

Non-operative correction of craniofacial anomalies in infants

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CHAPTER 9

SUMMARY / DISCUSSION

Summary

The human face has always been a key subject in the field of plastic and reconstructive surgery due to its esthetic and functional purposes. Anomalies or insecurities in the craniofacial region may greatly affect someone's mental or physical well-being and often lead to surgical alterations or corrections at an adult age. Children, however, often cannot decide whether they want any treatment for anomalies in said region, which may lead to unnecessary, parent-initiated treatments, or postponed, more invasive treatment methods, whilst a milder option has been missed. This thesis focuses on craniofacial anomalies that have no physiological, but rather have possible psychological implications, such as cranial and auricular deformations.

In this thesis, these craniofacial anomalies, their need for treatment and the treatment methods were evaluated. Chapter 2 focuses on the perceived importance of the different craniofacial elements of the adult human face [1]. Age- and gender-related differences were analyzed in 299 participants, who were asked to fill out a questionnaire containing questions related to their self-perception and their evaluation of the importance of each craniofacial element using Visual Analogue Scales. It was hypothesized that differences would be related to contemporary subjects and trends. Males were seen to be more satisfied with their appearance compared to females. And, unsurprisingly, teeth, hair and eyes came out to be the most important craniofacial elements for both genders. Although a positive correlation was found between being satisfied with how you look and being satisfied with your cranial shape, as well as valuing the importance of auricular shape for appearance, the craniofacial elements deemed least importance for appearance were the ears, cranial shape and forehead. Furthermore, it was found that older people tend to care less about the opinion of others.

This leaves the question as of why treatment is sought out in case of anomalies in the neonatal period. Hair coverage, which is often the case in adults, may be a reason as of why anomalies are not shown; cranial shape, ears and even the forehead are completely or partially hidden from the eye, causing a general disinterest in these craniofacial elements. Research has shown, however, that even bald men are not bothered by a deviating cranial shape [2]. Another possible reason behind the request for treatment of anomalies of the external ear or cranial shape at a neonatal age is the relatively young age of the parents. As mentioned, Chapter 2 shows that older people tend to care less about the opinion of others, therefore, parents possibly value the opinion of others more and project this on their children. Furthermore, a sense of responsibility for the health of their children may provide the motivation to look for professional help when they notice a craniofacial anomaly.

In the last decades, there has been an increase of positional cranial deformations at a neonatal age due to the Back to Sleep campaign [3-7]. This campaign was initiated

as a means to prevent Sudden Infant Death Syndrome and encourages parents to have their infants sleep on their backs rather than on their bellies [8-10]. This evidently causes a constant pressure on the posterior side of the cranium, which, in combination with gravitational forces, may lead to cranial deformations such as plagiocephaly and brachycephaly. Physical therapy, during which muscular development is stimulated, and helmet therapy, during which children receive a custom-made mold around their head, are treatment options for these conditions. In Chapter 3, the risk factors which have been reported in literature as being attributable to these anomalies as well as the results of the different kinds of treatment are being discussed [11]. 184 children were sent in for their plagio- or brachycephaly and underwent plagiocephalometry to evaluate the severity of their condition. The children received no treatment, physical therapy, helmet therapy or a combination of the latter two and were seen during follow-up visits. To evaluate plagiocephaly, the ODDI (oblique diameter difference index) was used and to evaluate brachycephaly, the CPI (cranial proportional index) was used. It was found that the male gender, prematurity, assisted delivery, being firstborn and positional preference were all risk factors for the development of plagio- and brachycephaly. Positional preference and assisted delivery were found to influence the type of deformation. Severity, however, was unrelated to the risk factors. It was found that ODDI and CPI both declined with age, regardless of treatment, but helmet therapy showed significantly more decline in ODDI. The higher the ODDI and CPI initially were, the greater the decline over time. This may indicate that upon motor development, gravitational and muscular forces may normalize the cranial shape. This does not mean, however, that therapy is to be deemed inefficient or unnecessary, but that it is rather a complementary treatment method to aid in normalization of cranial shape. With this knowledge, when reviewing Chapter 2, treatment request seems to be related to age indeed, but not necessarily solely to the age of the parents, but also to the age of the affected individual. As cranial shape normalizes with age, it is only logical that treatment becomes of less importance.

The auricle, however, is a craniofacial element that more often receives corrective intervention, even at an adult age. In many cultures, it has been viewed as an important esthetic component of the face and during recent years, it has transcended into becoming a multi-functional component of the human face, also being used in forensics and diagnosis of certain congenital syndromes [12-16]. The esthetic purpose, however, seems to be of increasing value too, with rejuvenating procedures being up and coming in the Western world. Neonates are sometimes born with an anomaly of the auricle [17-19]. When looking at the correction of ear anomalies in neonates, it is important to take the average proportions of a population into account. Chapter 4 focuses on the anthropometrical data of the adult Dutch human ear. The ears of 324 individuals were measured using scaled photography. Measurement of the bilateral auricles shows a near symmetry of the ears on average. It also shows that taller people tend to have bigger ears, which indicates a relatively large ear size for a relatively tall

Dutch population. This is confirmed when compared to Asian populations [20]. It is also confirmed that ear growth continues throughout life, with a total length growth rate of 0.021 cm per year, of which 0.009 cm per year is from lobule growth alone. Less protrusion is seen in the Dutch population compared to Asian populations. Proportions of the different anatomical components of the auricle are, however, similar.

Because the average of auricular proportions does not necessarily indicate that they are the most esthetically pleasing proportions, Chapter 5 focuses on ear satisfaction related to the auricular dimensions. Participants were asked to fill out a questionnaire regarding satisfaction with their appearance and their ears and to indicate whether they received comments on their ears and whether they would consider having corrective surgery of their ears. Results showed no difference in ear satisfaction based on gender. When people receive comments about their ears more frequently, they tend to be less satisfied about them and are more likely to consider surgical intervention. Our data showed an increase of ear satisfaction with age. Despite Chapter 4 discussing the growth rate of the external ear and ear rejuvenation surgery increasing across the world, larger ears apparently did not negatively impact ear satisfaction. On the contrary, ear and earlobe length were both found to be positively correlated with ear satisfaction. Attachment of the earlobe, despite often being reported in literature as being of importance for esthetic evaluation of the ears [18, 21], did not seem to impact ear satisfaction in the Dutch population. Helix protrusion was negatively correlated with ear satisfaction, which is odd considering the request for corrective surgery in case of protruding ears in children. Considering that none of the participants of this study were diagnosed with an ear anomaly, this may suggest that an overcorrected helix which lies too close to the scalp is esthetically more troubling than a normal protrusion, a finding which should be considered in both the non-operative as the operative correction of ear anomalies in infants.

Regarding ear anomalies, a distinction can be made between malformations (chondrocutaneous defect) and deformations (no chondrocutaneous defect) [22]. Although the former is usually caused by a developmental defect, the latter has an unknown pathogenesis. It is speculated that might be caused by external pressure on the ear or genetic predisposition [23, 24]. These ear anomalies may eventually cause lasting psychosocial consequences, due to bullying [25-27]. Therefore, various treatment methods are used in order to correct these anomalies; operative and non-operative treatment methods [28-30]. Operative treatment methods have been discussed in Chapter 1. The non-operative corrective method for ear anomalies discussed in this thesis is known as ear molding. This is a method that has been popularized in the 1980s and focuses on creating an anatomically correct shape by providing pressure [31-34]. It is hypothesized that the neonatal cartilage is more pliable at a neonatal age due to circulating maternal estrogen, which normalizes at six months of age [35-38]. This method tries to prevent bullying, surgery at a young age and the psychosocial

consequences related to both. Chapter 6 elaborates on the different methods of ear molding that have been used during the last decade [39]. It is seen that more and lesser developed systems have been in use, both resulting in favorable results in terms of correction. Most of the studies discussed in this chapter indicate that ear molding is a treatment method that should be initiated early in life. If initiated too late, it leads to a decrease in satisfactory results and a prolonged duration of treatment. Some of the studies treat for a specific amount of time, while other studies treat as long as it takes and sometimes even take time to stabilize the correction. Deformations are more easily treated through ear molding than malformations, but even cryptotia and constricted ears seem to benefit from ear molding. Prominent ears and mixed deformations proved to be the most difficult to treat. Complications occurred in 10% of the patients, mostly consisting of pressure marks and irritation and recurrence of anomalies was seen in 8%. Despite the majority of participants exhibiting satisfactory results, health insurance does not cover this treatment method. Chapter 7 briefly goes into this topic, after a reply was received on Chapter 6 indicating that health insurances in the United States only cover non-operative correction of ear anomalies in case of hearing problems [40, 41]. However, anomalies of the external ear rarely affect the inner ear. This shows that there is a worldwide ignorance about the benefits of this treatment method and there is a need for education and early identification of ear anomalies. Furthermore, what was noticeable about the different studies discussed in Chapter 6 was the variance in conductance; every study set-up was different than the other, which indicates a general lack of consensus in the non-operative treatment of ear anomalies.

One of the mostly used treatment methods seen at the moment is the Earwell Infant Corrective System [42]. This is a standardized silicone model which can be adhered to the peri-auricular skin. The use of this system in the Dutch population was investigated in 73 infants, which is further described in Chapter 8. 123 ears were treated with the Earwell System in total. Children were included between the age of 0 to 12 weeks and were followed-up every two weeks to evaluate correction grade. The benefits of the Earwell System are its easy applicability, its understandability and its comfort. The appearance of the system was its most criticized feature but was still graded to be okay. Average treatment duration lasted 59 days, including stabilization periods. Some anomalies, such as cup ears and prominent ears, took longer to correct and stabilize. Nevertheless, satisfactory rates were high for both parents and physician and the anomaly severity declined in all participants. The duration of treatment and age at initiation of treatment did not significantly impact results. Breastfeeding did not affect treatment. Complications were seen in about 11% of the population, which was similar to the complication rate in other studies [39]. It should be noted that these complications are fewer and less dangerous than the complications that may occur due to otoplasty, which may occur in 22% of cases [43]. Difficulties regarding the use of ear molding include mal adherence of the treatment device and the lack of an objective system to evaluate correction.

In conclusion, the non-operative correction methods used for craniofacial anomalies in neonates are not to be underestimated. This thesis has shown that although cranial shape and ears are not necessarily the most important craniofacial elements at an adult age esthetically, but that these elements are some of the most notable at a young age, leading to frequent visits from worried parents at the outpatient clinic. Despite helmet therapy being deemed less effective in the past, this thesis shown that it should be investigated further in order to properly judge its efficacy. Regarding ear anomalies, it should be noted that the relatively novel treatment method of ear molding should be given the attention it needs and deserves in order to prevent psychosocial harm and surgery in children. Eventually, hopefully, increased acknowledgement of non-operative treatment methods will lead to a prevention of unnecessary harm for all children.

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