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CASE REPORT
Craniofacial/Pediatric

Nonsurgical Correction of Congenital Auricular Anomalies: Design and Effectiveness of the Ear Splint

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Summary: Congenital auricular anomaly is a common problem for newborns. In recent years, the correction technology of ear molding has gradually become the mainstream therapy. Therefore, the purpose of this case report is to describe ear molding devices with low-temperature thermoplastic splints, designed by occupational therapists and called the Ear Splint for Taiwan, and to explore its effectiveness in treating newborns with congenital auricular anomalies. The ear splint is made by an occupational therapist based on the theory of corrective mechanics. The molded splint adjusts the ear to normal shape. Patients who received ear treatments at the Mennonite Christian Hospital in 2020 were enrolled as the subjects. A posttest research design was adopted in this case report to conduct a questionnaire survey among parents. The ear splint is a double C-shaped bracket. In this case report, there were two subjects in total, and two different types of malformed ears. According to the questionnaire survey, the average score of auricle shape improvement effectiveness after interventions were 5 and 4 points (5 excellent; 1 bad). The results of this case report indicate that it is feasible for occupational therapists to use the ear splint to mold the congenital auricular anomalies of newborns. Preliminary evidence shows that ear shapes can be corrected. The ear splint provides an early interventional therapy for newborns with congenital auricular anomalies in Taiwan. *(Plast Reconstr Surg Glob Open 2024; 12:e5961; doi: 10.1097/GOX.0000000000005961; Published online 5 July 2024.)*

Congenital auricular anomalies of newborns can be classified into malformations and deformations[1] according to whether the auricular structure is deficient. Regarding the treatment of congenital auricular anomalies, various types of noninvasive ear molding devices have been widely used in the last 20 years, emphasizing the correction of ear shape with external forces in the neonatal stage.[2,3] This treatment is suitable for ear deformations, and common categories include (1) cup ear, (2) lop ear, (3) Stahl ear, (4) helical rim deformities, and (5) cryptotia. Therefore, early intervention is crucial. Ear malformation requires surgery after the age of 6.[4]

Nonsurgical correction of auricular deformities has been developed for over three decades in foreign countries,[5] including ear molding devices made of various splints.[6,7] The authors of this study designed, researched, and developed the Ear Splint for Taiwan. Subsequently, a systematic correction treatment plan was established.

The purpose of this article is to explore whether the ear splint, designed by the occupational therapist with low-temperature thermoplastic materials, according to the principle of ear correction, is effective for newborns with congenital auricular anomalies.

METHODS

There are three design principles for the ear splint: (1) The retroauricular sulcus provides the support force for the base of the splint[4]; (2) according to Schonauer et al, an external correction force is applied in the opposite direction of the deformation force to adjust the ear shape.[8] (3) The C-shaped splint is put on the margin of the auricle, a scaphoid.

The ear splint is made of low-temperature thermoplastic plastics by the occupational therapist. It is softened by a heat gun and then shaped on the patient's ear. It is customized for each ear in each case. The basic structure includes a total of two C-shaped brackets (Fig. 1). Bracket I of the ear splint is placed in the retroauricular sulcus, and bracket II is placed in the scaphoid to support the helix. The helix is then fixed with tape. The ear splint needs to be worn 24 hours a day and removed once a day to check

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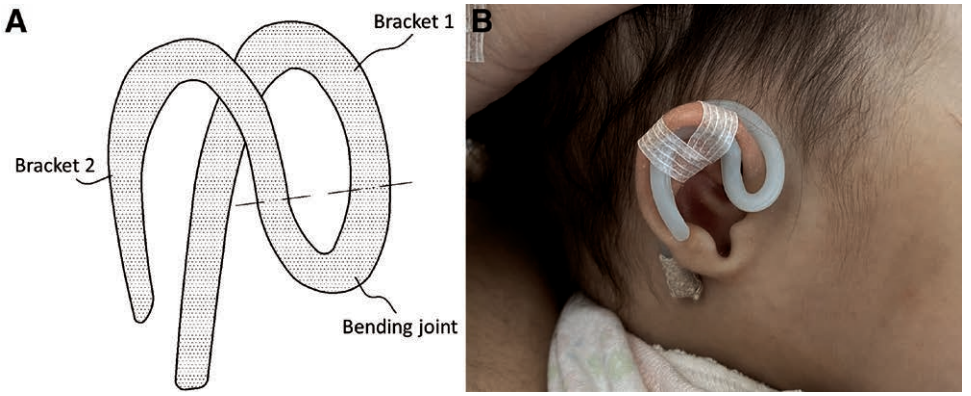

Fig. 1. Frontal view of the ear splint and wearing of the ear splint. A, Model of the ear splint. B, The splint worn by a patient.

for any abnormalities in the skin and the ear splint.[9] The ear splint is remade every 1–2 weeks, with each instance of remaking the splint representing one treatment.[5] The treatment is considered complete when the shape of the ear no longer changes.

This case report collected a total of two cases diagnosed with congenital auricular anomalies in Mennonite Christian Hospital in 2020, with a total of two ears (n = 2). The types of deformations are (1) cryptotia, n = 1 and (2) constricted ear, n = 1. Both cases were unilateral deformation. The one-group posttest design was adopted for the experiment, and the evaluation methods included reviewing the photographs taken before and after treatments and answering of the posttest questionnaire by parents. The questionnaire is scored by a five-point scoring system.

RESULTS

Both patients in this case report were female infants. The first patient, 87 days old, underwent eight treatments over 91 days, whereas the second patient, 7 days old, underwent 11 treatments over 84 days. The helix of case 1 was shaped into a more complete C shape, and the ear of case 2 was shaped into the basic shape of the external auricle (Figs. 2 and 3). According to the questionnaire survey, the effectiveness of auricle shape improvement after treatment intervention is scored as 5 and 4 points, respectively (5 excellent, close to normal ears; 1 bad, getting worse). The ease of wearing the splint is scored as 4 points in all cases (5 = very easy; 1 = very difficult). The splint caused slight redness on the skin, which took 20 minutes to return to normal after removal. No wounds occurred in either case, and the overall satisfaction score is 5 points for all cases (5 very satisfied; 1 very dissatisfied).

DISCUSSION

The researcher expected to establish a systematic nonsurgical ear correction course in Taiwan. The ear splint is customized according to the ear shape in the cases and is not an off-the-shelf model, to provide the most appropriate correction force.

The current mainstream ear correction systems suggest a treatment period of four to six weeks.[10] In this case report, the two cases were treated longer than in other studies. The shape of the ear had actually improved significantly after 6 weeks, and we tried to terminate the treatment. However, the shape of the ear was still slightly different from the opposite ear, so we decided to continue the treatment until the shape of the ear no longer changed. In this case report, the two ears were severely malformed, and case 1 was intervened at an older age, which might be related to the treatment duration. Nonetheless, there is still no definite conclusion on the treatment duration for ear correction.[3]

In this case report, both constricted ear and cryptotia are severe deformations that require considerable correction forces. Hence, a great pressure is produced by the large correction force on the skin. The splint was removed every day, resulting in skin redness and adding to the burden of care for the parents.

LIMITATIONS

The limitations of this case report are as follows. First, this case report lacked standardized assessment tools. The case report results relied on the subjective judgments of parents, and therefore, concrete data or objective judgment criteria are still needed in the future. Second, the samples are insufficient, and more samples are needed to explore the effectiveness of the original design. Finally, this case report lacked a rigorous research design, and a higher level of evidence is needed for future research design to further understand the applicable objects, effectiveness, and limitations.

CONCLUSIONS

The results herein show that it is feasible to apply an ear splint made of low-temperature thermoplastic materials by occupational therapists, according to the mechanics principle to ear deformation molding of newborns. Preliminary evidence shows that ear shapes can be corrected. Compared with surgical treatments, the ear splint developed in this research is noninvasive, low-risk, low-cost, and can provide early intervention treatments for newborns with congenital auricular anomalies.

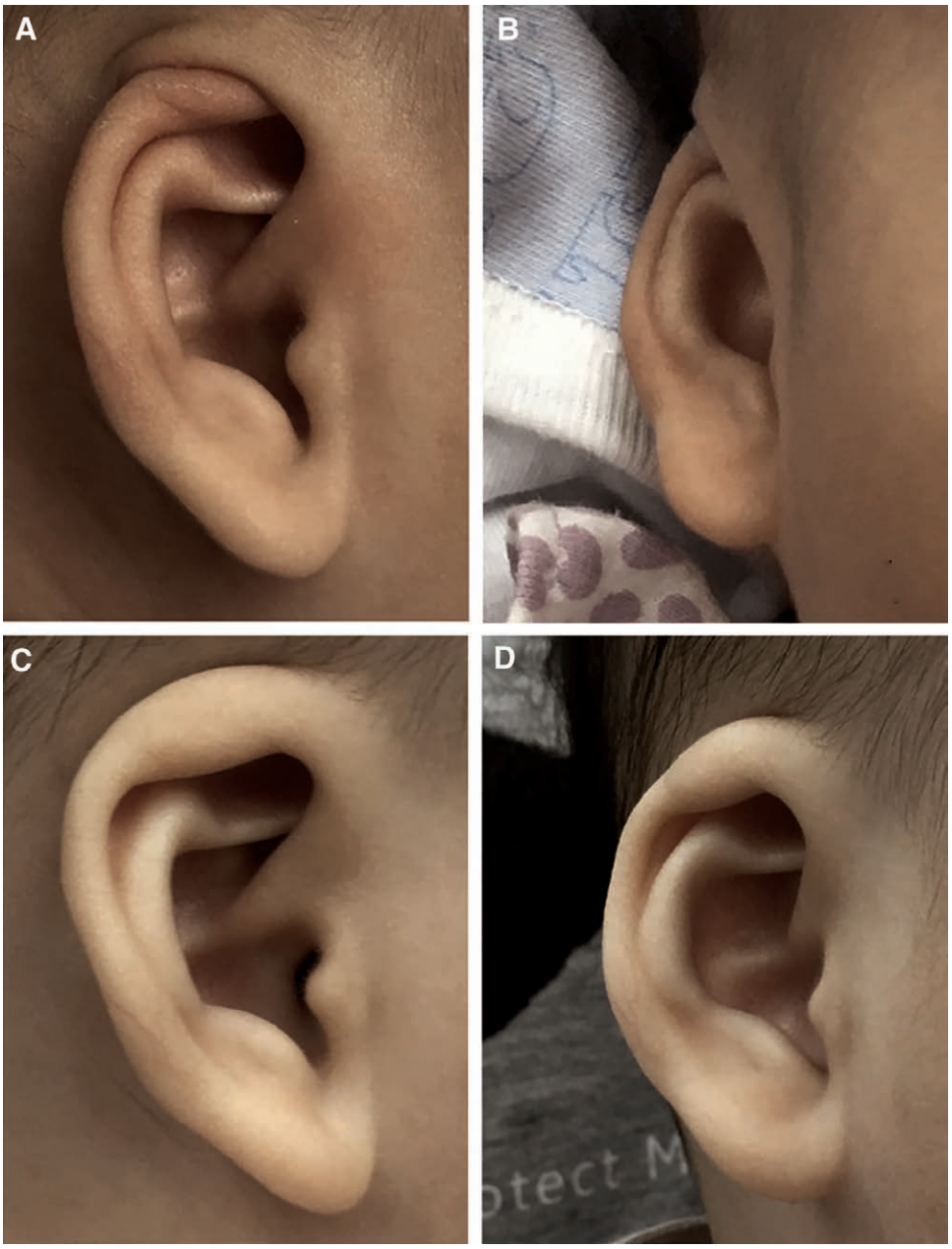

Fig. 2. Comparison of before and after intervention of case 1. A–B, The ear before intervention. C–D, The ear after intervention.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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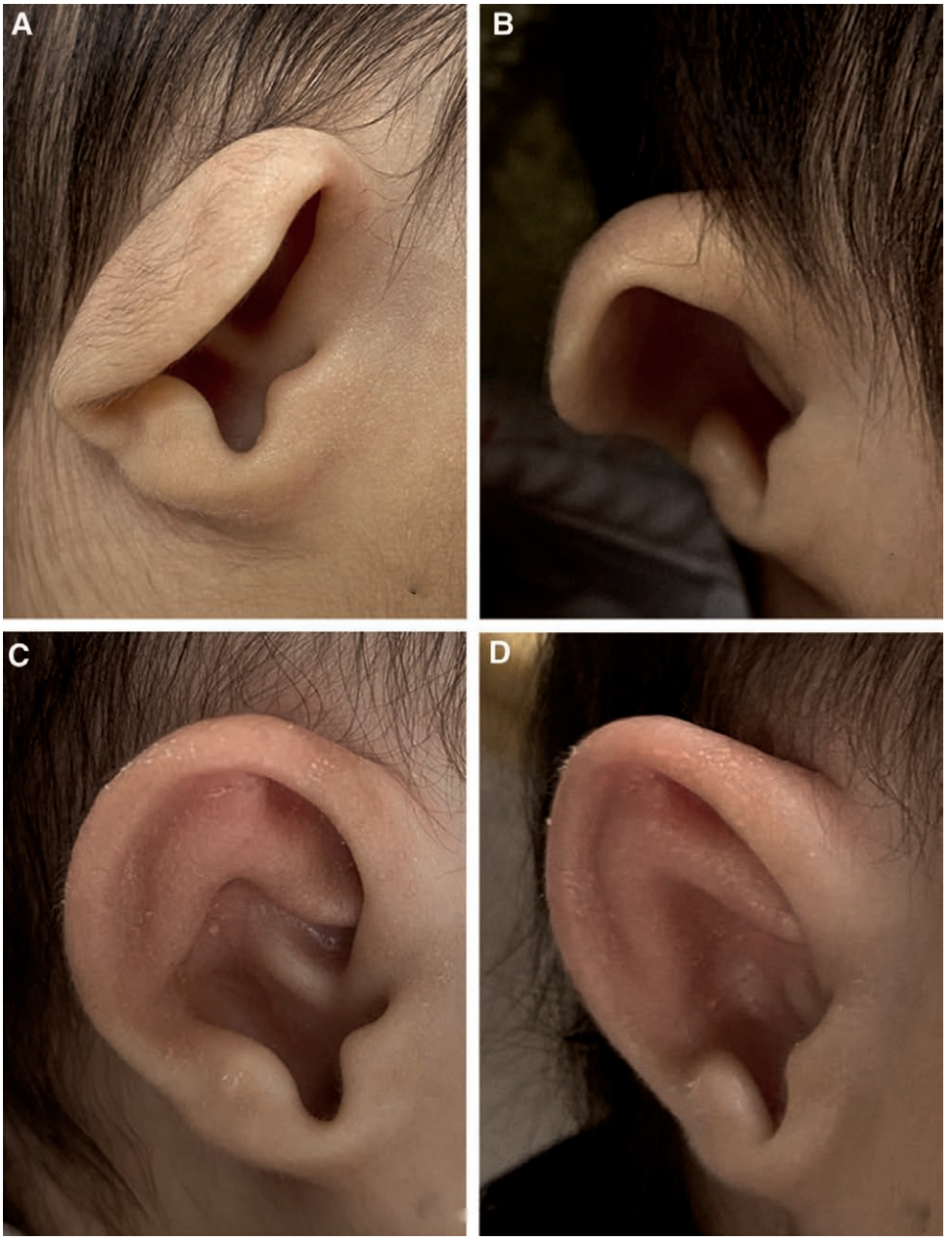

Fig. 3. Comparison of before and after intervention of case 2. A–B, The ear before intervention. C–D, The ear after intervention.

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