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REVIEW

Non-surgical correction of congenital deformities of the auricle: A systematic review of the literature

M.P. van Wijk *, C.C. Breugem, M. Kon

Department of Plastic Surgery, University Medical Center Utrecht, Heidelberglaan 100, 3584 CX Utrecht, The Netherlands

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Summary *Background:* Splinting is an elegant non-surgical method to correct ear deformities in the newborn. Since the late 1980s, many authors demonstrated that permanent correction occurs by forcing the ear into the proper position for several weeks. The external ear anomalies suitable for splinting have a common feature that no skin or cartilage is absent; the protruding, lop and Stahl's ears are good examples of these anomalies. Surprisingly, this technique is relatively unknown to plastic surgeons and is hardly ever communicated to the general public.
Purpose of study: To review the literature on non-surgical correction of ear deformities, focussing on indications, technique, results and possible complications.
Methods: A systematic literature search was performed in July 2008 using PubMed. Twenty papers were suitable for review.
Results: Splinting can be performed in many ways, provided that the ear is permanently kept in the desired shape without distorting it. It is disputable until what age splinting therapy can reasonably be offered — opinions vary from 'newborn only' to well up to 3 or 6 months of age. A rigid fixation seems to allow correction in older children. The time needed to splint for permanent correction depends upon the age at the time of starting the treatment. For a newborn, 2 weeks often suffice, whereas for older children splinting time becomes more variable — up to 6 months. Most patients we treated had lop, Stahl's or prominent ears. In a case series in Japan, cryptotia was the most frequent deformity encountered. Most authors made their own judgement on the results, categorising their outcomes from poor to excellent, or asked a lay opinion. Fair-to-excellent results were reported in 70—100% of the cases. The results tended to be poor in older children. Recurrence was seldom described clearly in the literature and was probably listed as poor result. No serious complications occurred and skin irritation was seen sporadically.
Conclusions: Ear splinting is an elegant technique that should be practised on a wider scale than is done today. Hopefully this article will challenge authors to perform prospective studies

* Corresponding author. Tel.: +31 88 7556897.
E-mail address: vanwijk48@hotmail.com (M.P. van Wijk).

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specifically addressing the relation between patient age, degree of deformity, stiffness of the cartilage, the time needed to splint and the treatment outcome.

Otoplasty is a common cosmetic surgical procedure for the plastic surgeon. It is performed in children to avoid their being teased and to improve their appearance. Surgery is delayed until after the age of 6 years, when most of the auricular growth has taken place. Especially in younger children, correction is often performed under general anaesthesia. In most cases, the postoperative course is uneventful, though serious complications can occur.[1]

The first medical publications on non-surgical correction of congenital auricular deformities were published in the late 1980s by Japanese plastic surgeons.[2–7] They demonstrated that by forcing the ear into the proper position and maintaining it there for several weeks, permanent correction may occur. The external ear anomalies suitable for splinting have a common feature that no skin or cartilage is absent. The ear bends towards the normal shape by digital pressure. Hunter classified this as a Grade I dysplasia[8] (modification from Weerda[9]). These anomalies are also described as ear deformations and are distinct from malformations like microtia.[10] It is not possible to bend the ear to a normal shape in ear malformations. Ear deformations do not seem to be the result of abnormal morphogenesis. However, it seems that either external pressure or malinsertion of the seven intrinsic and four extrinsic muscles may cause deformed ears. Although several distinct shapes exist,[8] protruding ears are the most common variant. Other deformities are lop ear with its drooping upper pole, Stahl's ear with an anti-helical crus perpendicular to the helical rim and abnormal kinks of the helix. Cryptotia is more common in the Asian population and is seen as a hidden upper helix, buried under the temporal skin.

Objectives

The goal of this article is to review the literature on the methods of non-surgical correction of ear deformities. We review indications and the duration of the treatment performed, and summarise the results and possible complications.

Materials and methods

A literature search was performed in July 2008 using the PubMed service of the US National Library of Medicine that includes citations from MEDLINE and other life science journals for biomedical articles dating back to the 1950s. Initial searches focussed on the text words: ear, auricular deformities, splint, non-surgical and correction. The medical subject heading (MeSH) terms 'ear' AND 'splints' were also used. All abstracts from English, Dutch, German or French papers were scanned for potential relevance. In addition, manual cross referencing was performed. We excluded articles that only reported on the treatment and not the results, unless specific remarks on the author's experiences and results were made. In total, 20 papers were included for review. Of the reviewed articles, we listed the splinting materials and methods used (Table 1), as well as the age of the children at the start of the treatment, the duration of splinting, the nature of the deformities treated, the outcome measure, the results, the length of the follow-up, the complications mentioned and the character of the study (Table 2). The results for the different deformities, if specified, are listed in Table 3. The results related to age, if specified, are listed in Table 4.

Results

Ear-splinting materials and methods

Table 1 provides a summary of the various ear-splinting materials and methods used. Most authors used a bendable, rounded splint placed in the scaphal hollow to define the anti-helical fold and to serve as a supporting pillar. The splinted ear is then fixed to the head using a tape or a bandage.[12–17,19,24–27] One author (Gault[13]) developed a commercially available splint (Ear buddies™). Yotsuyanagi preferred a rigid splint which sandwiched the ear from both sides.[18,22,23] This reflects the occurrence of cryptotia among a large number of his patients, a condition that can only be corrected with such a splint.[28] Another interesting concept for the treatment of protruding ears, named the Auri method, was presented by Sorribes[21] in which a specially designed plastic clamp that squeezes the cartilage is used during the night, followed by a double adhesive strip during daytime to maintain correction.

In most cases, splints were fixed by plastic surgeons, but Tan[17] showed that nurses who are familiar with the indications and technique can successfully fix them as well. Parents can be taught to replace the adhesive tapes when necessary. Most of them found this easy to do.[17]

The patients retain the splints 24 h a day, and only have them changed when the tape comes loose. Discontinuous use was associated with poor results.[14,21] Treatment continues until the desired shape persists without splints. This is assessed during those moments when the tape is renewed.[3,6,7,11–13,16–20] After permanent correction is achieved, some patients continue splinting (mostly for a week) to keep up the result.[13,15,22–24] Tan stopped therapy if 4 continuous weeks of splinting failed to produce any results.[13,16,17]

The time needed to splint for permanent correction depends on the age when the treatment was started. For a newborn, 2 weeks often suffice,[12,15] whereas for older children splinting time becomes more variable. Few authors give detailed information on age and duration of treatment.[7,11,13,16,27] These individual data are shown in Table 4. Some authors[12,14,15,26] treat only newborns and have