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OBSERVATIONS ON THE EARLY OSSIFICATION PROCESS OF THE MANDIBLE AS SEEN IN PLASTIC EMBEDDED HUMAN EMBRYOS

by

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INTRODUCTION

The early ossification of the mandible has been investigated by *Fawcett* (1905), *Dixon* (1958) and *Scott & Dixon* (1966). There seems to be a general agreement that the ossification starts at the 17—18 mm CR stage from one single center in the angle formed by the incisive and mental nerves, that is, in the region of the future mental foramen. From this center the formation of bone spreads rapidly backwards below the mental nerve and on the lateral side of the inferior dental nerve. A similar spread of ossification in the backward direction produces first a plate of bone in relation to the whole of the lateral aspect of the nerve and later on a bony through and canal for the nerve.

The plastic embedding method of human embryos renders itself very useful in viewing the ossification process of bones, seen either directly in the stereomicroscope or by stereophotography.

The aim of this study was to follow the early spread and direction of the ossification process in the mandible and not the actual site of the initial ossification centres.

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MATERIALS AND METHOD

Embryos for study were obtained from the collection of foetal material from the Institute of Anatomy, University of Bergen. Five specimens aged between 10—12 weeks were selected for this preliminary study.

The approximate foetal age was assigned by means of *Streeter's* tables (1948). The foetal material had previously been fixed in 4 % formaline. The foetal heads were sectioned parasagitally and the one half containing the nasal septum was dehydrated in increasing strengths of alcohol from 80 %, 85 %, 90 %, 96 % and 100 %. The specimens were kept 24 hours in each of the lower alcohol concentrations and for 48 hours in absolute alcohol, and each concentration was changed twice.

After absolute alcohol the specimens were placed in a mixture of Crystic resin 28 C, 100 volume per cent and Catalyst paste H, 1—2 volume per cent, in an aluminium foil embedding bar. The mixture was then placed in a refrigerator at a temperature of 1—4°C. This process prevents hardening, and the alcohol in the specimen is replaced by the plastic material by simple diffusion. When the specimen was translucent (usually after 1—5 days, depending on size), the embedding bar was put under vacuum (500 mm Hg) for 5 minutes to withdraw air-bubbles from the mixture.

From here the specimen was put into a heating chambre with temperature 35—40°C until the block was hard (usually between 1 and 4 days). The hard block was trimmed mechanically to a convenient size and form after which it was polished to give it a glass-clear translucency.

When the block is viewed directly or under a stereomicroscope, bone and cartilage show up very clearly while the soft tissues are rendered nearly completely translucent.

The plastic embedded foetal heads were viewed under a stereomicroscope, and stereoscopic photographs were taken from the medial, lateral and inferior aspects of the mandible. The stereophotographs were taken with the photographic tube and camera attached to the stereomicroscope. The plastic block containing the foetal head was resting on an angulating table and two exposures were taken from each field desired, by tilting the angulating table four degrees to either side from the horizontal plane.

OBSERVATIONS

At the approximate age of 10 weeks the mandibular body seems to consist of two definite ossified layers, a medial and a lateral layer (Fig. 1). These two layers are clearly distinguishable from the area of the symphysis back

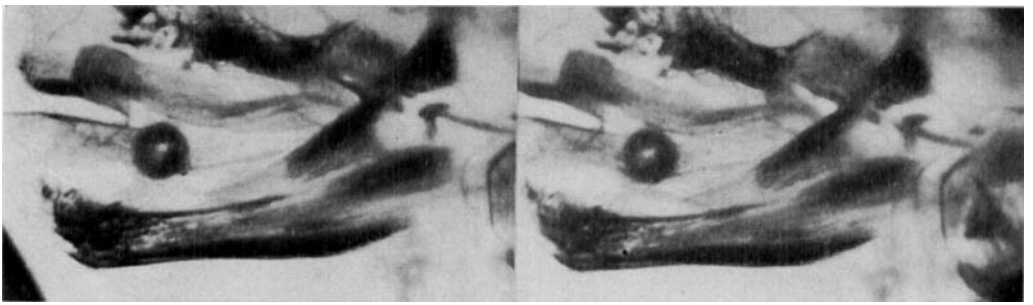

Fig. 1. Stereophotograph of an embryo 10.0 weeks old, showing early ossification of the mandible. Notice the densely ossified medial wall, especially the upper and lower borders, and the poorly ossified lateral wall except for the cranial aspect of the coronoid and condylar processes.

to the region of the jaw angle. The medial layer, closely related to Meckel's cartillage, consists of well marked and densely ossified inferior and superior borders, and of a slightly less densely ossified area in between. The inferior border is lying lateral to the superior border from the area just behind the symphysis to the jaw angle, and the mediolateral distance between the two borders is increasing in a backward direction. This gives the medial layer of the early mandible a screwed appearance from the symphyseal region to the jaw angle.

The lateral layer, continuous with the inferior border, the symphyseal region and the coronoid and condylar processes, has not the same screwed appearance, but is more like a vertical sheath.

The most striking difference between the two layers of the mandibular body is the poor ossification of the lateral layer compared to the much more densely ossified medial layer, this is especially well marked in the anterior and middle regions.

The coronoid and condylar processes of the ramus are much more advanced in their ossification process than the rest of the lateral aspect of the mandible, and both processes seem to be most densely ossified on their dorsal and cranial aspects. Meckel's cartilage can be seen to have no direct relationship to the coronoid and condylar processes, as these are lying well on the lateral aspect of the cartilage.

The jaw angle is obtuse, the condylar process is nearly in direct continuity with the body and parallel to Meckel's cartilage.

At the approximate age of 12 weeks the ossification process is more advanced, but there is still a striking difference in ossification density between the medial and lateral walls of the mandibular body (Fig. 2). The

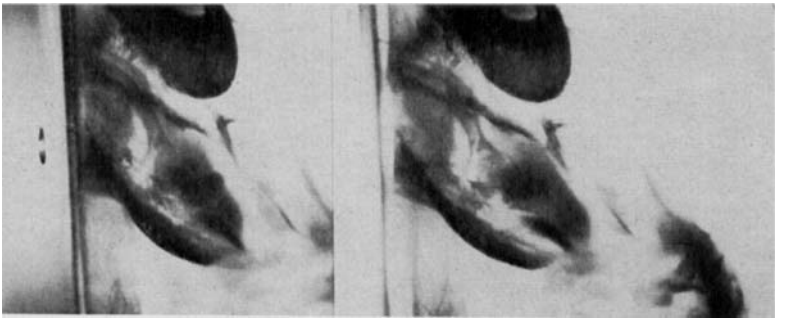

Fig. 2. Stereophotograph of an embryo 12.5 weeks old, showing antero-lateral view of the mandible. The screwed appearance of the medial plate of the mandibular body is seen. Notice poor ossification of the lateral wall in the region of the mental foramen as compared to the more densely ossified medial plate.

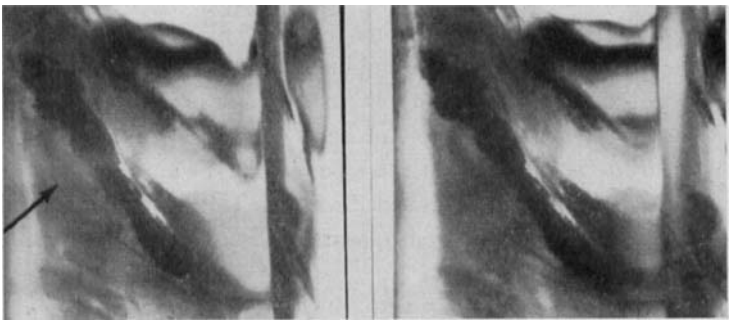

Fig. 3. Stereophotograph of an embryo 12.7 weeks old, showing caudal view of the mandible. Meckel's cartilage (see arrow) is seen to adhere closely to the medial wall of the mandibular body in the angular region. Anteriorly Meckel's cartilage is seen to turn medially, loosing its close contact with the medial wall of the mandibular body.

mental foramen can be seen faintly on the lateral wall. The angular region and the coronoid and condylar processes are well ossified.

Meckel's cartilage can be seen to follow the condylar process more or less parallel although lying medially. In the region of the jaw angle it comes into close relationship with the medial wall of the mandibular body, continues forward in this relationship until midway on the body, where it turns more medially and ends just dorsal to the symphysis. (Fig. 3).

CONCLUSIONS

1. The early ossification process of the human mandibular body (10—12 weeks intrauterine life) produces a medial and a lateral wall, the former in relation to Meckel's cartilage.

2. The ossification process is more active on the medial than on the lateral wall of the mandibular body.
3. The coronoid and condylar processes are continous with the lateral wall of the mandibular body.
4. Ossification of the coronoid and condylar processes is more active than that of the lateral wall of the mandibular body.

SUMMARY

The ossification process of the mandible was followed in human embryos between 10—12 weeks. The embryo-heads were embedded in plastic material and examined under a stereomicroscope and by stereophotography. The study revealed that the mandibular body consists of a more densely ossified medial wall and a less ossified lateral wall. The coronoid and condylar processes were found to be continous with the lateral wall of the body, being more densely ossified however, than the lateral wall of the mandibular body.

RÉSUMÉ

OBSERVATIONS SUR LES DÉBUTS DE L'OSSIFICATION DE LA MANDIBULE D'APRÈS L'ÉTUDE D'EMBRYONS HUMAINS INCLUS DANS UNE MATIÈRE PLASTIQUE

Le processus de l'ossification de la mandibule a été suivi dans des embryons humains pendant 10 à 12 semaines. Les têtes des embryons ont été incluses dans une matière plastique et examinées au microscope stéréoscopique et par stéréophotographie. Cette étude a révélé que le corps de la mandibule consiste en une lame médiane dont l'ossification est plus dense et en une lame latérale d'ossification moins dense. L'apophyse coronoïde et le condyle continuaient la lame latérale du corps de la mandibule, tout en présentant cependant une ossification plus dense que cette lame latérale.

ZUSAMMENFASSUNG

BEOBACHTUNGEN ÜBER DEN OSSIFIKATIONSPROZESS IM UNTERKIEFER ERFORSCHT AN MENSCHLICHEN IN KUNSTSTOFF EINGEBETTETEN EMBRYONEN

Der Ossifikationsprozess des Os mandibulare wurde an 10—12 Wochen alten mennschlichen Embryonen untersucht. Die in Kunststoff eingebetteten Embryoköpfe wurden stereomikroskopisch und stereofotografisch untersucht.

Die Untersuchung ergab, dass der Mandibularköper aus einer stärkeren ossifizierten medialen Schicht und einer weniger ossifizierten lateralen

Schicht besteht. Die Processi coronoideus und condylaris hatten eine Verbindung zu der lateralen Schicht des Mandibularkörpers. Die Ossifikation der beiden Processi war jedoch etwas deutlicher als die der lateralen Schicht des corpus mandibulae.

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