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EXPANSION OF THE MIDPALATAL SUTURE, STUDIED BY MEANS OF METALLIC IMPLANTS

by

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Expansion of the midpalatal suture seems to have been mentioned for the first time by the American *Angell* 1860. Since then this form of treatment has been discussed at regular intervals by both American and European orthodontists.

More recently, interest in the treatment has again been revived through the writings of *Derichsweiler.*

Previous discussions on the effect of suture expansion were largely speculative, but recent investigators have sought to register the effect of this form of treatment by various objective methods: by histological investigation using experimental animals (*Ziebe* 1930, *Derichsweiler* 1957, *Debbane* 1958), by direct measurement on frontal cephalograms and laminagrams (*Derichsweiler* 1956), and by occlusal roentgenograms taken under identical conditions (*Thörne* 1956).

These studies show that the dental arch is expanded, partly by a separation of the two maxillary segments, partly by movement of the teeth. By reason, however, of the difficulty of finding fixed points of reference, it has proved almost impossible, by the methods mentioned, to differentiate metrically between these two forms of expansion.

Methods of analysis of frontal cephalograms have been developed by *Harvold* 1954, and by *Krogman & Sassouni* 1957, but

This paper was presented at the Congress of the European Orthodontic Society, Copenhagen, July 4—8, 1958.

Fig. 1. Method for insertion of implants. The operator presses the instrument firmly against the selected point, while an assistant drives the implant into the bone with a leaden mallet.

as measurement of the expansion of the midpalatal suture requires the registering of relatively small changes in the upper face, it was considered desirable that a more precise method of measurement be devised.

The use of metallic implants in the human jaw as fixed points of reference, first described by *Björk* in 1955, was felt to be suitable for the present study, and this method has accordingly been applied in a series of experiments conducted on patients at The Royal Dental College, Copenhagen.

METHOD

Vitallium implants (0.6×2.0 mm) are inserted in the jaw by means of a special instrument. Under local anaesthesia the insertion is made by the operator pressing the instrument firmly

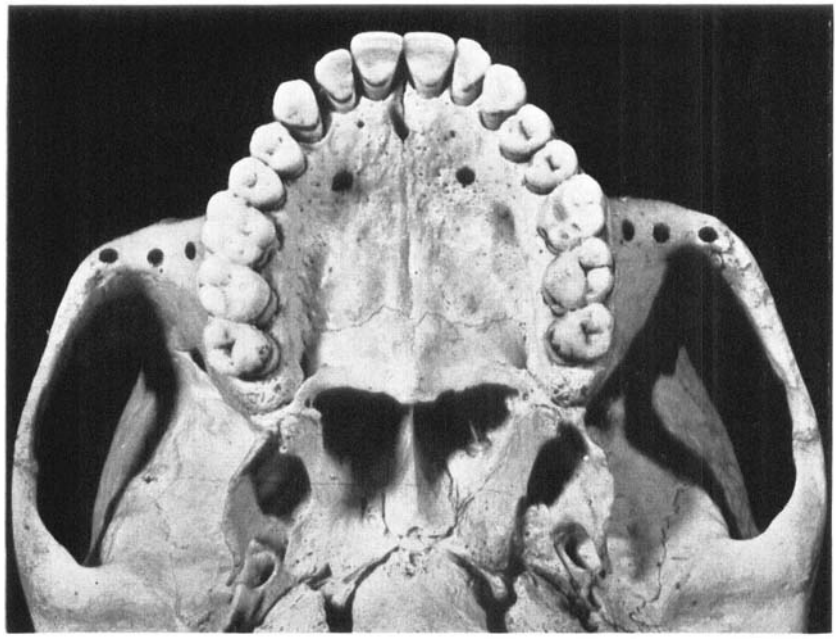

Fig. 2. Location of the implants. Three implants are inserted on either side in the infrazygomatic ridges and one or two in the alveolar bone lingually to the canines.

against the selected point, while an assistant drives the implants into the jaw with a leaden mallet (Fig. 1). Implants are placed in each side of the upper jaw both in the basal maxillary bone and in the alveolar bone.

With the aid of the former implants the separation of the basal component of the maxillary segments is registered, while the latter implants are used to register the widening of the alveolar arch, following suture expansion.

The preferable place for the implants, in the basal maxillary bone, is the infrazygomatic ridge of the zygomatic process (Fig. 2). Here, three implants are placed in a row on each side. It happens that an implant penetrates into the maxillary sinus in individuals with thin osseous walls and are lost in the soft tissue. When this occurs, however, the operator will be aware of it.

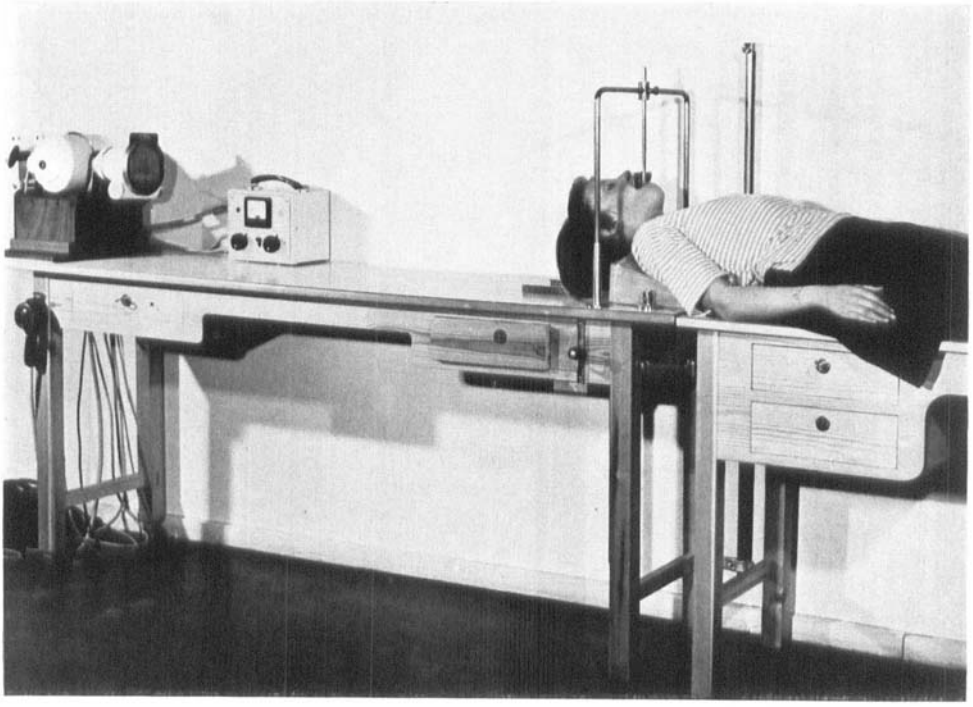

Fig. 3. Method for taking serial occlusal roentgenograms. The patient is lying on his back. The film holder is in close contact with the occlusal surfaces of the maxillary teeth.

In the alveolar bone, one or two implants are placed on each side lingually to the canines. Implants should not be placed in the buccal surface of the alveolar arch, because of the risk of displacement by the movement of the teeth; nor should implants be placed in the hard palate, which is too thin to accommodate them, and also is subjected to continuous remodelling by resorption and apposition.

The use of implants thus serves to register the transversal separation of the different maxillary segments, and by using several implants on each side it is possible to determine whether the separation is parallel or rotated.

Registration from cephalograms is carried out as follows:

A. *Frontal cephalograms* are used for measurement of the

effect of suture expansion on the basal maxillary segments and on the alveolar arch, and for determination of the extent of rotation of the maxillary segments in this plane.

B. *Occlusal roentgenograms* (taken in cephalostat, perpendicular to the occlusal plane (Fig. 3)) are used for analysis of the amount of expansion achieved in the anterior and posterior areas of the alveolar arch, and the extent of rotation of the maxillary segments in this plane.

C. *Standard profile cephalograms* are also taken in order that sutural growth activity in the sagittal and vertical directions may be followed.

Up to the present time this method has been used on 9 patients, but it is as yet too early for a composite of findings to be published. It has been considered of interest, however, to demonstrate the method by the following case.

CASE REPORT

The patient is an eleven year old boy with a bilateral crossbite caused by a narrow maxillary arch. A few deciduous molars have been extracted, but the permanent dentition is complete. With a single exception the canines and premolars have not yet erupted. An extremely crowded condition was found in both jaws. Suture expansion of the maxillae was carried out on orthodontic indication, by means of an expansion plate as described by *Derichsweiler* (Fig. 4).

The plate was expanded about 9 mm in the course of 25 days. For the purpose of retention the appliance was allowed to remain in the mouth for an additional period of 2 months and 9 days. At the end of this, the fixed appliance was replaced by a removable plate, which has so far been used continuously for 8 months.

The expansion of the dental arch is shown in Fig. 5.

Registration of the effect of the suture expansion was carried out with the help of roentgenograms taken in the various planes, as previously described.

In the author's opinion, it is easier to differentiate between the effect of the suture expansion of the basal maxillary segments and that of the alveolar arch by analysis of the frontal cephalograms than by use of the occlusal roentgenograms. For the pur-

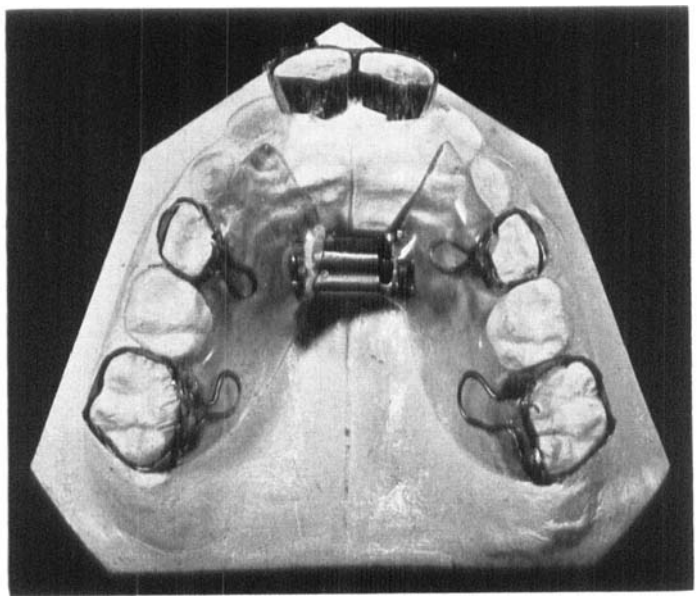

Fig. 4. Expansion plate as described by *Derichsweiler.*

pose of this discussion, therefore, the metrical evaluation of the expansion has been confined to the frontal cephalograms.

The expansion of the dental arch was determined from the dental models, and in addition to the distance between implants, the width of the nasal cavity was measured on the cephalograms.

Measurements of expansion:

(1) The width between the lingual surfaces of the canines level with the gingival margin. Measured on dental models.

(2) The width between the lingual surfaces of the first molars level with the gingival margin. Measured on dental models.

(3) The width between the right and left sides of the alveolar arch. Measured between the implants placed lingually to the canines.

(4) The bimaxillary basal width. Measured between the implants placed in the infrazygomatic ridges.

(5) The width of the nasal cavity. Measured between the antral walls 1 cm above the floor of the nasal cavity.

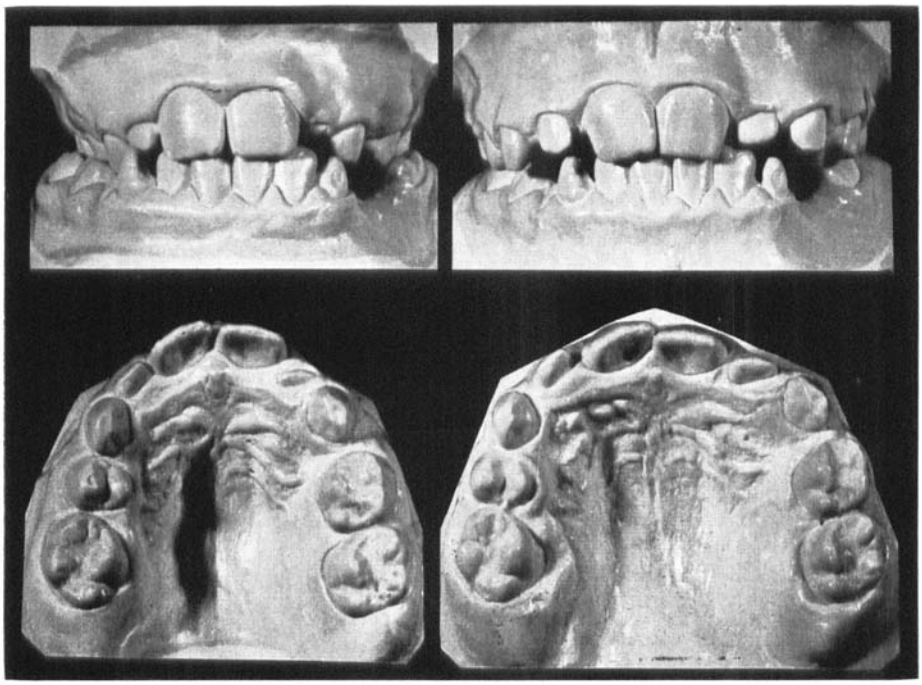

Fig. 5. Dental models before and after expansion of the midpalatal suture.

RESULTS

Changes in width were registered a) after expansion, b) after retention with a fixed appliance, and c) after 8 months' retention with a removable plate (Fig. 6).

Fig. 6 shows that it is possible not only to differentiate between the effect of the suture expansion in the various zones, but also to follow the reaction during the various phases of treatment.

In the case reported, the increase in width of the dental arch during active treatment was about twice that of the basal maxillary segments, while the increase of the alveolar arch lingually to the canines was almost midway between these two.

The increase in width of the nasal cavity was less than that between the basal maxillary segments as would be expected since the latter are placed closer to the dental arch than the floor of the nasal cavity.

During the retention period the width of the dental arch was

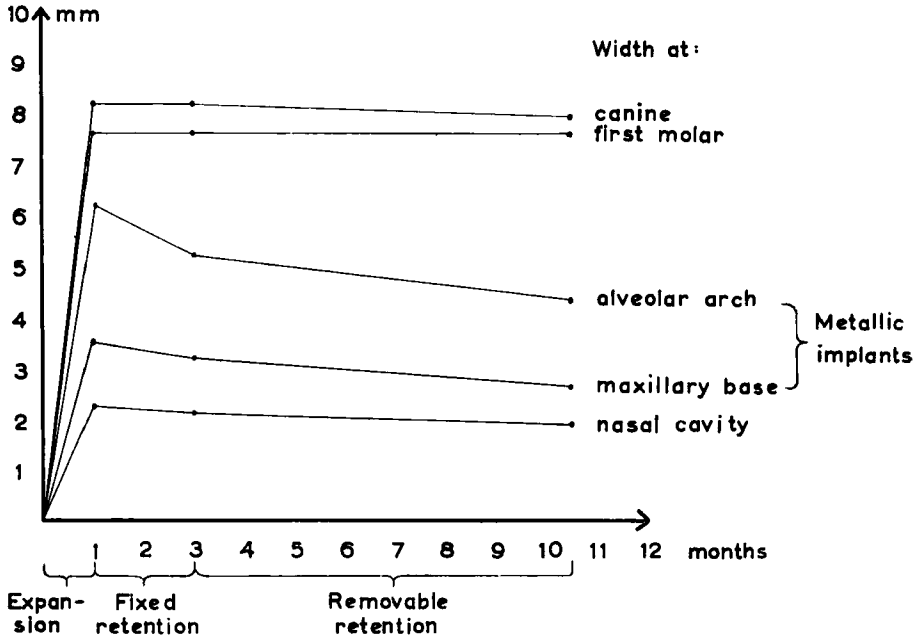

Fig. 6. Effect of the expansion in various zones during different phases of treatment.

maintained by the use of the retainers, while the distance between the right and left sides of the alveolar arch and the basal maxillary segments showed a tendency to lessen during the retention period.

The greater increase between implants in the alveolar arch than between implants in the infrazygomatic ridges is probably due to a rotation of the maxillary segments in the frontal plane.

The rotation is expressed by a greater increase in width in the lower segments than in the upper segments of the maxillae. Furthermore, a rotation in the transversal plane should be considered, the increase anteriorly being greater than posteriorly.

The linear measurements thus show that the effect of the expansion decreases in the direction from the dental arch towards the base of the skull. In order to express metrically this rotation of the maxillary segments in the frontal plane, implants in the infrazygomatic ridges have been used to provide angular measure-

ments characterising the position of the maxillary segments in relation to the base of the skull.

A line tangential to the superior contours of the two orbitae has been chosen as line of reference. Exact measurements are difficult to make, but the present case shows a rotation of 3° on the right side as against 1.5° on the left side.

Rotation in the transversal plane may be seen on the occlusal cephalograms and is measurable as the difference between anterior and posterior changes during the expansion. These measurements, however, have not been registered in the present case.

SUMMARY

This paper is a preliminary report of work being carried out at The Royal Dental College, Copenhagen, to clarify, by experiments with metallic implants, the effect of expansion of the midpalatal suture.

The use of metallic implants increases the possibility of an exact evaluation of the effect of expansion in the various zones of the facial skeleton. The insertion of metallic implants is a slight surgical operation in comparison with the suture expansion itself.

Series of cephalograms show great accuracy in the determination of the increase in distance between the implants. It is, however, as yet difficult to determine exactly the amount of rotation of the maxillary segments.

Before more definite conclusions can be reached on the subject of the midpalatal suture expansion, larger groups of patients must be analysed.

The author wants to express his sincere thanks to Professor Arne Björk, for his encouraging interest and kind help.

RÉSUMÉ

EXPANSION DE LA SUTURE PALATINE MEDIANE ETUDIÉE PAR L'EMPLOI DE REPÈRES METALLIQUES IMPLANTÉS

Cet article doit être considéré comme un aperçu préliminaire d'un travail fait à l'Ecole Dentaire Royale de Copenhague. On a cherché au moyen de repères métalliques implantés à éclairer l'effet de l'expansion de la suture palatine médiane.

L'implantation des repères metalliques est une intervention legère comparée avec l'expansion de la suture.

L'usage de repères metalliques implantés augmente la possibilité d'une détermination exacte de l'effet de l'expansion dans les différentes zones du squelette facial.

Des séries de téléradiographies permettent de déterminer avec une grande exactitude l'augmentation de la distance entre les repères.

Cependant, il est toujours difficile de déterminer exactement le degré de rotation des maxillaires supérieurs.

On ne pourra tirer de conclusions plus définitives quant à l'expansion de la suture palatine médiane qu'après des travaux supplémentaires pour perfectionner la technique et analyser son degré d'exactitude. Il est de même nécessaire d'augmenter le nombre de patients examinés.

ZUSAMMENFASSUNG

EINE UNTERSUCHUNG DER EXPANSION DER SUTURA PALATINA MEDIANA MIT HILFE VON METALLIMPLANTATEN

Diese Arbeit ist ein vorläufiger Bericht einer Untersuchung, die auf der Königlichen Zahnärztlichen Hochschule, Kopenhagen, ausgeführt ist, um auf Grund von Versuchen über die Verwendung metallischer Implantate die Erweiterungswirkung der Sutura palatina mediana zu erklären.

Die Einsetzung metallischer Implantate ist im Vergleich mit der Suturerweiterung eine leichte chirurgische Operation.

Die Verwendung metallischer Implantate vergrössert die Möglichkeit einer genauen Beurteilung der Erweiterungswirkung in den verschiedenen Zonen des Gesichtsschädels.

Serien von Cephalogrammen zeigen eine grosse Genauigkeit in der Bestimmung der Abstandsvergrösserung zwischen den Implantaten.

Es ist indessen immer noch sehr schwierig die Rotationsgrösse der Maxilsegmente zu bestimmen.

Ehe man endgültigere Konklusionen betreffs der Erweiterung der Sutura palatina mediana ziehen kann, sind eine Verbesserung der Methodik, eine Analyse ihres Genauigkeitsgrades und eine

Ausdehnung der Untersuchung, um eine grössere Gruppe von Patienten zu umfassen, wünschenswert.

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