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Changes of the soft tissue profile during growth

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SUMMARY The study concerns changes of the soft tissue profile of 33 girls and 37 boys from 4 to 10 years of age. The results are presented in growth curves. Generally, it seems that the changes of the soft tissue profile follow the changes of the skeletal profile. However, a difference is noted in the soft tissue area overlying points A and B. Due to variation in the facial expression, it was impossible to examine the vermillion area of the lips with a desirable degree of certainty. The nose seems to be responsible for most of the changes in profile convexity. The changes are due to increment in nose length, as its inclination is relatively unchanged.

It is necessary for orthodontists to be aware of the great profile changes produced by the nose, and evaluate them during treatment planning.

Introduction

In the 1930's growth studies of the human head were revolutionized by the introduction of the roentgen-cephalometric technique. Since then the skeletal growth of the human profile has been studied by numerous workers. Only a few have studied the growth of the integumental profile, as the general opinion has been that the soft tissue passively reflects the position and form of the underlying skeletal structures.

To some extent this might be true, but the studies of Burstone (1959) and Subtelny (1959) have shown that this is only part of the truth, and that soft tissue, within limits, has its own growth potential. It is important to locate these growth areas, and to try to determine the amount of growth, and to ascertain at what age it occurs. This is especially so if these growth centres are located in areas where it is possible to change the form and position of the soft tissue draping by orthodontic manipulation of the underlying hard structures. Lack of information about the possible growth changes will make the effect of treatment hazardous and the results impossible to predict.

One aim of orthodontic treatment is to harmonize a poor profile, and to maintain a good one. Before this desire can be fulfilled, detailed knowledge of the normal growth changes of the face is necessary.

This report is a summary of a larger study, and the intention of the work is:

(1) To describe the changes of the soft tissue profile of Norwegian girls and boys between 4 and 10 years of age.
(2) To demonstrate the differences between hard and soft tissue profile growth.
(3) To investigate whether the soft tissue profile form can provide information about the basal sagittal relationship of the jaws.
(4) To evaluate the sagittal growth of the nose and its influence on the profile form.

Material and methods

The material consisted of 33 girls and 37 boys aged from 4 to 10 years. Headplates were taken at yearly intervals. The reference points used are shown in Figure 1.

In order to study the effect of mimics on the soft tissue reference points, a group of 30 children at age 7 was chosen and headplates exposed at three week intervals. The error was found to be within acceptable limits compared to the error of double recordings of the main group (Table 1). Reference points on the vermillion area of the lips were excluded from the study because of too great variation. However, as would be expected, the error was greater than the error found from duplicate measurements on the same headplates. It is impossible to obtain reliable data from a soft tissue study compared with a hard tissue study. The soft tissue reference points, contrary to most skeletal points, are not related to typical anatomical structures and are more easily affected by varying quality of the roentgenograms, and in the most movable areas are also influenced by expressive and functional movements. The growth curves should not, therefore, be evaluated quantitatively. However, the direction and form of the curves are thought to be indicative of the changes taking place during the period studied.

The growth curves were constructed according to a method of multiple interpolation introduced by Solow (1969), and later modified by Odegaard (1970).

Results and discussion

Generally, the changes of the soft tissue profile seemed to follow the changes of the underlying hard tissue. The greatest difference was found in the area of the alveolar processes of the jaw. This area is of special interest to the orthodontist, as other studies have shown that the soft tissue of this area can be influenced by movement of the teeth as

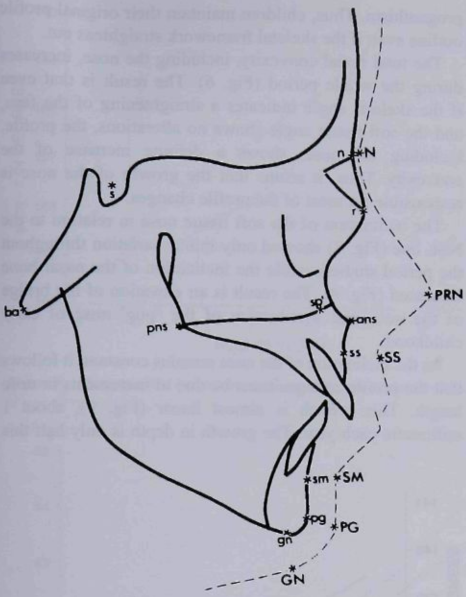

Figure 1 Reference points used in the study.

Table 1 Comparison of the method error calculated from double recordings of the roentgenograms in the main group, and the method error calculated from measurements on different roentgenograms of the same individual in the control group.

Variable	Main group	Control group
s-N-SS	0.308	0.433
s-N-SM	0.271	0.482
s-N-PG	0.218	0.453
N-SS-PG	0.366	0.707
N-PRN-PG	0.388	0.890
N-PRN-SS	0.415	1.459
PG-N-PRN	0.294	0.550
n-N	0.279	0.167
ss-SS	0.237	0.391
sm-SM	0.161	0.243
pg-PG	0.131	0.167
gn-GN	0.093	0.264
N-SS	0.237	0.738
SS-GN	0.218	0.771
N-GN	0.237	0.339
N-PRN	0.360	0.257

well as by movement of the alveolar process (Baum, 1961; Bloom, 1961; Rudee 1964). In this study the hard and the soft tissue SNA angles changed differently; the former decreased, while the latter increased. The reason seemed to be a thickening of the soft tissue overlying point A (Fig. 2), while the thickness of the soft tissue in the nasion area was relatively constant (Fig. 3). In both areas there was a slight sex difference, with greater thickness for the boys, but the magnitude of the changes was the same.

From a clinical point of view, these findings are most interesting, as the orthodontist's work is centred around the mouth. During treatment he often wants to influence the appearance of the soft tissue profile. According to these results, it seems difficult to predict the changes of the profile from skeletal analyses and knowledge of the skeletal growth alone. It would also seem illogical that this area should be merely a passive curtain, reflecting the form of the skeleton, as we know that the mouth area is most active during facial expression and functional movements related to speech, mastication and deglutition.

Similar results were also found in the lower jaw. The increase in soft tissue thickness in the region of point B (Fig. 4) is greater than over nasion. No sex difference was found. Clinically, this may result in a reduction of the depth of the mentalis sulcus, which can improve the appearance if the sulcus is initially deep, or worsen it if the patient has a receding chin.

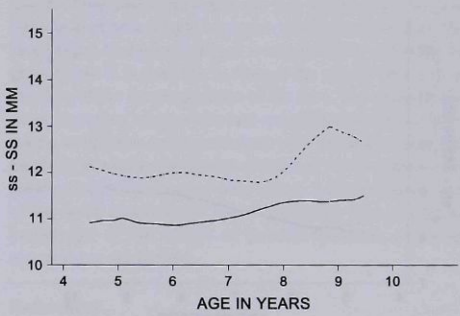

Figure 2 Changes in soft tissue thickness overlying point ss (Down's A-point). ♀—— ♂----

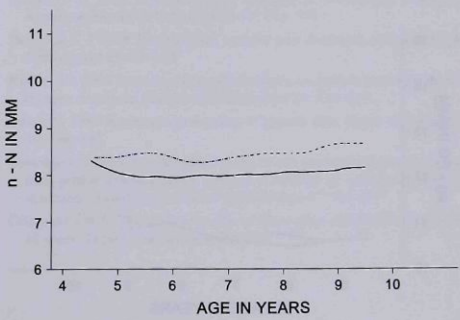

Figure 3 Changes in soft tissue thickness overlying point n. ♀—— ♂----

The basal sagittal relationship of the jaws is a keystone of orthodontic diagnosis and treatment planning. Thus far, the roentgen-cephalometric technique has been the only reliable auxiliary in determining the ANB angle. For routine diagnosis this is a laborious and expensive process. If the profile of the patient reflected the position of the underlying hard structures, it would have been possible to evaluate the ANB angle by the position of the corresponding soft tissue reference points. According to the results cited above, this procedure will not give sufficiently reliable information about the skeletal sagittal relationships.

The prognathism of the chin changes almost identically for both hard and soft tissues. This is only natural, as the change of soft tissue thickness on the chin (Fig. 5) is almost identical to that found over nasion. This means that soft tissue changes of the chin cannot be responsible for changes in the profile convexity. The skeletal facial convexity decreases in both sexes, while the soft tissue facial convexity, excluding the nose, is almost unchanged. The reason seems to be the increase of soft tissue thickness over point A. This growth is apt to camouflage the increased mandibular prognathism. Thus, children maintain their original profile outline even if the skeletal framework straightens out.

The total facial convexity, including the nose, increases during the whole period (Fig. 6). The result is that even if the skeletal angle indicates a straightening of the face, and the soft tissue angle shows no alterations, the profile, including the nose, shows a definite increase of the convexity. Thus, it seems that the growth of the nose is responsible for most of the profile changes.

The inclination of the soft tissue nose in relation to the NSL line (Fig. 7) showed only minor variation throughout the period studied, while the inclination of the nasal bone increased (Fig. 8). The result is an elevation of the bridge of the nose and a reduction of the 'pug' nose of early childhood.

As the inclination of the nose remains constant, it follows that the profile changes must be due to increments in nose length. This growth is almost linear (Fig. 9), about 1 millimetre each year. The growth in depth is only half this

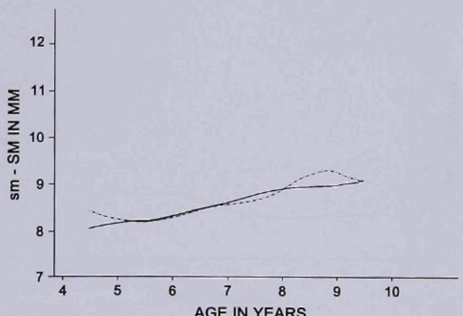

Figure 4 Changes in soft tissue thickness overlying point sm (Down's B-point). ♀—— ♂----

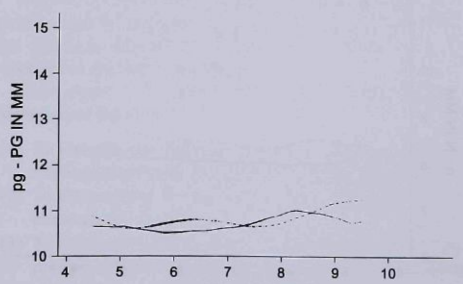

Figure 5 Changes in soft tissue thickness overlying point pg. ♀—— ♂----

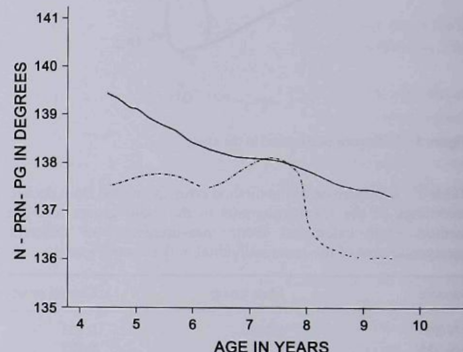

Figure 6 Changes in the total profile convexity. ♀—— ♂----

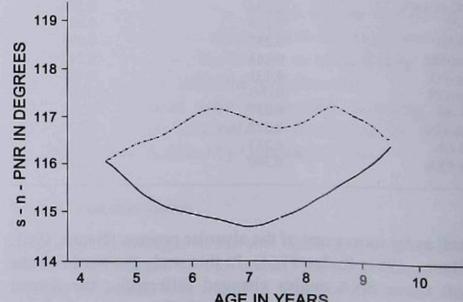

Figure 7 Changes in the inclination of the nose in relation to NSL. ♀—— ♂----

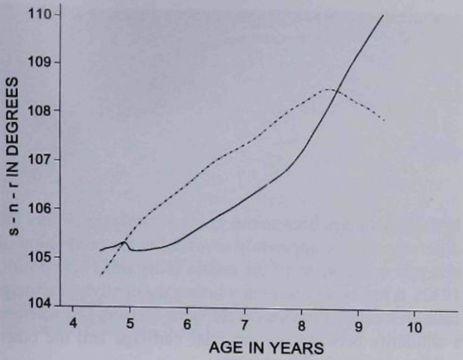

Figure 8 Changes in the inclination of the nasal bone in relation to NSL. ♀—— ♂----

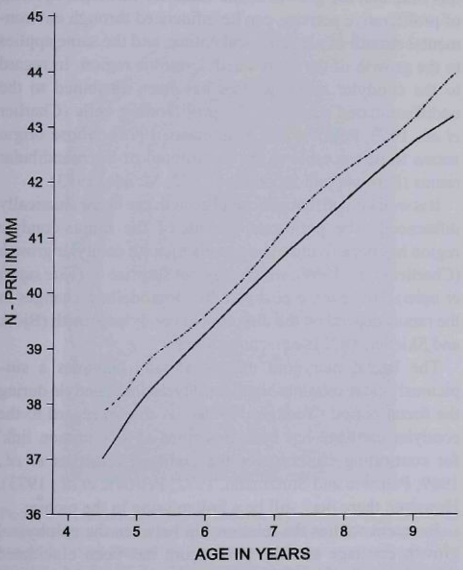

Figure 9 Changes in the length of the nose. ♀—— ♂----

amount and, as it does not change the inclination of the nose, it only seems to compensate the anterior movement caused by the downward growth along the original growth axis, determined by the inclination. This growth will change

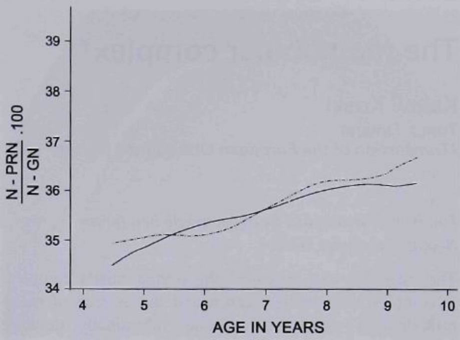

Figure 10 Index showing that the length of the nose increases relatively more than the face height. ♀—— ♂----

the position of the tip of the nose in relation to the chin, and thus change the profile convexity. Doubtless the nose is the structure which produces the most dramatic profile changes. This effect can be demonstrated by an index where the length of the nose is related to the face height (Fig. 10). It is obvious that nose length increases relatively more than the face height. Orthodontically, it is impossible to influence its growth, but it is possible to change the mouth area and in this way affect the proportions of the face. The orthodontist must, therefore, always take into consideration that the nose seems to become more prominent with increasing age, and carefully evaluate orthodontic treatment which changes the position of the lips in cases where there is a risk of distortion of the facial proportions. This is especially true as long as knowledge of the effects of general treatment on facial appearances are limited.

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