THREE-DIMENSIONAL FACIAL RECONSTRUCTION
ON THE BASIS OF HUMAN SKULL

ABSTRACT — The sculptural reconstruction method of the face on the basis of human skull enables to obtain some concrete data about the face of the person to whom the skull belonged. It is based on existing relations between the shape of individual parts of the skull and between the thickness and forming of the adjacent soft tissues.

KEY WORDS: Facial reconstruction.

INTRODUCTION

In Czechoslovakia the first reconstruction was done in 1927 by sculptor M. Bentler under the guidance of J. Malý on the artificially deformed skull of an American Indian from Tiahuanaco. Nevertheless till the middle of this century the anthropologists, when evaluating the skeletal finds, gave only the most basic data and usually no comparative studies with the graphical portraits or statues were realized. V. Suk, one of our outstanding experts refused the possibility of obtaining the original facial features of a person from his skull, many attempts, however, to obtain information about some parts of the face appear in the identification works of J. Matieška.

Since the middle of this century the results of the studies of M. M. Gerasimov from Moscow became known. V. Fetter developed a special modification of Gerasimov’s method for the criminalistic practice. It was an excellent contribution towards the identification of persons by comparing the photography of the missing person and the skull. The advantage of this method is the speed and promptness; its disadvantage is confirmed by the fact that only a specialist with a thorough knowledge of the description of individual facial elements and the occurrence of their variability can use it with success.

The study of a reliable material can help greatly to obtain the necessary experience for solving these questions. Unfortunately only very rarely is it possible to compare the studied skull with a portrait of the same individual.

For the above reasons I describe here my experience with the reconstruction of soft tissues of the face of an elderly man. His skull, portrait and post-mortem mask have been deposited in Hrdlička’s Museum of Man in Prague since 1923.

METHODS AND RESULTS

The reconstruction was done on plaster cast of the skull using modelling material recommended by Gerasimov. The original skull was the all the time at my disposal so that I could get all the necessary information from it.

At first the maxilla and the temporals were built up and the places of their muscular attachment to the skull suggested their large development. Gerasimov recommends not to model the individual mimic muscles but to build up about 1 cm wide stripes whose height is given in important places on the skull. The median stripe was applied quite easily. When modelling the stripe in the plane of Frankfort horizontal a considerable width of zygomatic bones and their large dimensions on both sides were revealed. Also on the mandible in the place of attachment of the large masseter several smaller problems occurred with the angulus mandibulae and its environments.
The empty spaces between the individual stripes were in the following stage of work mechanically filled with the material used for modelling. Neither the supposed increase of fat tissues nor the change caused by increasing age were taken into consideration. The built up eye-ball was placed in the orbit and covered with orbicularis oculi. Then the eyelids were formed, but at this stage the distending in their environments ascertainment according to the quality of the bone in this part was not modelled. The reconstruction was performed only on one half of the skull, the other one was left free for control.

All wrinkles grow deeper, especially the nasolabial ones, the mouth corners as well as the tip of the nose are drooping, double chin is formed and males develop an increase of parotid gland. The quality and quantity of these changes characteristic of the individual are perceptible in every decade.

After the reconstruction of the second half of the face “the aging” corresponding to the sixth decade was carried out. The respective fat layer was added, the pouches under the eyes and the distending of eyelids were built up as ascertainment on the skull. Of course, the individual parts of the reconstructed face greatly both from the portrait and from the reconstruction of the face. Those differences are caused by illness, loss of body weight, drooping of soft tissues due to post-mortem rigidity as a result of gravitation, the disturbance of this rigidity and by the dislocation of some parts of the facial tissues during the dissection or casting. These differences are concerned mainly with the upper part of the face, i.e. with parts between the nasion and gnathion.

S. M. Gensinov, the author of this reconstruction method, underlines that the reconstruction should be done by a specialist in anthropology and anatomy. He rejects the assistance of a sculptor. According to our experience, however, this thesis can

This method proves to be useful for moulding the bridge of the nose the shape of which according to M. M. Gensinov is the exact copy of the contour of the nasal aperture. One of the most difficult tasks was the shaping of the mouth. Even though the general rules for its course and contour were strictly followed, it was very difficult to build up naturally and authentically the shape and the mutual position of the upper and lower lips. For the first time I felt the lack of sculptural skill.

The finished half of the reconstructed face, yet without hair and ear, represents a man 20-30 years old without any traces of aging and without the fat layer. After reaching adult age the skull remains several decades without any changes. The changes start to appear after reaching the age of fifty years, or even later. By this time, however, the soft parts are changing, horizontal wrinkles appear on the forehead, vertical ones above the root of the nose, there are wrinkles around the eyes; the eyebrows are drooping, the eyelids are formed by more folds, circles appear under the eyes and the lower contour of the mandible.

This part of work is very difficult for the layman sculptor and it takes quite a lot of time.

The last step was the modelling of the ear, eyebrows and of the scalp. The correct shaping of the hair-do is very important, for it influences the appearance of the portrait. The skull itself gives only very little information, in fact only the scalp margin in some cases, but not the lack of it, etc. Therefore, M. Y. Kisin recommends to include the upper part of the photographic portrait of the missing person, i.e. the hair-do, when presenting the skull for criminal reconstruction.

The results of the finished reconstruction are as follows:

1. Only one portrait of the studied person exists (made when he was alive) for comparison with the reconstruction. This portrait reveals that the differences concern especially those parts of the face for whose reconstruction insufficient information is available.

2. The comparison of the reconstructed face with the post-mortem mask indicates that the cast differs

4. The profile of the same skull.

5. The stage of the reconstruction of the face before the changes caused by aging are added.

6. The stage of the reconstruction of the face after the changes caused by aging are added.

7. The final stage of the reconstruction on face.

8. The final stage of the reconstruction from half-profile.
be accepted only for those portions of the reconstructed face, where the material is mechanically applied on the skull. Such places are many, but besides them there exist such parts of the face for whose reconstruction the data are incomplete or non-existent. Then the sculptor's skill, which Gerasimov really possessed, is of great assistance. More anatomico-anthropological knowledge can hardly help in this case.

4. A true reconstruction of the face is possible only in general outlines, i.e., it is possible to recognize the type of the face, to build up precisely the shape of the forehead, partly of the nose and approximately the contour of cheeks. The width and the position of the mouth is given in detail, its shape only approximately. We know the course of the eyebrow but not its quantity, we are able to indicate the scalp margin but not the quantity of hair, the position and adhesion of the ear lobe but not the characteristic features of its relief etc.

5. During his ontogenetical development the individual changes by gaining or losing weight, but it always means growing old. We must take these factors into consideration and realize that the skull does not give always enough information for the various nuances of these changes. Considerable morphological changes on the skull occur only at the old age. On the contrary, the changes typical of each individual decade affect especially the muscles, fat layer and skin. They are not accompanied by corresponding changes on the skull. Therefore, when performing the reconstruction according to anatomico-anthropological principles, we obtain in the first stage the face of a younger man whose features must then be adapted according to the determined age by the characteristics in the skull.

6. As mentioned in the above paragraph there are fewer problems connected with the reconstruction of a younger person. It is, therefore, easier for a layman sculptor if he does not have to take into consideration different stages of age.

7. The reconstruction gives an average and at most a probable thickness of soft tissues. When individually identifying a skeletal find we have to take into account that besides the average cases we can meet also some extremes as it occurs with all biological phenomena. Thus the results of the reconstruction based on average probable values may differ from the exceptionally formed true appearance of the identified person.