1 Introduction

One important question in planning craniofacial surgery interventions is how the patient should look like after the operation. Therefore, the functional aspects have to be kept in mind as well as the aesthetic appearance of the patient. Under this point of view we are interested in the ideal appearance of the patient, which should be as close as possible to the aspect he/she would have without any defects [1].

Therefore, we introduce the term "virtual healing" which describes the mechanism of transforming the pathological state of the patient into a healthy one with ideal shape (Figure1).
The first step to achieve this is to build a database (Figure 2) of three dimensional CT and MRT data sets which allows the comparison between the current shape of a patient with a typical "normal" shape while taking such factors as age and sex of the patient into consideration.

2 Norm Data and its Problems

The norm data which is only in 2 available at the moment has been gathered by orthodontists over several years. The problem is, that this data is based on two-dimensional X-ray images [2],[3] only. However for the correction of complex craniofacial malformations three dimensional data is required. Another problem is that some of the available data has been acquired from patients with deformities.

3 Method

We started to collect CT and MRT data from patients who had been taken to the hospital under a certain suspicion which could not be confirmed. For example, a child had been taken to the hospital with the question: "Does the patient have an intracranial haematoma?"
A CT was made but the initial diagnosis was not confirmed. With this examination we were able to obtain a valid data set that could be used for the 3D norm database (Figure 3). Using this method, we have been able to avoid unnecessary radiation. All these data sets have been classified by age and sex. For each class one representative model has been build by averaging all the members of this class.

In co-operation with two Radiology Units (Mannheim and Heidelberg) over 100 CT data sets have been collected. Additionally, a study for determining the optimal landmarks for the process of averaging has been started. The collected data has been sorted and classified (Figure 4).

4 Results
Representative models according to age and sex can be used as a basis for virtual patient specific operation planning and simulation.

5 Outlook

This has been the first step in developing a set of tools for "virtual craniofacial surgery" (Figure 5). Further work is aimed at developing a tool for semiautomatically generating plans for the operation. This tool will be designed to present a proposal with individually optimized bone cuts and repositioning of bone segments to the surgeon who will then be able to accept or change the plan.
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7 References

