anthropology and craniofacial anomalies

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Children with craniofacial anomalies show a wide range of cranial and facial features. For a surgeon whose goal is to reconstruct the heads and faces of these children, it is very important to understand as precisely as possible what kind of problems they are dealing with, what the results of their surgical procedures are and how these children grow, so they can produce the best results possible from these surgeries. All of this requires some way of measuring the heads and faces of their patients.

Taking measurements

There are many ways to take measurements. The most common is cephalometry, taking measurements from x-ray films. This is standard practice in orthodontics and jaw surgery. Measurements can be taken from both 2-D and 3-D CT scans and new 3-D camera systems that allow measurement of surface dimensions of the face from computer-generated images. All of these methods of measurement have developed from a much older system of measurement known as anthropometry.

What is Anthropometry?

Anthropometry is the measurement of the human body and its parts, which includes the head and face. The technique was invented more than 350 years ago and is the foundation of all later systems of measurement. Anthropometry was invented by a German anatomist named Johann Sigismund Elsholtz when he was a graduate student at the University of Padua in Italy. Elsholtz was interested in studying the symmetry of the human body but there were no instruments or standard techniques to do this, so he had to create them. He invented an instrument he called an anthropometron. This was a vertical rod which he divided into six equal parts he called pedis (feet). He then subdivided each foot into 12 equal parts he called uncias (inches). Elsholtz finished his device by attaching a horizontal slide to this rod and mounting the whole thing on a wooden base.

The examination

An anthropometric examination is relatively simple, inexpensive and non-invasive. To be accurate, it should be performed by someone with training in the techniques, preferably an anthropologist with a graduate degree and experience in taking the measurements. Most of the measurements are taken with standard anthropometric calipers and a tape measure, but there may be a few special gadgets used, depending on the exact set of measurements taken.

The examination itself involves a set of surface measurements of the head and face. The number of measurements varies from center to center, depending on the preferences of the person doing them, but can range upward from as few as 20 to 25 to as many as 75 to 125. The greater number provides more detailed information about your child's head and face but also increases the length of the exam. The time involved can be as short as 15 to 20 minutes and requires little more of your child than to sit in a chair and be measured. The measurements are taken in short sets, two to three at a time, so there is plenty of time to fidget

in-between and for you to ask questions. Children usually regard this with interest or tolerance, though very young children may become impatient.

The first set of measurements provides a baseline that is used to track your child's growth and development from then on. Ideally, it should be performed before any surgery is done. The measurements, and a series of proportions that are calculated from them, only begin to have meaning when they are compared to normal standards which are matched to the sex and age of the patient. This gives your surgeon a numerical description of your child's anomalies which is more precise than visual observations.

The timing of the next measurements will depend on your surgeon's recommendations for treatment. If your child is not having surgery immediately, they would be re-examined in a year. By comparing the two sets of measurements, we can see how their head and face and all its parts are growing. This information can help your surgeon decide on the timing, nature and extent of the surgery they recommend.

If your child has surgery very soon after their examination, the follow-up changes. Their next exam would be about six to eight weeks after surgery. This allows time for their postoperative swelling to go away and the surgery to heal, but is close enough to their first examination that growth will not affect the measurements. The postoperative exam is much shorter and focuses on the area of the surgery. This allows us to see exactly how the head or face has been changed, which means that when your child is seen again in a year, we can see how growth is affecting the surgical results.

The anthropometric examination should be repeated annually until your child is fully grown. This isn't always practical, but it is a goal to aim for. As your child gets older, and growth of the head and face slow down, they may skip a year or two without any affect on their treatment plan.

Advantages and disadvantages

Anthropometry has several advantages over more complex techniques for collecting information about craniofacial anomalies. A skilled anthropologist can gather much more information about the size and shape of the head and face with these measurements than is possible at present using computer imaging techniques, whether CT-based or 3-D camera systems. Because it is non-invasive, it can be repeated whenever needed without much cost and risk.

On the other hand, it has one important disadvantage. Because these measurements are taken directly from a patient, they cannot be duplicated because that patient grows and the measurements change. Computer-based measurements can be taken from stored data, so they can be re-done at a later date as measurement techniques change and improve, and are becoming more and more important to our understanding of craniofacial anomalies. The foundation of these techniques, though, remains anthropometry.

In the long run, all of this data provides a benefit to many more people than a single child. As we gather this information from larger and larger groups of patients, we can separate the data by diagnosis and combine the results for individual syndromes to re-define the characteristics of each syndrome. We also learn about the growth patterns in each syndrome, which can help the surgeons refine their surgical techniques. All of this will benefit children with craniofacial anomalies well into the future.