REVOLUTIONIZING ECTOPROSTHETICS IN PATIENTS WITH METACHRONIC AURICULAR TUMORS VIA 5D DIGITAL DESIGN

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Annotation: Aesthetic, functional, and psychological illnesses are caused by defects of the craniofacial region of different etiologies, and these disorders are frequently only treated surgically using a variety of excision techniques. Regretfully, not all instances can be resolved surgically in terms of satisfactory cosmetic results or reconstructive treatments. Sometimes patients refuse major, multi-stage surgeries because of fear. Facial prosthesis is an alternate therapy option for patients in the scenarios mentioned. When manufacturing ectoprostheses, outstanding aesthetic outcomes are achievable because to modern silicone materials. These devices can be attached using medical adhesives, or the prosthesis can stick to the skin better thanks to the funnel-shaped structure.

Key words: anthropometry, craniofacial region, defects, ears

Relevance. Ectoprosthetics is one alternative available for the rehabilitation of individuals with abnormalities in the craniofacial region. Structures called facial ectoprostheses are created from a variety of materials with the goal of restoring the anatomical integrity (look) of the missing facial area. Aesthetic, functional, and psychological illnesses are caused by defects of the craniofacial region of different etiologies, and these disorders are frequently only treated surgically using a variety of excision techniques. Regretfully, not all instances can be resolved surgically in terms of satisfactory cosmetic results or reconstructive treatments. Sometimes patients refuse major, multi-stage surgeries because of fear. Facial prosthesis is an alternate therapy option for patients in the scenarios mentioned. When manufacturing ectoprostheses, outstanding aesthetic outcomes are achievable because to modern silicone materials. These devices can be

attached using medical adhesives, or the prosthesis can stick to the skin better thanks to the funnel-shaped structure. Elderly patients with matechronous auricle tumors were the subjects of the investigation. The majority of the ear concha is affected by the tumor, resulting in an aesthetic deformity. Patients see surgeons again to have the missing part restored after rehabilitating. The majority of medical professionals do not advise restorative procedures when a metachronous tumor is identified.

Purpose of the study. to enhance ectoprosthetics in individuals with matechronous auricle tumors using digital technologies.

Materials and methods. A targeted patient survey was conducted among individuals presenting with auricular defects secondary to metachronous tumors of the ear, with the objective of collecting clinical data and assessing treatment preferences. While many such cases can typically be addressed through surgical reconstruction, prosthetic rehabilitation, or other conventional methods, some present substantial limitations. In certain patients—especially those affected by metachronous tumor recurrences—surgical intervention is either contraindicated or yields suboptimal outcomes due to prior surgeries, radiation exposure, or insufficient tissue for reconstruction. In other cases, the process is excessively prolonged and offers minimal functional or cosmetic benefit.

In our clinical experience, approximately 3% of all patients with auricular defects fall into this non-operative category, with a notable prevalence difference between adults and pediatric cases, observed at a ratio of 1:8. For this subgroup, we recommend the use of digitally fabricated ectoprostheses as the primary solution for facial rehabilitation.

Currently, 23 patients under our care rely on permanently worn auricular epitheses, custom-designed using advanced 5D digital technologies. These devices are produced using high-precision scanning and modeling tools that capture the patient’s anatomy, generate symmetrical ear models (often based on the contralateral ear), and allow for non-invasive prosthetic solutions that do not

require surgical adjustment. Many patients, appreciating the reversibility and aesthetic realism of these devices, opt for ectoprostheses as a preferred alternative to further surgical procedures.

An ectoprosthesis is a custom external prosthetic device designed to replicate lost facial anatomy, particularly the ear in this context. It serves both to restore the natural contours of the facial region and to conceal anatomical defects, typically caused by oncologic resection. These prostheses are manufactured from medical-grade, skin-compatible silicone, and are designed for secure daily use through adhesive systems or implant-retained attachments. Beyond restoring appearance, they play a vital role in improving psychological well-being, contributing significantly to social reintegration and self-esteem.

The integration of 5D digital workflow into prosthetic fabrication includes 3D surface imaging, automated morphologic adjustments, texture and pigment mapping, and symmetry optimization using artificial intelligence. This ensures the final prosthesis is highly accurate, closely matching the patient's skin tone, surface texture, and anatomical geometry. The result is a prosthetic solution that is aesthetically realistic, biomechanically comfortable, and adaptable over time.

In conclusion, for patients with non-reconstructable auricular defects, particularly those resulting from metachronous malignant processes, digitally designed ectoprostheses offer a viable and effective alternative to traditional surgical repair. These technologies provide patient-specific solutions that improve not only aesthetic outcomes but also emotional and social functioning—thus significantly elevating the overall standard of care in facial prosthetic rehabilitation.

Results. Observing patients with ectoprostheses revealed that the material used to make the prosthesis can change its color and condition depending on the environment. Strong winds and cold can cause microdefects to appear on the surface of the prosthesis, and it fades in bright sunlight. As a result, restorations should be used or the prosthesis should be changed every 1.5 to 2 years.

Ectoprostheses in children should be replaced more frequently than once a year because the prosthesis's ability to stay securely in place in the orbital cavity becomes more difficult as the body grows. On the other hand, prostheses created with digital technology are more advantageous than those created with analog technology.

Conclusion. Therefore, one technique used to help patients with severe mandibular zone deformities with their cosmetic and psychological rehabilitation is ectoprosthetics. There are specific guidelines and limitations for this technique. Additionally, the patient must be appropriately prepared on both a physiological (such as by treating open wounds) and psychological level (such as by explaining the guidelines for using an ectoprosthesis). Enhancing the technology for producing prostheses is crucial because it will greatly enhance the cosmetic qualities of the products and the environments in which they are used.

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