



Case Report

Polymethyl Methacrylate (PMMA) in the Treatment of a Case of Hemifacial Microsomia

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Abstract

Hemifacial microsomia (HMF) is a morphological alteration characterized by facial deformities. These alterations are a consequence of a congenital anomalous development of the first and second branchial arches. It may present a genetic or environmental origin or a mixture of both and is considered mostly multifactorial. The clinical presentation varies; however, some characteristics are predominant such as unilateral mandible hypoplasia, agenesis or malformation of the auricular pavilion, and agenesis or malformation of the eye globe. The aim of this paper was to report a clinical case of a patient with late diagnosis of HMF which presented multiple deformities and received treatment with polymethyl methacrylate (PMMA) implant in different concentrations. Aiming for facial harmony, the PMMA implant occurred in the following regions: canine fossa, nasolabial sulcus, mandible, Bichat Ball, chin outline, lip contour, nose base, columella, nose tip, and dorsum. The treatment resulted in significant improvement in the facial symmetry.

Level of Evidence: 5

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Hemifacial microsomia (HMF) is a consequence of a wide spectrum of congenital malformations due to the anomalous development of the first and second branchial arches. The degree of deformities varies from a small dystrophy of the temporal bone or condylar head to an orbital fissure in most severe cases.^{1,2} The multiple phenotypes observed in patients with HMF lead to different diagnosis records which reflect in the real incidence records. The most accepted incidence of HMF is of 1:5,600 newborns.³ Its etiology is related to genetic and environmental factors, and therefore known as multifactorial inheritance disease.¹

The diagnosis is performed with a comparative physical examination between the hemifaces in observation of size and shape, deviation of mandible and mentum,

inter-pupillary line, eyes and infraorbital border, lips and the proportional face ratio regarding vertical and transversal

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planes. Additionally, image examinations are requested depending on the degree of the malformation.⁴

The treatment of agenesis and malformations is performed with bone autograft, titanium mini-plates and, most recently, the use of alloplastic materials. The last ones present the advantage of being highly available and allowing the confection of pieces in the necessary form and size to reconstruct partially or totally the deformed anatomy.⁵ Amongst these materials is the polymethyl methacrylate (PMMA) as its complication rates are statistically similar when compared with autologous bone or titanium grafts, bone repair surgeries. Also, the PMMA use in facial reconstructions and repairs is widely spread.^{6,7}

Polymethyl methacrylate was successfully synthesized for the first time in 1902 and since 1994 the PMMA microspheres have been widely used in several medical specialties. They are known as an excellent material for the stabilization of long bone fractures, craniofacial reconstructions, and filling of soft tissue.^{8,9}

The goal of this report was to describe the use of PMMA in a patient with a late diagnosis of HMF.

CASE REPORT

A 40-year-old female patient sought a consultation with a plastic surgeon, without a previous diagnosis of HMF and consequently without adequate follow-up. During anamnesis, the patient reported that the facial alterations were present since childhood and have been increasing with aging. The physical examination determined deviation of the labial commissure and right wing of the nose as well as hypotrophy of the right ramus of the mandible. A computerized tomography of the facial sinus was requested, which showed the right mandible body was shorter and thinner; dense, thin, and oblique hemi palate, degeneration of the subchondral mandible condyles, asymmetry of the mastication muscles (smaller on the right side), microtia and bone and membranous atresia of the right external ear canal, volumetric reduction of the right tympanic cavity and hearing bones. Such a description allowed the probable diagnosis of HMF as it is performed with clinical data with no specific genetic standard diagnosis.¹⁰ Therefore, it was diagnosed on the right side of the patient: hypoplasia of the zygomatic, temporal, maxilla, and mandible ramus bones, lateral facial fissures, ocular asymmetry, atrophy of the nasal wing, agenesis of the parotid gland and mastication muscles (buccinator and masseter muscles). These important bone deformities cannot be solved or softened by other fillers due to their absorption by the organism. The surgical treatment is extremely invasive, expensive, and physically and psychologically demanding. The patient did not report the



Video 1. Watch now at <http://academic.oup.com/asjof/article-lookup/doi/10.1093/asjof/ojaa002>

use of other fillers prior to PMMA. Hemifacial microsomia leads to important bone deformities in the patients which cannot be solved or softened by other fillers due to their absorption by the organism. The surgical treatment is extremely invasive, expensive, and physically and psychologically demanding. Therefore, PMMA is a good choice because it is not absorbed and shows relatively easy application, and good cost–benefit rate. This technique is already established and widely used in both human and animal models.^{11–13}

To promote facial harmony, implantations of PMMA were performed after local anesthesia using Klein,¹⁴ 2% lidocaine. The technique is demonstrated in [Video 1](#). On April 24, 2011, the first PMMA implantation procedure was performed using a polymer of the Art Safe brand (produced by Laboratório Lebon, Porto Alegre, Rio Grande do Sul, Brazil) in the following concentrations and regions: 2% in the subcutaneous, 10% in the intramuscular, and 30% in the periosteal. In the canine fossa, 1.0 mL (10%) was implanted on the right side and 0.5 mL (10%) on the left side. The same procedure was performed in the right nasolabial sulcus. In the right jawline, 2.0 mL (30%) was implanted and 1.5 mL (30%) was implanted in the left one, 4.8 mL (10%) in the right Bichat Ball, 1.0 mL (10%) in each side of the chin outline, 0.5 mL (30%) in each side of the chin, 1.0 mL (10%) in right the lip contour, 1.0 mL (10%) in the right lip orbicular muscle, 0.3 mL (30%) in the nose base, 0.2 mL (30%) in the columella, 0.3 mL (30%) in the nose tip, and 0.4 mL (30%) in the nose dorsum. On June 15, 2011, a second implantation procedure was performed as follows: 0.8 mL (10%) in right canine fossa, 1.0 mL (10%) in nasolabial sulcus, 3.0 mL



Figure 1. Anatomic planes of the PMMA implantation sites. 1. Bichat ball; 2. canine fossa; 3. nasolabial sulcus; 4. mandible; 5. chin outline; 6. lip contour; 7. columela; 8. nose base; 9. nose tip; 10. dorsum.

(10%) in Bichat Ball, 1.0 mL (10%) in each side of the chin outline, 0.5 mL (30%) in each side of the chin, and 0.3 mL (10%) in each side of the upper lip. In [Figure 1](#), the anatomic planes of the implantation sites are demonstrated. The patient returned after 2 months for the follow-up consultation and presented a reduction of the facial asymmetry and clinical evolution without complications. A new implantation procedure was considered necessary and performed on September 1, 2011, as follows: 1.0 mL (10%) in the right Bichat Ball. The last implantation procedure was performed on September 4, 2012 as follows: 0.5 mL in the right canine fossa, 0.7 mL (10%) in the right nasolabial sulcus, 2.0 mL (10%) in the right Bichat Ball, and 0.3 mL (10%) in each side of the upper lip. In [Figure 2](#), it is possible to observe the aesthetic correction in the patient HMF. In 2019, the patient presented no signs of injuries nor adverse reactions such as seromas, granulomas, or erythema, which indicate good evolution ([Figure 3](#)).

DISCUSSION

The PMMA implantation is being used as a single or complementary procedure in the correction of the contours of soft tissues of the face. Amongst its advantages, it is important to highlight the possibility of ambulatorial application, the possibility of subtle corrections and that it is a minimally invasive technique with long-lasting results and absence of donor zone as observed in autografts.^{15,16}

Cohen et al¹⁷ reported safety and long-term efficacy of 5 years of PMMA use in the correction of the nasolabial sulcus. They also observed that the PMMA filling maintained the correction and improved the facial aesthetics throughout the studied period. Only 8.3% of the 145 studied individuals presented adverse effects related to the treatment (1.4% moderate and 0.7% severe).¹⁷ Gelfer et al¹⁷ described the occurrence of late granulomatous reactions and suggested that the natural progression of these reactions may be the spontaneous resolution, dismissing specific treatment in most cases.¹⁸

The Brazilian Medical Community has been using PMMA for several years and recommends it as a useful tool for reconstructive and aesthetic procedures to regain facial balance. Therefore, this material presents success in the filling of bone structures as well as other regions such as intramuscular and subcutaneous ones.¹⁹ However, there is no formal record of the use of PMMA in the treatment of congenital malformations, only case reports which increase the need for research on the subject. A limitation of this report is the short period of the patient follow-up.

CONCLUSION

Polymethyl methacrylate was able to fill regions of the facial hypotrophy minimizing the asymmetry due to the phenotypic presentation of HMF which helped the patient achieve satisfactory facial aesthetic results, reported by the patient herself. Therefore, this report contributes to the use of this product for aesthetic purposes in situations of congenital malformations.

Disclosures

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Figure 2. (A, C, E) Before and (B, D, F) 2-month post-PMMA implantation photographs of a 40-year-old female patient with hemifacial microsomia. (A) Note the deviation of the labial commissure and hypotrophy of the right mandible ramus before PMMA implantation and (B, D, F) how the deviations were decreased post-implantation.

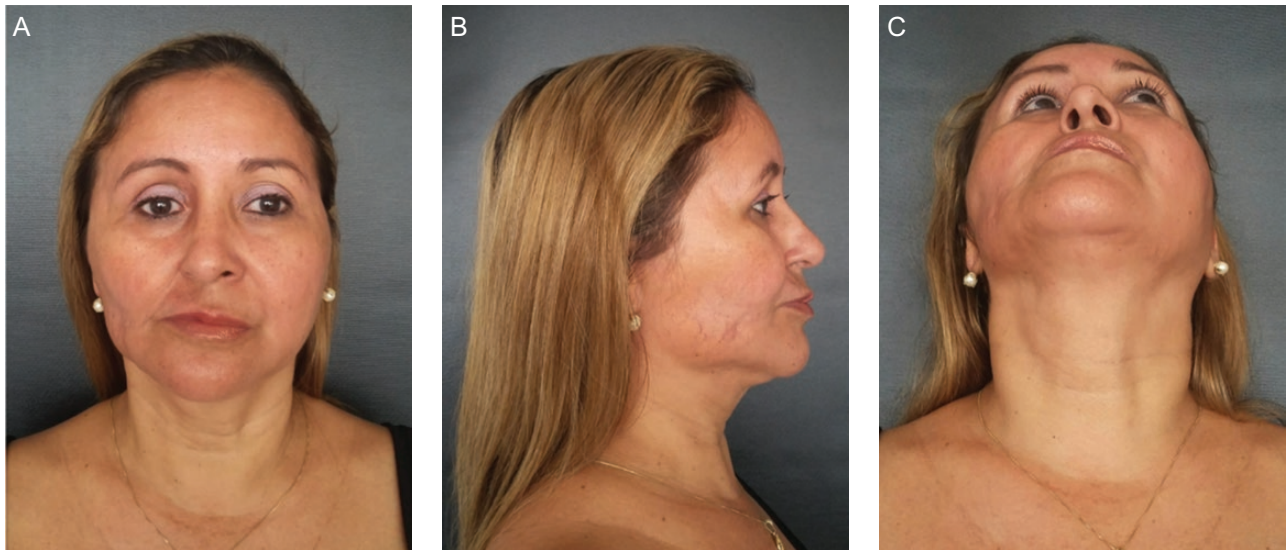


Figure 3. Photographs of the same patient (age, 49 years old) with hemifacial microsomia, 8 years after the PMMA implantation.

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