mm (min. 19, max. 32) — 18 cases
in the septum between M_1—M_2
21,7 mm (min. 18, max. 25) — 6 cases
in the septum between M_2—M_3
21,— mm (min. 15, max. 30) — 12 cases
in the septum distally from M_3
22,3 mm (min. 18, max. 27) — 9 cases

Cf. graph Fig. 1 above.

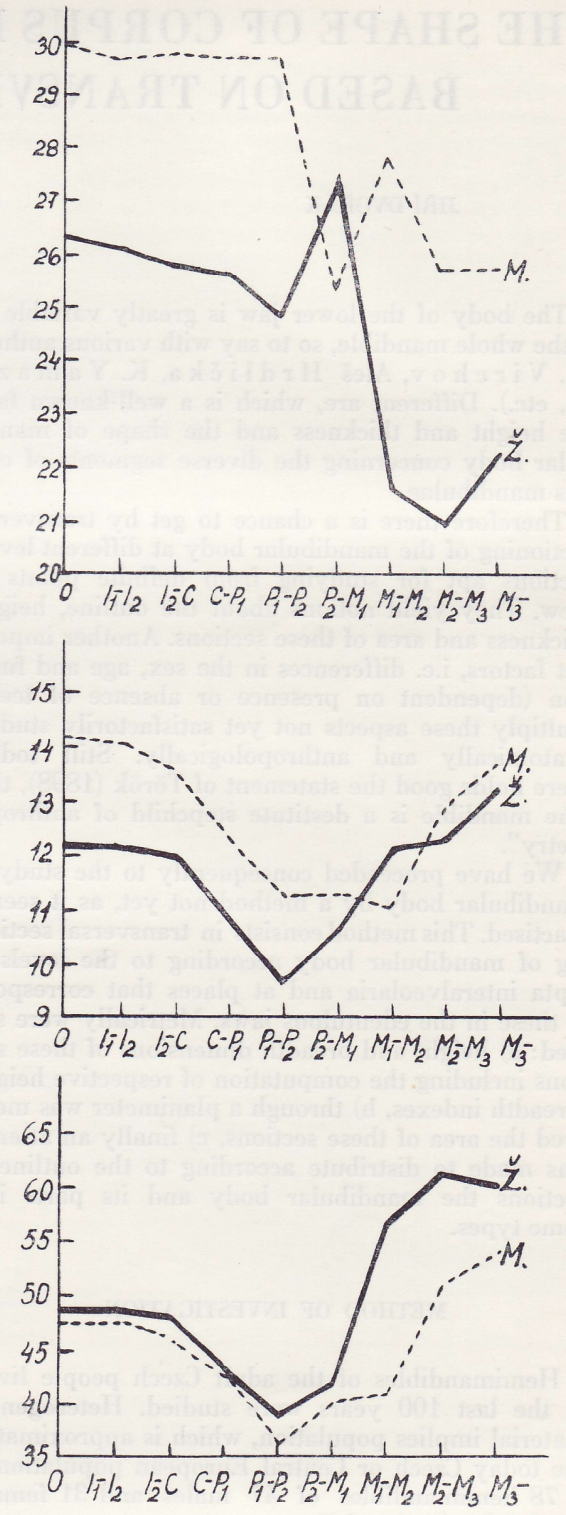

FIG. 1

Dentigerous mandibles: height (above), breadth (in the middle), height-breadth index (below). m-men, ž-women. Sections in septa interalveolaria below, millimetres on the left.

Summary: The height of mandibular body is uneven (Fig. 1 above).

a) In the man it has its maximum from the median sagittal plane to the septum between P_1—P_2. Between this septum and septum P_2—M_1 the mandibular body grows distinctly down. The second lower maximum

lies on the level of septum M_1—M_2. The minima are between P_2—M_1 and distally from M_2.

b) In the woman the maximum of height is in the frontal region, especially on the level of septum P_2—M_1. From this plane the corpus mandibulae decreases, but more distinctly than in man. The fall begins by the breadth of P_2 more distally.

c) Greatest differences between both sexes are in the anterior part from the median sagittal plane to the septum P_1—P_2, and in the posterior part from septum M_1—M_2 distally. Corpus mandibulae of women is here distinctly lower than in men. On the contrary, on the level of septum P_2—M_1 the height is a little greater in women than in men.

2) Breadth of mandibular body in septa interalveolaria.

Martin's measure 69 (3) refers to the greatest breadth of corpus mandibulae in the niveau of mental foramen perpendicular to the longitudinal axis of mandibular body. Other similar anthropological measures are lacking.

Average breadths in men:

in the median sagittal plane
14,2 mm (min. 10, max. 19) — 38 cases
in the septum between I_1—I_2
14,1 mm (min. 8, max. 18) — 38 cases
in the septum between I_2—C
13,6 mm (min. 7, max. 16) — 40 cases
in the septum between C—P_1
12,3 mm (min. 7, max. 16) — 39 cases
in the septum between P_1—P_2
11,3 mm (min. 7, max. 14) — 37 cases
in the septum between P_2—M_1
11,3 mm (min. 7, max. 14) — 33 cases
in the septum between M_1—M_2
11,— mm (min. 7, max. 15) — 21 cases
in the septum between M_2—M_3
12,9 mm (min. 8, max. 16) — 29 cases
in the septum distally from M_3
13,7 mm (min. 9, max. 16) — 24 cases

Cf. graph Fig. 1 in the middle.

Average breadths in women:

in the median sagittal plane
12,2 mm (min. 8, max. 17) — 17 cases
in the septum between I_1—I_2
12,2 mm (min. 8, max. 15) — 17 cases
in the septum between I_2—C
12,— mm (min. 7, max. 19) — 22 cases
in the septum between C—P_1
19,9 mm (min 6, max. 18) — 23 cases
in the septum between P_1—P_2
9,7 mm (min. 7, max. 15) — 23 cases
in the septum between P_2—M_1
10,7 mm (min. 7, max. 14) — 18 cases
in the septum between M_1—M_2
12,2 mm (min. 8, max. 14) — 6 cases
in the septum between M_2—M_3
12,4 mm (min. 8, max. 15) — 12 cases
in the septum distally from M_3
13,3 mm (min. 9, max. 19) — 9 cases

Cf. graph Fig. 1 in the middle.

Summary: Breadth of the mandibular body is unequal (Fig. 1 in the middle).

a) In the man the greatest breadth of corpus mandibulae is in the region of incisors and canine teeth, and distally from septum M_2—M_3. The thinnest part of mandibular body lies in the region P_1—M_2.

b) In the woman the thickest part of corpus mandibulae is in the region of incisors and mainly in the region of molars, and is distally thickening. Its thinnest part is in the region P_1—P_2.

c) Sexual differences are evident in the anterior part of mandibular body from the median sagittal plane to P_2. In women corpus mandibulae is thinner here than in men, mainly in the region of the incisors. Distally from P_2 no expressive differences in thickness between both sexes can be observed.

3) Height-breadth index on the level of singular 9 sections has been calculated according to the formula $\frac{\text{breadth} \times 100.}{\text{height}}$

Among Martin's anthropological indexes only the height-breadth index of mandibular body can be taken into consideration, i.e.

$$\frac{\text{height of corpus mandibulae (on the level of for. mentale)} \times 100}{\text{height of corpus mandibulae (in the level of for. mentale)}}$$

Height-breadth index in men:

in the median sagittal plane	47,7	(33,3—70,4)	— 38 cases
in the septum between I_1—I_2	47,7	(33,3—67,9)	— 38 cases
in the septum between I_2—C	45,8	(32,3—67,9)	— 40 cases
in the septum between C—P_1	42,5	(21,9—67,9)	— 38 cases
in the septum between P_1—P_2	36,3	(25,- —59,3)	— 37 cases
in the septum between P_2—M_1	40,—	(29,6—58,3)	— 33 cases
in the septum between M_1—M_2	41,1	(28,1—60,-)	— 21 cases
in the septum between M_2—M_3	51,2	(33,3—76,2)	— 29 cases
in the septum distally from M_3	53,9	(31,- —75,-)	— 24 cases

Cf. graph Fig. 1 below.

Height-breadth index in women:

in the median sagittal plane	48,7	(23,3—83,3)	— 17 cases
in the septum between I_1—I_2	48,6	(25,8—83,3)	— 17 cases
in the septum between I_2—C	48,—	(25,8—86,4)	— 22 cases
in the septum between C—P_1	43,4	(23,1—86,4)	— 23 cases
in the septum between P_1—P_2	39,—	(21,9—57,1)	— 22 cases
in the septum between P_2—M_1	41,9	(27,6—70,—)	— 18 cases
in the septum between M_1—M_2	56,9	(44,4—68,2)	— 6 cases
in the septum between M_2—M_3	61,3	(41,4—100,—)	— 12 cases
in the septum distally from M_3	60,6	(39,1—80,9)	— 9 cases

Cf. graph Fig. 1 below.

The height-breadth indexes allow to dispose the mandibular boies and their segments into 3 groups:

a) mandibles chamae-eury-corporal have the index number high, the breadth of jaw is considerable in comparison with the height. The bodies are low and broad. In extreme cases the mandibular body on section has a round, square or rhombic shape, etc. Such sections are practically only in the atrofic edentulous jaws (vide infra).

b) mandibles meso-corporal are transitory jaws between the former and the latter group. The index numbers are of middle values.

c) mandibles hypsi-steno-corporal have their index numbers low, the height of mandibular body is remarkable in comparison with the thickness. The bodies are on section tall and slender.

The absolute numbers marking the limits of the three groups are not quoted because they are in the singular sections too varyiing. The number of cases is in some groups of women too small, as well. The comparison of minimal, middle, and maximal values forms an idea of numeral extent of indexes for singular groups of sections.

„Physiologically" the following confines may be considered (Fig. 1 below):

In men.

a) Between 45—55 are mandibles meso-corporal, i.e. from the median sagittal plane to canine teeth and in the region of M_1 and M_2.

b) Up to 44,9 are mandibles hypsi-steno-corporal, i.e. in the region of premolars.

c) Above 55,1 are mandibles chamae-eury-corporal, i.e. in the region of M_3, and distally.

In women.

a) Between 40—50 are mandibles meso-corporal, i.e. from the median sagittal plane to P_1, and in the region of M_1 and M_2.

b) Up to 39,9 are mandibles hypsi-steno-corporal, i.e. in the region of septum P_1—P_2 and P_2.

c) Above 50,1 are mandibles chamae-brachy-corporal, i.e. in the region of septum M_2-M_3, M_3, and distally.

Summary:

a) The height-breadth indexes in both sexes are lowest in the region of septum P_1—P_2, or (broadly) in men between C-M_1, in women between C-M_2 (indexes hypsi-steno-corporal). In the region of incisors (incl. canine), and mainly and distinctly in the region of molars the mandibular body is relatively low and thick (indexes chamae-eury-corporal).

b) Sexual differences following from height-breadth indexes: The corpus mandibulae in women is everywhere lower and thicker than in men. The decisive difference is in the region of molars (Fig. 1 below).

4) Area of sections of mandibular body in the septa interalveolaria.

The area of each from the 9 sections was measured with aid of a planimeter.

Area in men:

in the median sagittal plane
259 mm² (140—340) — 38 cases

in the septum between I_1—I_2
260 mm² (140—350) — 38 cases

in the septum between I_2—C
233 mm² (140—330) — 40 cases

in the septum between C—P_1
234 mm² (120—390) — 39 cases

in the septum between P_1—P_2
231 mm² (100—320) — 37 cases

in the septum between P_2—M_1
237 mm² (110—300) — 33 cases

in the septum between M_1—M_2
225 mm² (110—330) — 21 cases

in the septum between M_2—M_3
232 mm² (130—330) — 30 cases

in the septum distally from M_3
207 mm² (140—330) — 24 cases

Cf. graph Fig. 2 above.

Area in women:

in the median sagittal plane
200 mm² (130—280) — 17 cases

in the septum between I_1—I_2
200 mm² (120—290) — 18 cases

in the septum between I_2—C
192 mm² (100—280) — 22 cases

in the septum between C—P_1
193 mm² (100—280) — 23 cases

in the septum between P_1—P_2
193 mm² (100—280) — 22 cases

in the septum between P_2—M_1
207 mm² (110—330) — 19 cases

in the septum between M_1—M_2
190 mm² (110—240) — 6 cases

in the septum between M_2—M_3
183 mm² (100—240) — 12 cases

in the septum distally from M_3
198 mm² (130—290) — 9 cases

Cf. graph Fig. 2 above.

These numbers are averages taken from jaws with a full or partial set of teeth, as seen in the unequal number of cases.

Results of measurement of areas of mandibles with a full set of teeth have been calculated from the number of mandibles, which is very small. Notwithstanding, they are interesting, as follows:

Values of area in hemimandibles with the denture I_1—M_3:

	11 men	1 woman
in the median sagittal plane	270 mm²	240 mm²
in the septum between I_1—I_2	260 mm²	200 mm²
in the septum between I_2—C	240 mm²	200 mm²
in the septum between C—P_1	220 mm²	180 mm²
in the septum between P_1—P_2	230 mm²	190 mm²
in the septum between P_2—M_1	240 mm²	230 mm²
in the septum between M_1—M_2	220 mm²	230 mm²
in the septum between M_2—M_3	240 mm²	210 mm²
in the septum distally from M_3	230 mm²	230 mm²

Values of area in hemimandibles with the denture I_1—M_2:

	2 men	3 women
in the median sagittal plane	180 mm²	200 mm²
in the septum between I_1—I_2	190 mm²	170 mm²
in the septum between I_2—C	200 mm²	170 mm²
in the septum between C—P_1	200 mm²	160 mm²
in the septum between P_1—P_2	130 mm²	150 mm²
in the septum between P_2—M_1	200 mm²	150 mm²
in the septum between M_1—M_2	190 mm²	150 mm²
in the septum between M_2—M_3	230 mm²	170 mm²
in the septum distally from M_3	170 mm²	170 mm²

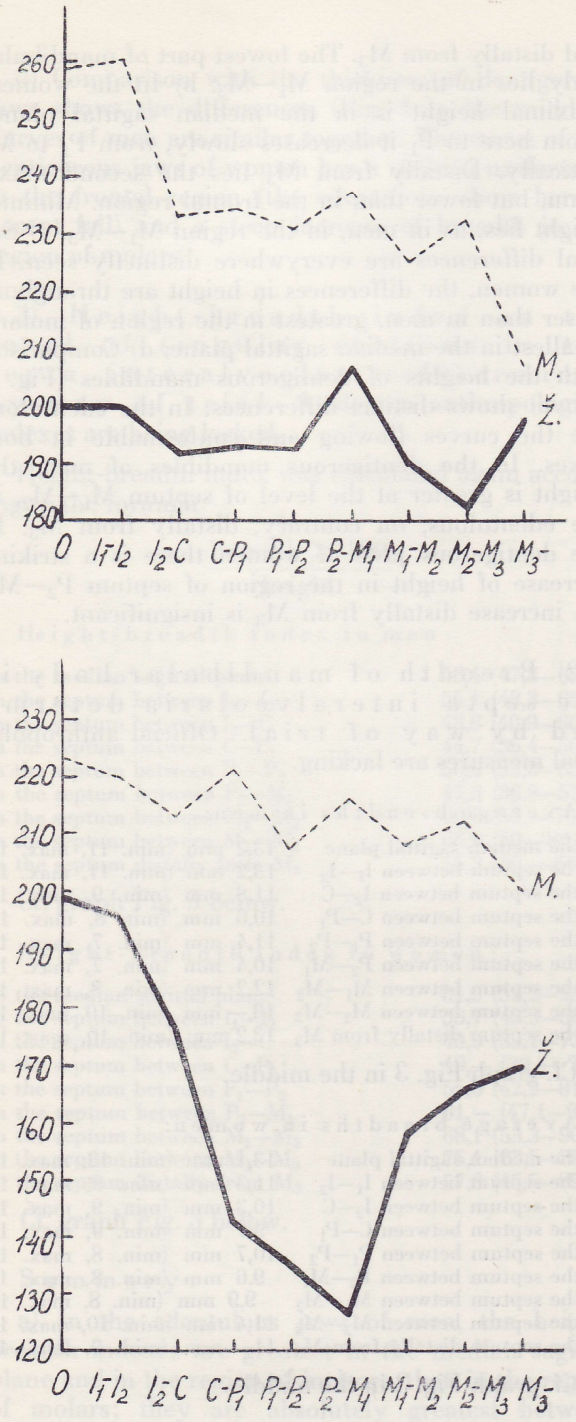

FIG. 2

Areas of dentigerous (above) and edentulous (below) mandibles, m-men, ž-women. Sections in septa interalveolaria below, square millimetres on the left.

Average ideal areas of sections of mandibles with a full set of teeth, i.e. sums from all sections divided by a due number are:

in men I_1—M_3 216 mm²	in men I_1—M_2 175 mm²
in women I_1—M_3 191 mm²	in women I_1—M_2 149 mm²

The ideal average calculated from transversal sections of mandibular body is in men 210 mm², in women 160 mm². Comparison of the ideal areas snows that the mandibular body is, in women, reaching the size of sections 76,2 % of similar values in men in the case of values in men being 100 %. On the whole one can conclude that the size of mandibular body in women equals approximately $^3/_4$ of size of mandibular body in men. Corpus mandibulae of man is therefore about by a fourth part stronger than in woman.

Similar values computated from the mandibles with a full and partial set of teeth are: In men the ideal average is 235 mm², in women 195 mm². Comparison of values in both sexes shows that the strength of the mandibular body in women equals 82,9 % of the similar strength in men. Corpus mandibulae of women equals then $^4/_5$ of the mandibular body in men.

S u m m a r y: The strength of corpus mandibulae of women is 75—80 % of the strength of mandibular body in men.

For graphical illustration it is indispensable to make use of results from jaws with full and partial sets of teeth (Fig. 2 above).

S u m m a r y:

a) In men, the maximum of the area is at the median sagittal plane and in septum I_1—I_2. From here to the septum I_2—C the area is distinctly decreasing, to the septum M_2—M_3 decreases gradually. Distally from M_3 is the fall again critical.

b) In women, maximal values are less striking (aa) from the median sagittal plane to the septum I_1—I_2, (bb) between P_2—M_1 (maximum), (cc) distally from M_3, areas are very much advancing toge-

c) Sexual differences. In the women, the area is everywhere smaller then in men, most striking from the median sagittal plane to the septum I_1—I_2. Distally from M_3. Minimum lies between M_2—M_3.
ther.

II. EDENTULOUS MANDIBLES

1) H e i g h t o f m a n d i b u l a r b o d y a t t h e l e v e l o f s e p t a i n t e r a l v e o l a r i a d e t e r m i n e d b y w a y o f t r i a l. Equivalent anthropological measures are lacking.

A v e r a g e h e i g h t s i n m e n:

in the median sagittal plane	23,6 mm	(min. 21, max. 29)
in the septum between I_1—I_2	24,2 mm	(min 21, max. 30)
in the septum between I_2—C	24,4 mm	(min. 22, max. 30)
in the septum between C—P_1	23,8 mm	(min. 22, max. 28)
in the septum between P_1—P_2	22,6 mm	(min. 20, max. 27)
in the septum between P_2—M_1	21,8 mm	(min. 19, max. 25)
in the septum between M_1—M_2	20,— mm	(min 17, max. 24)
in the septum between M_2—M_3	19,8 mm	(min. 15, max. 24)
in the septum distally from M_3	23,9 mm	(min. 20, max. 29)

Cf. graph Fig. 3 above.

A v e r a g e h e i g h t s i n w o m e n:

in the median sagittal plane	21,9 mm	(min. 15, max. 25)
in the septum between I_1—I_2	21,7 mm	(min 15, max. 25)
in the septum between I_2—C	21,3 mm	(min. 15, max. 25)
in the septum between C—P_1	20,4 mm	(min. 15, max. 24)
in the septum between P_1—P_2	17,4 mm	(min. 12, max. 21)
in the septum between P_2—M_1	16,— mm	(min. 12, max. 19)
in the septum between M_1—M_2	14,7 mm	(min. 11, max. 17)
in the septum between M_2—M_3	15,4 mm	(min. 12, max. 18)
in the septum distally from M_4	19,6 mm	(min. 16, max. 22)

Cf. graph Fig. 3 above.

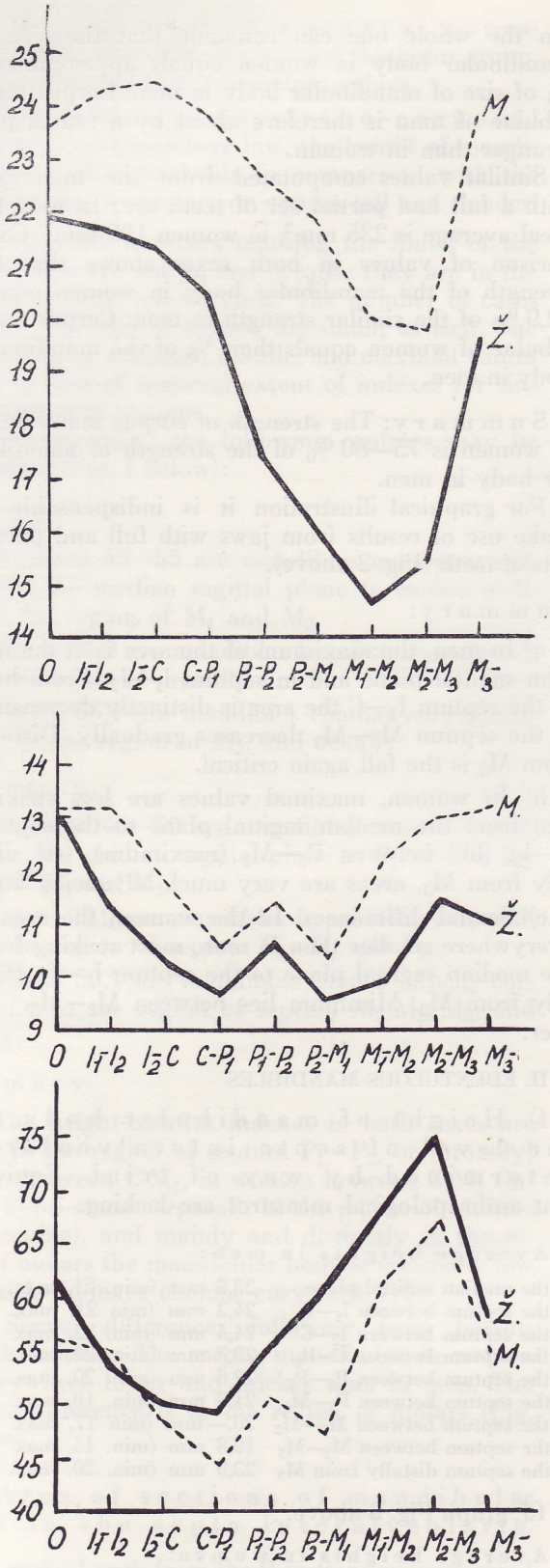

FIG. 3

Edentulous mandibles: height (above), breadth (in the middle), height-breadth index (below). m-men, ž-women. Sections in septa interalveolaria below, millimetres on the left.

Summary:

a) In the edentulous mandibles of men, the maximal height is in the frontal part of denture (incl. P_1) and distally from M_3. The lowest part of mandibular body lies in the region M_1—M_3. b) In the women, maximal height is in the median sagittal plane. From here to P_1 it decreases slowly, from P_1 to M_1 critically. Distally from M_3 lies the second maximum, but lower than in the frontal region. Minimal height lies, as in men, in the region M_1—M_3. c) Sexual differences are everywhere distinctly seen. In the women, the differences in height are throughout lesser than in men, greatest in the region of molars, smallest in the median sagittal plane. d) Comparison with the heights of dentigerous mandibles (Fig. 1 above) shows distinct differences. In the edentulous are the curves flowing and conformable in both sexes. In the dentigerous mandibles of men, the height is greater at the level of septum M_1—M_2, in the edentulous, on contrary, distally from M_3. In the dentigerous jaws of women there is a striking increase of height in the region of septum P_2—M_1. An increase distally from M_3 is insignificant.

2) Breadth of mandibular body in the septa interalveolaria determined by way of trial. Official anthropological measures are lacking.

Average breadths in men:

in the median sagittal plane	13,2 mm	(min. 11, max. 15)
in the septum between I_1—I_2	13,2 mm	(min. 11, max. 15)
in the septum between I_2—C	11,8 mm	(min. 9. max. 14)
in the septum between C—P_1	10,6 mm	(min 8, max. 12)
in the septum between P_1—P_2	11,4 mm	(min. 7, max. 13)
in the septum between P_2—M_1	10,4 mm	(min. 7, max. 13)
in the septum between M_1—M_2	12,2 mm	(min. 8, max. 15)
in the septum between M_2—M_3	13,— mm	(min. 10, max. 16)
in the septum distally from M_3	13,2 mm	(min. 10, max. 15)

Cf. graph Fig. 3 in the middle.

Average breadths in women:

in the median sagittal plane	13,1 mm	(min. 12, max. 14)
in the septum between I_1—I_2	11,3 mm	(min. 9, max. 15)
in the septum between I_2—C	10,3 mm	(min. 9, max. 11)
in the septum between C—P_1	9,7 mm	(min. 9, max. 11)
in the septum between P_1—P_2	10,7 mm	(min. 8, max. 11)
in the septum between P_2—M_1	9.6 mm	(min. 8, max. 11)
in the septum between M_1—M_2	9,9 mm	(min. 8, max. 12)
in the septum between M_2—M_3	11,4 mm	(min. 10, max. 13)
in the septum distally from M_3	11,— mm	(min. 9, max. 13)

Cf. graph Fig. 3 in the middle.

Summary:

a) In the edentulous jaws of men there is the greatest thickness from the median sagittal plane to the septum I_1—I_2 and distally from M_2, i.e. on both ends of the mandibular body. The smallest breadth is in the region from C to M_1.

b) In the women, maximal breadth is in the median sagittal plane, distally from M_2 a moderate increase can be seen. Minima are nearly same as in men, i.e. in the region C—M_2.

c) Sexual differences are distinct again, curves of both sexes are similar. In the women breadth measures are smaller everywhere than in men with the exception of the median sagittal plane; here they are in harmony with one another. Greater differences are in the region of molars.

d) Comparison with the thickness of dentigerous jaws shows the differences (Fig. 1 in the middle). Curves of men are similar together. The curve of the dentigerous jaws of women has a striking uniformity in the frontal region (the edentulous show here a decent fall) and a steep increase of breadth in the region of molars.

3) Height-breadth index on the level of singular sections in the septa interalveolaria determined by way of trial. Analogous anthropological indexes are being lacked.

Height-breadth index was calculated again according to the formula

$$\frac{\text{breadth} \times 100}{\text{height}}.$$

Height-breadth index in men:

in the median sagittal plane	56,4 (47,8—65,2)
in the septum between I_1—I_2	55,1 (43,3—65,2)
in the septum between I_2—C	48,6 (40,9—60,9)
in the septum between C—P_1	44,7 (36,4—50,—)
in the septum between P_1—P_2	50,6 (33,3—65,—)
in the septum between P_2—M_1	47,3 (36,8—52,4)
in the septum between M_1—M_2	60,8 (50,—70,6)
in the septum between M_2—M_3	66,9 (50,—88,2)
in the septum distally from M_3	55,3 (50,—66,7)

Cf. graph Fig. 3 below.

Height-breadth index in women:

in the median sagittal plane	61,9 (52,2—93,3)
in the septum between I_1—I_2	53,7 (40,9—66,7)
in the septum between I_2—C	49,9 (39,1—73,3)
in the septum between C—P_1	49,— (39,4—73,3)
in the septum between P_1—P_2	55,6 (42,9—91,7)
in the septum between P_2—M_1	61,— (47,1—91,7)
in the septum between M_1—M_2	68,1 (53,3—90,9)
in the septum between M_2—M_3	75,1 (62,5—86,7)
in the septum distally from M_3	57,6 (45,5—85,—)

Cf. graph Fig. 3 below.

Summary:

a) In the edentulous jaws of men, the height-breadth indexes are greatest in the median sagittal plane and in the region of incisors, then in the region of molars; they are absolutely greatest between M_2—M_3 (the jaw is here, therefore, lowest and broadest, chamae-eury-corporal). Minima are in the region C—M_1 and distally from M_3 (region hypsi-steno-corporal).

b) In the women, the maxima are on the whole the same, i.e. median sagittal plane and the region of molars (mainly M_2—M_3). Minima move between I_2—P_1 and distally from M_3.

c) Sexual differences are evident in the region C—M_3. In the region of incisors and distally from M_3 greater differences are absent.

d) Comparison with the indexes of dentigerous jaws (Fig. 1 below) proves definite accordance. The edentulous jaws are in the median sagittal plane relative lower. This is much more obvious in the region of molars. Distally from M_3, they are on the contrary relative higher.

4) Area of sections of mandibular body in the septa interalveolaria determined by way of trial. Area was measured with aid of a planimeter.

Area in men:

in the median segittal plane	223 mm² (160—320)
in the septum between I_1—I_2	220 mm² (150—270)
in the septum between I_2—C	213 mm² (120—280)
in the septum between C—P_1	221 mm² (170—250)
in the septum between P_1—P_2	208 mm² (130—250)
in the septum between P_2—M_1	216 mm² (100—240)
in the septum between M_1—M_2	208 mm² (110—240)
in the septum between M_2—M_3	212 mm² (110—250)
in the septum distally from M_3	200 mm² (130—270)

Cf. graph Fig. 2 below.

Area in women:

in the median sagittal plane	199 mm² (140—230)
in the septum between I_1—I_2	196 mm² (130—230)
in the septum between I_2—C	177 mm² (100—180)
in the septum between C—P_1	143 mm² (80—180)
in the septum between P_1—P_2	136 mm² (80—140)
in the septum between P_2—M_1	127 mm² (80—150)
in the septum between M_1—M_2	158 mm² (70—150)
in the septum between M_2—M_3	166 mm² (70—150)
in the septum distally from M_3	170 mm² (80—150)

Cf. graph Fig. 2 below.

Summary:

a) In the edentulous jaws of men, the area of sections is greatest in the median sagittal plane; distally from here it is decreasing uniformly.

b) In the women, the first maximum reaches in the median sagittal plane and in the region of incisors, the second (lower) maximum in the region of molars and distally from M_3. The minimum lies in the region of premolars M_1 inclusively, mainly at the level of septum P_2—M_1.

c) Sexual differences. Women have the area of sections everywhere smaller than men. The least differences are in the region of incisors and distally from M_3, the greatest in the region from C to M_3 (maximum on the level of P_2—M_1).

d) Comparison with the areas of dentigerous jaws (Fig. 2 above): In the dentigerous jaws, maximal difference between both sexes is in the region of incisors; in the edentulous mandibles, the difference is minimal. In the edentulous, there is the maximal difference between both sexes on the level of septum P_2—M_1, the dentigerous have the difference small here!

The outline of sections

The contours of sections of mandibular body are seen on Fig. 4—9. The lamella on the left side of the observer is a lingual one, the lamella on the right side is a vestibular one. Every section (with the exception of edentulous segments of the mandibles with a partial set of teeth) is provided above with the proper height-breadth index ($i = \frac{\text{breadth} \times 100}{\text{height}}$) below with the proper area in square millimetres (vide supra). The 9 sections are mesiodistally from

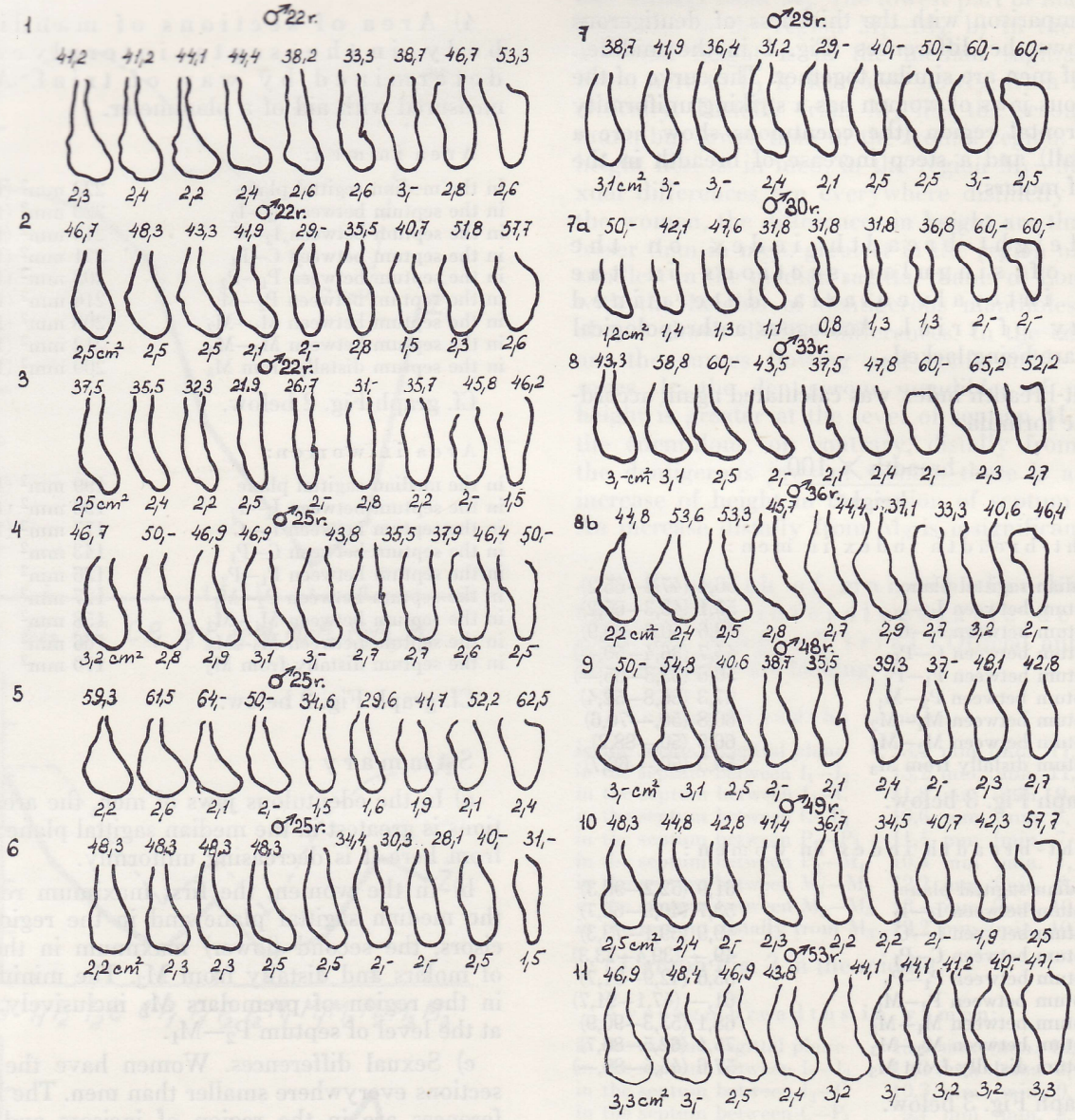

FIG. 4
Mandibles with a full set of teeth. Men.

left to right: median sagittal plane, septum interalveolare between I_1—I_2, I_2—C, C—P_1, P_1—P_2, P_2—M_1, M_1—M_2, M_2—M_3, distally from M_3.

The sections can be studied in three groups: a) frontal region of incisors and canine, i.e. septum C—P_1 inclusively (sections 1—4), b) hinder region of premolars and molars, i.e. from P_1—P_2 to M_2—M_3 (sections 5—8), c) retromolar, i.e. immediately distally from M_3.

1. Sections through the fully dentigerous mandibles (Fig. 4, 5).

a) Frontal part is on sections quite slender (men No. 3). But mostly the basal part is belly-shaped more (men 5) or less. The base is convex more vestibularly (in the case of being present fossa prementalis, men 1, 4, women 1, 2) or lingually (men 9, 10, 11, women 2, 4). Another time, the section is of the shape of a triangle or a small boot (men 1, 5, women 4). The shape of a roll or a crescent is seen in the case of anterior concavity looking forward and upward (men 3, 7). The reason of it is repeatedly the various depth of the fossa prementalis.

b) Sections of the region of premolars and molars are more symmetrical then in the frontal region. It may be that the mandible is very much delicate (men 7a, women 4). Striking is the s-like bending of section in the region of molars. Here the mylohyoid line is also more distinct then in the region of premolars (men 1, 2, 7a). The lingual convexity is a functional extension at the insertion of the mylohyoid muscle. Even the whole lingual lamella of the bone may present an expressive lingual convexity (men 8b, 11, women 1, 2). Breadth measures in the molar region are, of course, greater than in the

premolar region, mainly in women, who have a lower mandibular body in comparison with men.

c) Retromolar section represents various shapes of fovea retromolaris (men 1, 5, 8, women 3), also according to the relation of the third molar to the ramus. The trigonum retromolare is not seen, since lying more distally. The lingual over-hanging convexity above the mylohyoid line may be distinct more (men 1, 4, 7, 7a, 8b, 10, women 4) or less (men 2, 3, 5, 8, 9). The shape of the section is one of a typical triangle of different thickness or of a slender outline (men 6). The linea mylohyoidea lies mostly at the inferior level of the over-hanging part, but sometimes at the level of arcus alveolaris, and it may be more often in the lower mandibular body of women (women 2, 4).

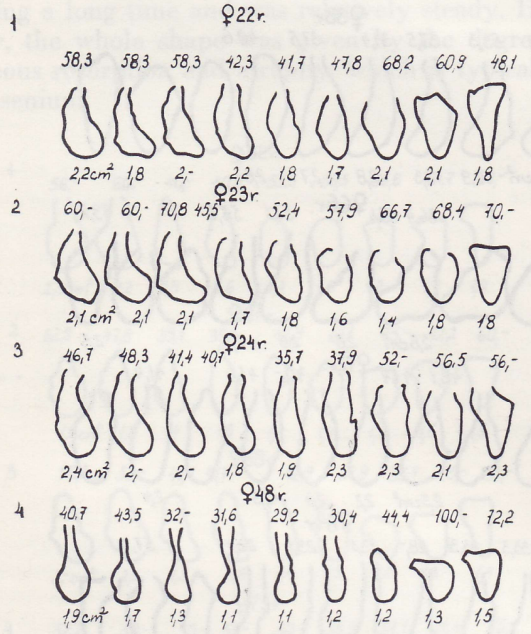

FIG. 5
Mandibles with a full set of teeth. Women.

On the whole, transitory forms are seen from slender shape (men 3, 7a, women 4) to the robust ones (men 11, women 1, 2).

Sexual differences in the particular segments are for the most part lacking. As a typical feminine type, only a frontal section of a belly-shaped bottle with a narrow neck (women 4), could be taken. Other cases are mixed; that is why outlines of sections may be very similar in both sexes: a) in the frontal segment men 4 and women 1, men 8 and women 2, men 4, 7 and women 3. b) In the premolar and molar region men 1, 3, 4, 5, 7, 8, 10 and women 3, men 7a and women 4 (delicate). But a greater height measure in men in the region of molars is the reason of formal differences. c) In the retromolar segment men 10 and women 1, men 5 and women 3.

Formal differences according to age in the denti-

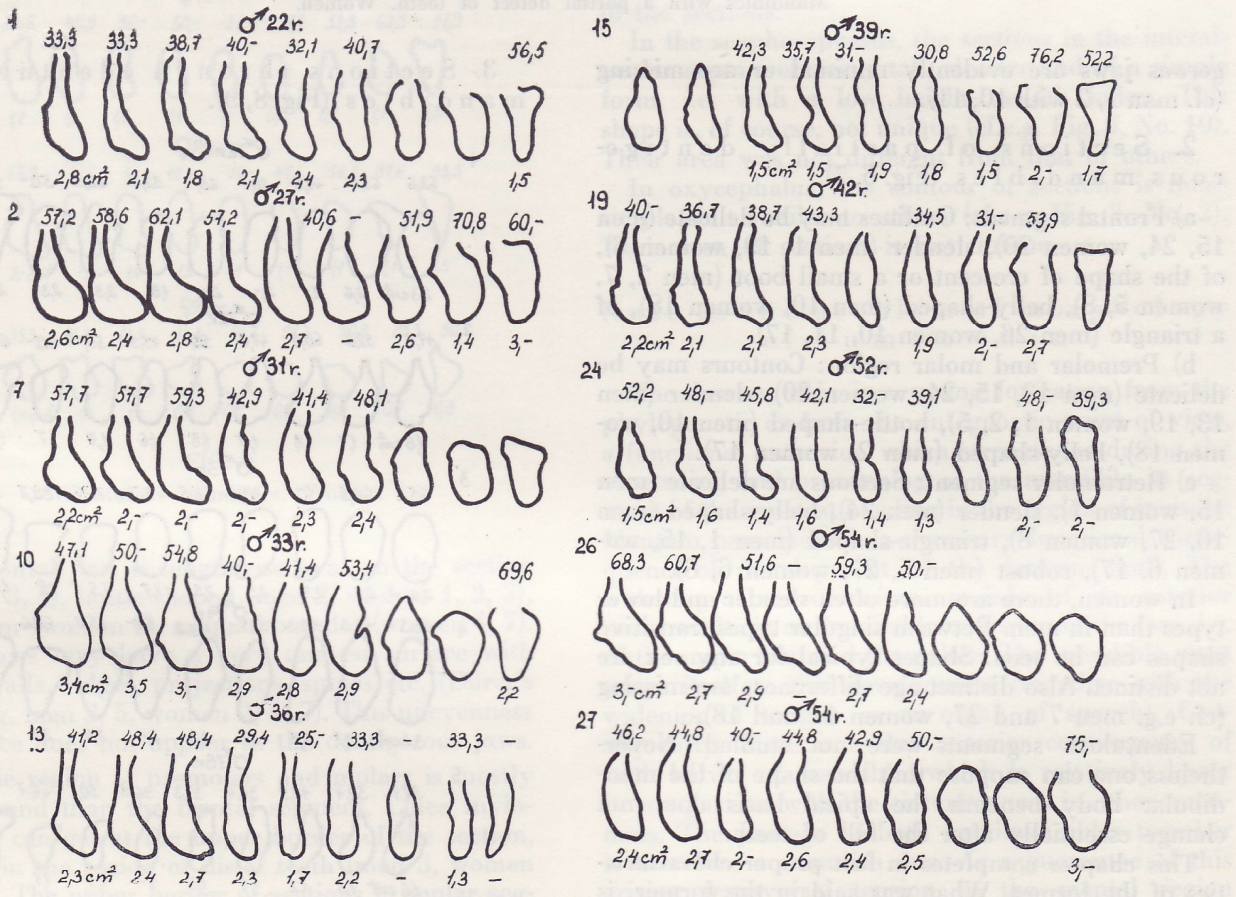

FIG. 6
Mandibles with a partial defect of teeth. Men.

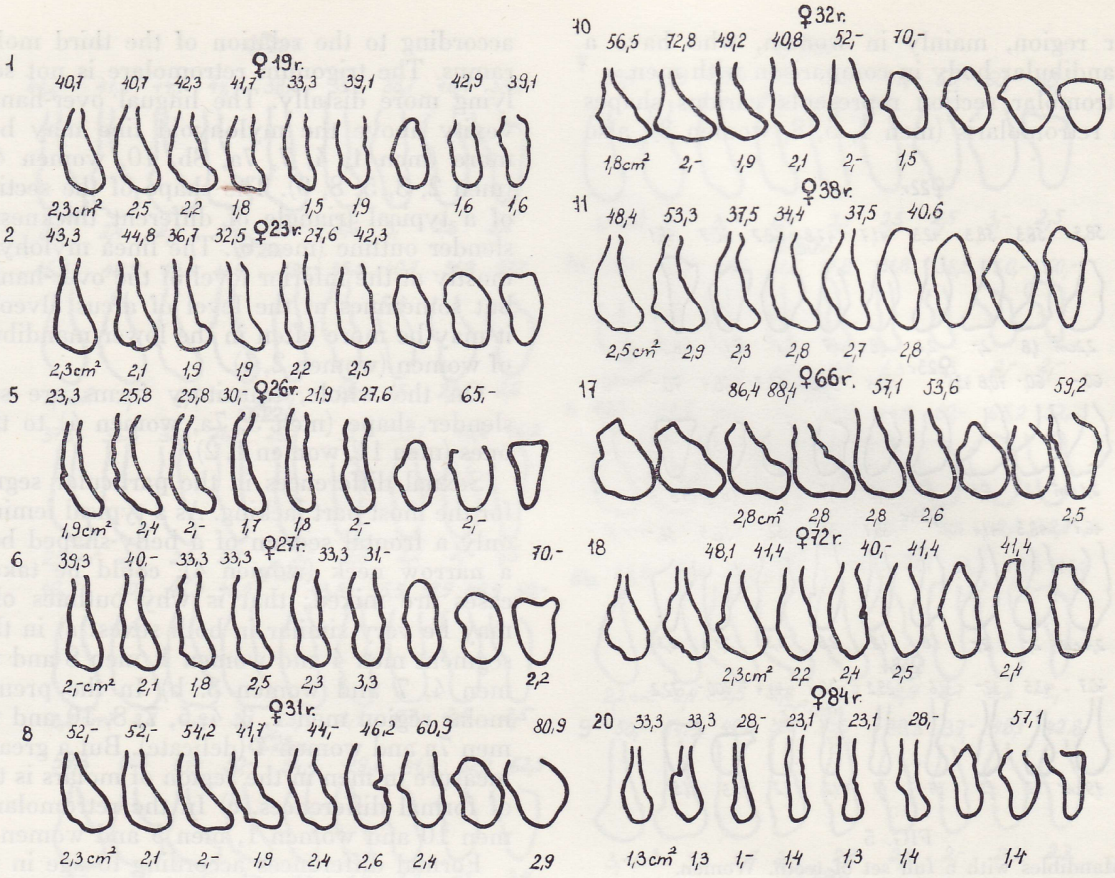

FIG. 7
Mandibles with a partial defect of teeth. Women.

gerous jaws are evidently minimal or are missing (cf. man 1, 2 with 10, 11).

2. Sections of partially dentigerous mandibles (Fig. 6, 7).

a) Frontal segment: Outlines may be delicate (men 15, 24, women 20), slender (men 1, 19, women 6), of the shape of crescent or a small boot (men 2, 7, women 5, 8), belly-shaped (men 10, women 18), of a triangle (men 26, women 10, 11, 17).

b) Premolar and molar region: Contours may be delicate (men 13, 15, 24, women 20), slender (men 13, 19, women 1, 2, 5), bottle-shaped (men 10, women 18), belly-shaped (men 2, women 17).

c) Retromolar segment: Sections are delicate (men 15, women 1), slender (men 24), belly-shaped (men 10, 27, women 8), triangle-shaped (men 1, 15, women 6, 17), robust (men 5, 27, women 6, 8).

In women, there are more often slender and lower types than in men. Between singular types transitive shapes can be seen. Shapes typical for any sex are not distinct. Also distinct age differences are missing (cf. e.g. men 7 and 27, women 11 and 18).

Edentulous segments were not studied. Nevertheless one can suppose that the shape of the mandibular body beneath the apical basis does not change essentially after the fall of teeth.

This chapter completes in fact proper characteristics of the former. What was said in the former, is for the most part valid also in the latter for some types of sections which are similar in both groups.

3. Sections through edentulous mandibles (Fig. 8, 9).

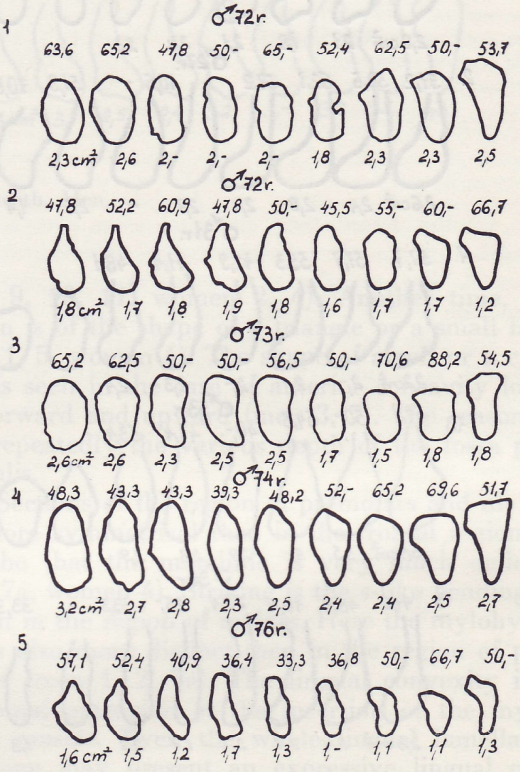

FIG. 8
Edentulous mandibles. Men.

By putting on of the average breadth of singular teeth the position was determined of singular septa interalveolaria, in which the mandibular body had been severed. Fresh osseous scars were nowhere visible. Then, edentulous state had been already lasting a long time and was relatively steady. However, the whole shape was given by the degree of osseous resorption and atrophy, which is typical for the senium.

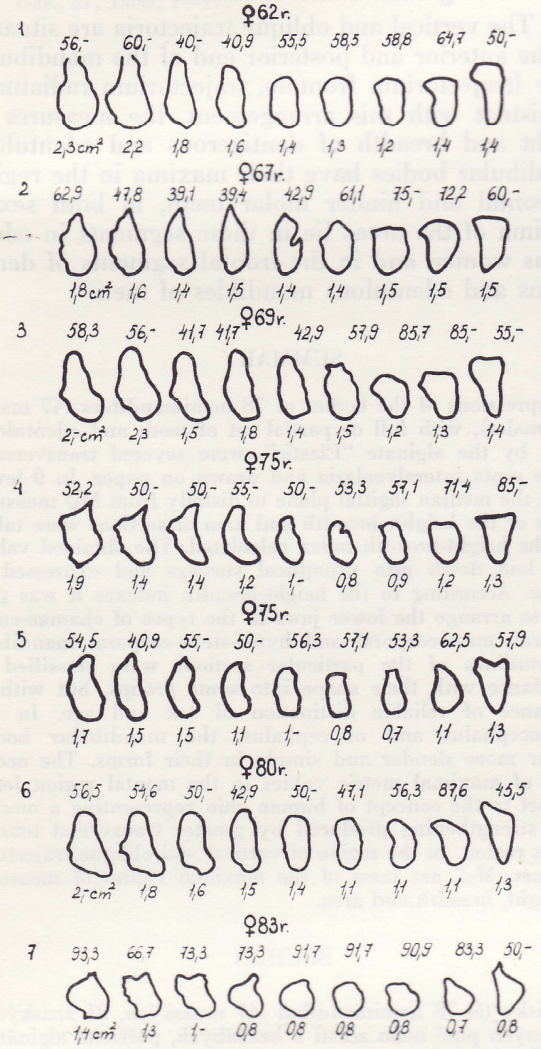

FIG. 9
Edentulous mandibles. Women.

a) Frontal part is lengthwise oval on the section (men 1, 3, 4), bottle-shaped (men 2, women 1, 2, 3), triangular (women 6), or quadrangular (women 4, 7). Some jaws may have a very uneven surface with many walls, ridges, projections, spines etc. (Dürer's type, e.g. men 2, 5, women 2, 4, 7). This unevenness of surface does not appear in the dentigerous jaws.

b) The region of premolars and molars is mostly more round than the frontal segment. Linea mylohyoidea can get at the upper border of the section, mainly in the region of distal teeth (men 3, women 1, 2, 4). The upper border of sections in molar segment has, according to the thickness of mandible in this region, often a shape of horizontal line.

c) Retromolar section in the proximity of the ramus is influenced by the form of fovea retromolaris. It is in the habit of being over-hanged on the lingual side in the same direction of the declivity of alveolar part together with the wisdom tooth. Distinct is the hinder end of the mylohyoid line, which is seen on the lower margin of the over-hanging part in case of advanced resorption on the mediolingual border (men 2, 4). The sharpened linea mylohyoidea bears the name crista mylohyoidea.

The whole shape of edentulous mandibular bodies has an appearance ranging from narrow and slender forms (men 5, women 5) to the robust oval types (men 1, 3), and to the square or circular types in the region of hinder teeth (women 7), which can be seen in case of advanced resorption.

Corpus mandibulae in pathological states and in deformations of the skull

Among the mandibles studied there were 2 female edentulous pieces with the arthrosis of the temporomandibular joint (Fig. 9, No. 1, 62 years, and No. 6, 80 years); 2 males belonging to the scaphocephalus (with full denture, Fig. 4, No. 3; with partial denture, Fig. 6, No. 1, both 22 years); 1 female with partial denture was oxycephalus (Fig. 7, No. 6, 27 years).

In the mandibles with arthrosis of the temporomandibular joint there were not any deviations neither morphological nor concerning linear measures of the sections.

In the scaphocephalus, the sections in the interalveolar septa were very tall, slender and of a simple form, i.e. with a low height-breadth index. This shape is, of course, not unique (cf.e.g. Fig. 6, No. 19). Their area was not different from that of others.

In oxycephalus, the contour of sections is more simple, but similar to others (cf.e.g. Fig. 7, No. 2). Their area of sections is not unique.

Note to the problem of morphology of human chin

The osseous chin is a young formation from the phylogenetic as from the ontogenetic point of view, a functional extension which strengthens during the shortening and broadening of the mandible its segment of the greatest bending in the region of incisors. Mentum prominens is a necessary functional consequence of development of the human skull. The widening of neurocranium, mainly of its anterior part, results in an inevitable widening of the face, i.e. of the upper jaw and the palate. The mandible must adopt itself to this development (together with the widening of tongue as an organ of speech). Consequently, there is a due anterior convergency of both halves of mandible, which is relatively lesser in comparison with the circumstances in other mammals. The passage of both hemimandibles together is therefore a roundish one. As a guarantee of this arising transversal tension in the mental region comes into being as a new formation the strengthening of the osseous mental mass. Aiding to its origin

are also ossicula mentalia, a specific human formation.

This conception of Toldt concerning the origin of typical human chin in the recent man is accepted, completed and supported by us by the verified facts: nearly all measures of height and breadth and areas of sections in the septa interalveolaria have their maxima in men and women in the dentigerous and edentulous jaws in the mental region (Fig. 1—3).

The relation of the trajectoria mandibulae to the personal results

Trajectoria, i.e. the strengthened formation of osseous frame-work of the spongiosa, are a supporting and strengthening system of bones. Their number, strength and course depend on the physiological role of bone and on quality and quantity of functional stress.

The mandibular body is strengthened by vertical and oblique trajectoria on the anterior and posterior end of the dental arch (trajectorium frontale, trajectorium radiatum). This formation has its reflection in the personal results. The measures of height and breadth of dentigerous and edentulous jaws have their maxima in the region of these trajectoria, i.e. in segments of the frontal and hinder molar teeth in both sexes. In the areas of sections there is a striking agreement in edentulous women and in the frontal segments of dentigerous and edentulous jaws of men. The molar (distal) segment of these male jaws presents no rising tendency.

CONCLUSIONS

1) Various values of height, breadth, height-breadth index and the area of sections through the mandibular body are grafically demonstrated for both sexes on Fig. 1—3, singular height-breadth indexes and areas on Fig. 4—9. The average numbers including maxima and minima are seen in the respective surveys. Summaries added are aiding in the explanation of graphs (vide supra).

2) According to the heigth-breadth indexes it is possible to divide the mandibular bodies and their segments into mandibles: a) chamae-eury-corporal with the body low and broad, and with the high index, b) meso-corporal with the medium number of index, c) hypsi-steno-corporal with the body tall and slender, and with a low index.

3) Outlines of singular sections (Fig. 4—9) were in jaws of singular groups dealt out in different types according to the shape. Sexual differences are moderate. Sections through the body of female mandibles are generally more delicate than those of men. Compared altogether, they do not afford reliable signs of differences between both sexes. The age differences in shape of dentigerous lower jaws are minimal or lacking at all.

4) In the mandibular bodies with the arthrosis of the temporo-mandibular joint deviations neither morphological nor metrical were proved. In the oxycephalus and especially in scaphocephalus, the mandibular body appears more high, slender and simple.

5) Toldt's conception concerning the form of typical chin of recent man was completed and supported by the facts, that almost all measures of height, breadth and areas of sections through mandibular body have their maxima in men and women, and in the dentigerous and edentulous mandibles in the mental region, that is strengthened in its frontal segment of greater transversal tension.

6) The vertical and oblique trajectoria are situated on the anterior and posterior end of the mandibular body (trajectorium frontale, trajectorium radiatum). Consistent with this arrangement, the measures of height and breadth of dentigerous and edentulous mandibular bodies have their maxima in the region of frontal and hinder molar teeth, in both sexes. Maxima of the areas lie in these segments in edentulous women and in the frontal segments of dentigerous and edentulous mandibles of men.

SUMMARY

Impressions of the bodies of 78 hemimandibles (47 males, 31 females), with full or partial set of teeth and edentulous, taken by the alginate "Elastic", were severed transversally in the septa interalveolaria and drawn on paper. In 9 levels (from the median sagittal plane to distally from M_3) measurements of the height, breadth and area of sections were taken and the height-breadth index calculated. The obtained values were laid down into synoptical surveys and expressed in graphs. According to the height-breadth indexes it was possible to arrange the lower jaws in the types of chamae-eury-corporal, meso-corporal and hypsi-steno-corporal mandibles. The outlines of the particular sections were classified in accordance with their shape into some groups, but without a chance of reliable distinction of sex and age. In the scaphocephalus and oxycephalus, the mandibular bodies appear more slender and simple in their forms. The occurrence of maximal metric values in the mental region lends support to the concept of human chin representing a mechanical strengthening produced by greater transversal tension in this region. In the region of vertical and oblique trajectoria (incisors, M_3), are most of the maximal values of measures of height, breadth and area.

SOUHRN

Otisky těl 78 hemimandibul (47 mužských, 31 ženských), ozubených plně nebo zčásti a bezzubých, pořízené alginátem zn. Elastic, byly rozřezány napříč v mezizubních septech a překresleny na papír. V 9 úrovních (od střední čáry až distálně od M_3) byla měřena výška, šířka a plošný rozsah řezů a vypočítán index výškošířkový. Získané hodnoty byly srovnány do tabulek a vyjádřeny přehledně v grafech. Výškošířkové indexy umožnily rozdělit mandibuly v typ chamae-eury-korporální, meso-korporální a hypsi-steno-korporální. Obrysy jednotlivých řezů byly roztříděny podle tvaru do více skupin; nedovolují však bezpečně rozlišit ani pohlaví ani věk. U skafocefalu a oxycefalu se zdají být těla čelistí štíhlejší a jednoduššího tvaru. Vznik typické brady recentního člověka je v souhlase s maximálními metrickými hodnotami nalezenými v bradové krajině, která je zesílena v oblasti zvýšeného příčného napětí. V místech svislých a šikmých trajektorií v oblasti řezáků a M_3 je většina maximálních měřených hodnot lineárních a plošných.

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