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OBSERVATIONS ON THE EARLY OSSIFICATION OF THE UPPER JAW

by

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INTRODUCTION

An examination of the literature regarding the ossification of the maxilla and premaxilla indicates that there are different views and considerable uncertainty regarding the status of the premaxilla in relationship to the maxilla.

Chase (1942) in a summary of the literature relates that *Kollicker*, *Schwick*, *Mall*, *Brune*, *Inouye* and *Felber* all agree that there is one center bilaterally for the premaxilla; *Leuckhard*, *Albrecht*, *Biondi*, *Herbst*, that there are two, while *Peter*, *Jarmer*, *Callender*, *Rambaud* and *Renault* describe even more centers.

Not only is the number of ossification centers disputed, but the very existence of a premaxilla in man has been doubted. *Fawcett* (1911), *Frazer* (1916), and *Jacobsen* (1953) were unable to demonstrate the existence of a separate premaxillary ossification center. *Wood et al.* (1967) found a single ossification area, appearing as a lamina, which extended from the molar to the incisor region, and from these findings they contended that there is no separate ossification center for premaxilla and there is therefore no premaxilla in man.

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Another view, first advocated by *Callender* (1869) and later reiterated by *Wood Jones* (1947) and *Woo* (1949), is that the premaxilla is »buried» or embraced by the maxilla proper on the facial aspect, while *Peter* (1921), and *Noback* and *Moss* (1953) claim that the premaxilla and maxilla unite by fusion at the ectofacial surface.

The aim of this study was to follow the early spread and direction of the ossification process in the maxillary, premaxillary and palatine bones of human embryos.

MATERIAL AND METHODS

The material of this study was the same as in a previous study (*Kvinnsland* 1969); the method is described in detail in connection with that study.

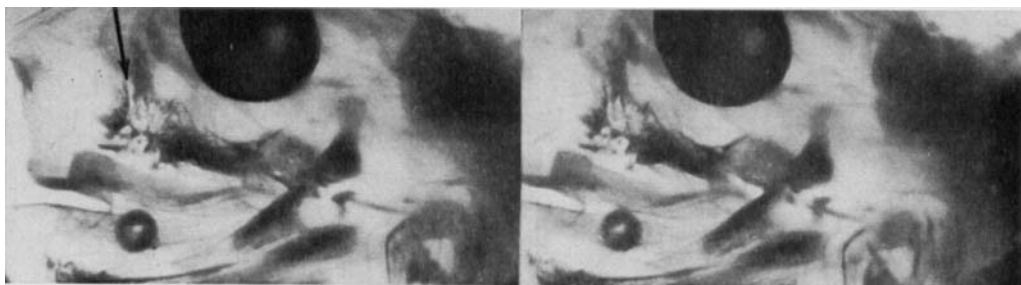


Fig. 1. Stereophotograph of an embryo 10 weeks old, showing early ossification of the upper jaw (lateral view). The alveolar and palatal processes of the maxilla are well ossified whereas the frontal process is less so. A definite suture seems to be present between the maxillary and premaxillary frontal processes (see arrow).



Fig. 2. Stereophotograph of an embryo 10 weeks old, showing early ossification of the frontal, alveolar and palatal processes of the maxilla and premaxilla, and horizontal and perpendicular plates of the palatine bone (medial view). Notice the suture between the frontal processes of the maxilla and premaxilla, (see arrow) and the overlapping nature of the suture between the horizontal processes of the maxilla and the palatine bone.

OBSERVATIONS

At the approximate age of 10 weeks, the frontal, alveolar and palatal processes of the maxilla are clearly distinguishable (Figs. 1 and 2). The alveolar and palatal processes are well ossified whereas the frontal process is less so, especially in its caudal part. A definite anterior margin can be seen on the frontal process of the maxilla from the lateral aspect (Fig. 1), making the maxillary contribution to the premaxillary-maxillary suture on the facial aspect. From the medial aspect (Fig. 2) a bridge of ossified tissue can be seen to connect the palatal and frontal processes of the maxilla, constituting the palatal aspect of the maxillary part of the premaxillary-maxillary suture.

The frontal and anterior processes of the premaxilla are also clearly seen (Figs. 1 and 2). Viewed from the lateral side (Fig. 1), a well defined, densely ossified posterior border can be seen constituting the premaxillary boundary to the premaxillary-maxillary suture.

In the anterior alveolar region on the caudal aspect of the premaxilla a small spicule of bone is seen on the lateral side. This seems to be continuous with the maxilla and is possibly the early beginning of the «embracing» process of premaxilla by the maxilla described by *Callender* (1869), *Wood Jones* (1947) and *Woo* (1949).

The suture between the horizontal process of the maxilla and the corresponding process of the palatine bone is seen. This is an overlapping suture where the palatine bone develops on the cranial aspect of the maxilla. (Fig. 2).

The horizontal process of the palatine bone is more advanced in its ossification process than the perpendicular plate of the same bone.

At the approximate age of 12 weeks, the ossification process is more advanced. No suture between the premaxilla and maxilla can be seen on

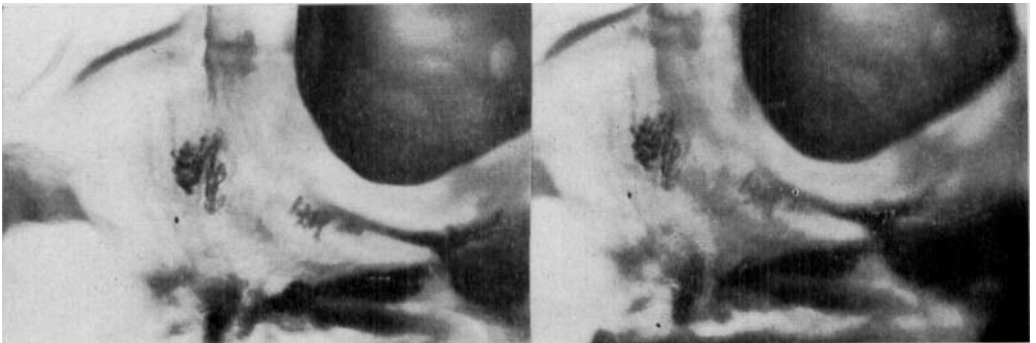


Fig. 3. Stereophotograph of an embryo 12.5 weeks old, showing facial aspect of the upper jaw. No suture can be seen between the maxilla and premaxilla at this stage.

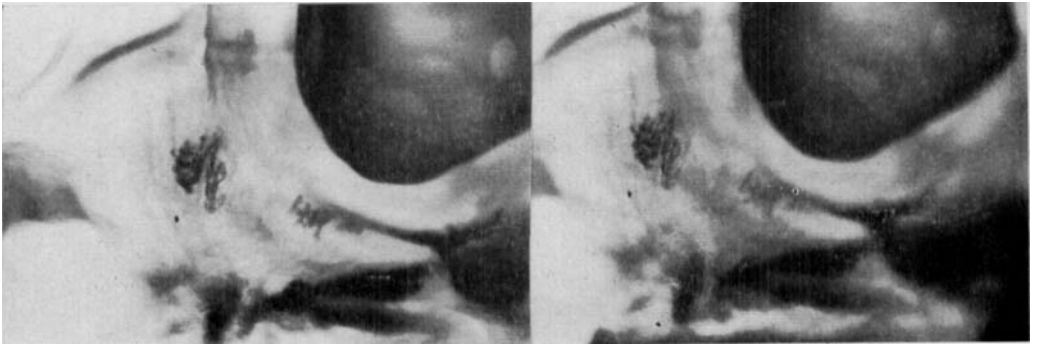


Fig. 4. Stereophotograph of an embryo 12 weeks old, showing the medial aspect of the upper jaw. The premaxillary-maxillary suture is seen on the palatal process; on the frontal process, however, only a faint groove is seen indicating its possible previous position (see arrow.)

the facial aspect; only a faint vertical groove indicates where the suture may have been (Fig. 3). Horizontal spicules of bone continuous with the maxilla in the zygomatic region can be followed right forward to the labial alveolar region. This would further indicate that the maxilla embraces the premaxilla in its forward ossification process as advocated by *Callender* (1869), *Wood Jones* (1947) and *Woo* (1949). Viewed from the medial aspect (Fig. 4) the premaxillary-maxillary suture is seen on the palatal process, but no definite sign of it is seen on the frontal process, only a faint groove indicating its possible previous position.

Further dorsally the overlapping nature of the suture between the horizontal processes of the maxilla and palatine bone is clearly seen (Fig. 4). The alveolar and palatal processes of the maxilla and premaxilla are more advanced in their ossification process than the frontal process.

CONCLUSIONS

1. The early ossification process of the upper jaw (10—12 weeks intrauterine life) is more active in the palatal and alveolar processes than in the frontal processes of the maxilla and premaxilla.
- 2) There seems to be a definite suture between the maxilla and premaxilla on the facial aspect up to about 10 weeks intrauterine life. After this period no suture can be seen on the facial aspect.
- 3) The suture between the horizontal processes of the maxilla and premaxilla is continuous through the frontal process up to about 10 weeks intrauterine

life. After this period only the palatal aspect of the suture can be distinguished clearly.

4) The suture between the horizontal processes of the maxilla and palatine bone is a horizontally overlapping suture where the palatine bone develops cranially to the maxilla.

SUMMARY

The ossification process of the maxilla, premaxilla and palatine bones has been followed in human embryos between 10—12 weeks. The sagittally sectioned embryo heads were embedded in plastic material and examined under a stereomicroscope and by stereophotography.

The study revealed a suture between the maxilla and premaxilla in the facial and medial aspects up to about 10 weeks intrauterine life, after this period no suture could be distinguished on the facial aspect, on the medial aspect, however, a faint groove was seen. The horizontal process of the palatine bone develops cranially to the maxilla and the suture between these processes is an overlapping suture.

RÉSUMÉ

OBSERVATIONS SUR LES DÉBUTS DE L'OSSIFICATION DU MAXILLAIRE SUPÉRIEUR
Le processus de l'ossification du maxillaire supérieur, du prémaxillaire et de l'os palatin a été suivi dans des embryons humains pendant 10 à 12 semaines. Les têtes des embryons, sectionnées dans le sens sagittal, ont été incluses dans une matière plastique et examinées au microscope stéréoscopique et par stéréophotographie.

Cette étude a révélé qu'il existait entre le maxillaire supérieur et le prémaxillaire une suture visible à la partie antérieure et à la partie médiane jusqu'à la dixième semaine de la vie intra-utérine environ; après cette période, il n'était plus possible de distinguer de suture à la partie faciale, tandis que, à la partie médiane, une rainure estompée était visible. La lame horizontale du palatin se développe à un niveau plus haut que l'apophyse palatine du maxillaire supérieur, et la suture entre elles est une suture avec superposition.

ZUSAMMENFASSUNG

BEOBACHTUNGEN ÜBER DIE FRÜHE OSSIFIKATION IM OBERKIEFER

Der Ossifikationsprozess der Maxilla, Praemaxilla und des Os palatinum wurden an 10—12 Wochen alten menschlichen Embryonen untersucht.

Die sagittal geschnittenen Embryoköpfe wurden in Kunststoff eingebettet und stereomikroskopisch wie stereofotografisch untersucht.

Die Untersuchung ergab, dass im Frontal- und Medianschnitt eines 10 Wochen alten Embryos eine Sutur zwischen Maxilla und Praemaxilla vorhanden ist. Nach dieser Periode konnte man im Frontalschnitt keine Sutur mehr beobachten, dagegen war im medialen Schnitt eine schwache Vertiefung wahrzunehmen. Der horizontale Process des Os palatinum entwickelt sich cranialwärts auf die Maxilla zu, und die Nahtatellen zwischen diesen Process überlappen sich gegenzeitig.

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