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Case Report

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Aesthetic Correction After Rupture of The Right Brachial Plexus Using Nonabsorbable Filler

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Summary

Introduction: The brachial plexus (BP) is a group of nerves that originate in the neck region of the spinal cord and run down the arm. The BP is highly exposed to traumatic injury, and this often occurs in adults due to car and motorcycle accidents.
Objective: demonstration the utility of PMMA correcting unsightly sequelae in a patient with traumatic BP injuries.
Methods: The following is the case report of a patient with unsightly sequelae due to a motorcycle accident which ruptured his BP and who was treated with polymethyl methacrylate (PMMA). 786ml of PMMA 30% (Biossimetric) were injected into the following muscles: right and left pectoral, right and left biceps, right and left deltoid, right and left trapezius, ascending portion of the trapezius, right triceps, and right forearm. This was done over 4 procedures along 9.4 months in all.
Result: After the intramuscular implant of 786ml of 30% PMMA, the necessary volume enhancement was achieved for the aesthetic correction of the muscles affected by the BP injury.
Conclusion: The filler restored muscles proportionality and improved physical appearance.

Keywords: PMMA, physical injury, aesthetic

Introduction

The brachial plexus (BP) is a group of nerves that originate in the neck region of the spinal cord and run down the arm. These nerves control the muscles of the shoulders, elbows, wrists, and hands, and also provide sensitivity to the upper limbs [1]. The BP originates at the nerve roots from C5 to T1, may involve C4 and T2, and is frequently affected due to the vulnerability of this anatomical region [1,2].

The BP is highly exposed to traumatic injury. Due to its special relationships with the mobile structures of the neck and shoulder, it can be involved when force vectors cause traction on these structures. Due also to this region´s relative lack of protective muscle and bone, it can also be injured by sharp blows and puncture wounds.[2,3] American and European studies demonstrate that 10% to 20% of peripheral nervous system injuries involve the BP. Of these, 80 to 90% are due to automobile and motorcycle trauma.[2] In adults, BP injuries are generally traumatic injuries, but they can also be secondary to the appearance of tumors or after treatments for other diseases [4].

Traffic accident-related BP injuries constitute a public health problem considering that in 2006 external causes had an economic cost equivalent to 1.2% of Brazil's gross domestic product, according to data from the Brazilian government's Institute for Applied Economic Research [4].

Polymethylmethacrylate (PMMA) is a synthetic microsphere polymer that, once implanted, acts as a matrix that stimulates collagen production involving muscle tissue [5].

The first clinical use of PMMA was in 1936 for dental prosthetics and has since been used extensively in a variety of medical and dental products [6].

This polymer is used to treat various diseases and health conditions, especially in facial and bodily sequelae of congenital or acquired diseases, and is widely used for aesthetic purposes [6]. Its biocompatibility has been demonstrated in research (Lemperle, 1991; McClelland et al., 1997; Lemperle et al., 2004) and had recently been demonstrated histologically by Teixeira et al. [7,8,9,10]. The present work intent to demonstrated the PMMA correcting unsightly sequelae in a patient with traumatic BP injuries.

Methods

This is a retrospective study analyzing the medical records of a patient seen at the Fagnani Clinic who underwent treatment with polymethyl methacrylate for unsightly sequelae resulting from a motorcycle accident. The study was approved by the research ethics committee of the Centro Universitário da Várzea Grande, UNIVAG, under protocol number 80158524.5.0000.5692.

Clinical Case

Male patient, 43 years old, undergoing treatment for sequelae after a motorcycle accident.
The patient sought clinical treatment following a motorcycle accident that occurred approximately 14 years prior which had ruptured his right BP. He reported constant pain even after two surgical attempts to reduce it. He used Gabapentin 600mg (which was reduced after surgery), Deposteron, GH, creatine supplements, and the patient denied the use of vitamin D. He performs daily weight training and plays football every week. The patient denied other previous procedures on the region, or other illnesses or allergies.

During office visit, the patient reported a motorcycle accident which had previously ruptured his right BP. In an attempt to recover some movement and reduce the intensity of pain, he underwent two surgeries which provided some pain relief but did not restore movement.

On physical examination, severe atrophy of these muscles was found: pectoralis major, trapezius (transverse and ascending portions), deltoid, biceps, and triceps, in addition to the muscles of the anterior portion of the forearm (flexor carpi radialis muscle, palmaris longus muscle and flexor carpi ulnaris muscle).

Due to the irreversible damage done to these nerves, in addition to the atrophy, we noted that the patient felt constant pain, showed muscle weakness, was unable to articulate the shoulder, had a significant loss of tactile sensitivity, and the movement of his arm and hand was almost completely compromised.

The patient reported great psychological discomfort due to the asymmetry between the right and left sides, causing him anguish and anxiety.

Upon visual analysis, there was a significant difference in volume and shape between the muscles on the affected (right) side and the unaffected (left) side.

Regarding the volume needed to treat this asymmetry, planning indicated a total of 480ml of product distributed in the regions in need of volumetric expansion as follows: chest up to 180ml per side; deltoid up to 60ml; trapezoid up to 30ml; biceps up to 30ml; triceps up to 30ml; forearm up to 30ml.

The possible need for more than one procedure was also considered, in addition to respecting muscle compliance and volume of muscle space which could limit the volume of PMMA applied during a single procedure.

The following pre-procedure tests were performed: blood count, quantitative C reactive protein, serum urea, serum creatinine, total serum calcium, serum ionic calcium, parathyroid hormone (PTH), serum phosphorus, serum sodium, erythrocyte sedimentation rate, glutamic-oxaloacetic transaminase test, transaminase pyruvic glutamic, 25-hydroxy vitamin D, 1.25 OH vitamin D, simple urine test, urinary proteinuria, urinary calcium, and creatinine index. Ultrasound of BP and region.

With laboratory tests within normal limits, the patient returned to the clinic to undergo the first procedure of several which had been staged to account for the maximum permissible volumes estimated per muscle per procedure, overall volume, and muscle compliance.

In the first procedure, the team performed local anesthesia with 250ml of 0.75% diluted Xylocaine followed by intramuscular filler implantation as shown in Table 1.

The volumetric differences of each injection were calculated to correct muscular asymmetries and improve aesthetic appearance. The volumes initially implanted were smaller than the volumes stipulated in prior planning as we continued to prioritize the muscular capacity to accept the filler in addition to the volume to be achieved visually, which ended up limiting the amount of material used in the first procedure.

After the first procedure (54 days), the patient returned to undergo the second procedure. This time, the triceps injection was performed on the right side (the atrophied side) totaling 27 ml intramuscularly under local anesthesia with 40 ml of 0.75% diluted Xylocaine (Table 1).

Before the third procedure, these follow-up laboratory tests were requested: serum urea, serum creatine, total serum calcium, serum ionic calcium, parathyroid hormone, urinary calcium/creatinine index, urinary protein/creatinine index, urinary albumin/creatinine index.

After the second procedure (56 days), the patient returned to the clinic for a check-up where it was decided, after medical evaluation and normal laboratory tests which revealed no changes, to make some adjustments to the filler volume. The third procedure was carried out under local anesthesia with 60 ml of 0.75% diluted Xylocaine and subsequent injection of intramuscular filler (Table 1).

Before the fourth procedure, these follow-up laboratory tests were done: serum urea, serum creatine, total serum calcium, serum ionic calcium, parathyroid hormone (PTH), urinary calcium and creatinine index, urinary protein index and urinary albumin index.

The fourth procedure was done 177 days after the third. This time, after medical evaluation and normal laboratory tests, some adjustments to the volumes were made. Ultrasound of BP and region.

The procedure was carried out under local anesthesia with 250ml of 0.75% diluted Xylocaine and subsequent injection of intramuscular filler (Table 1).

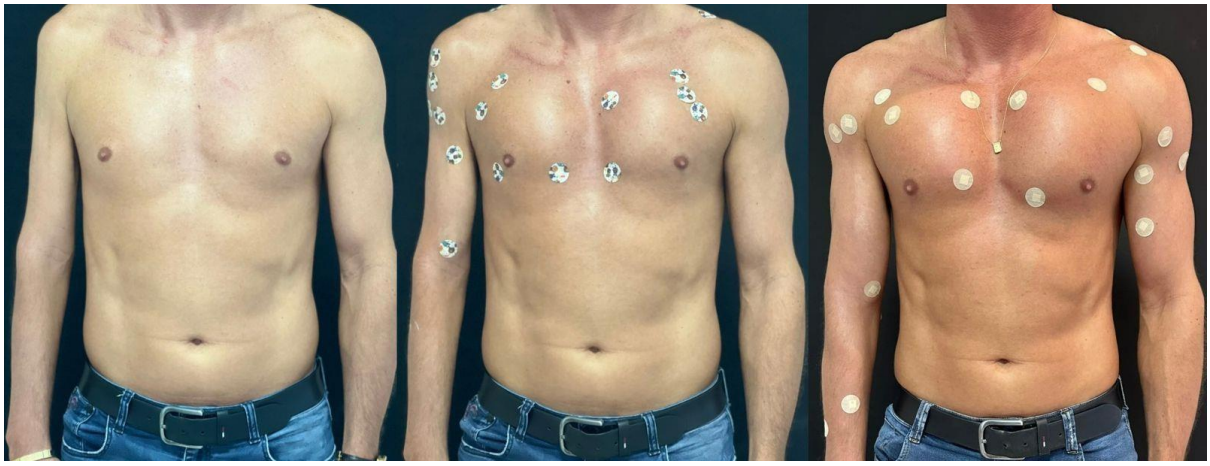

Figure 1: Before, during and immediately after the 4th procedure. Front view.

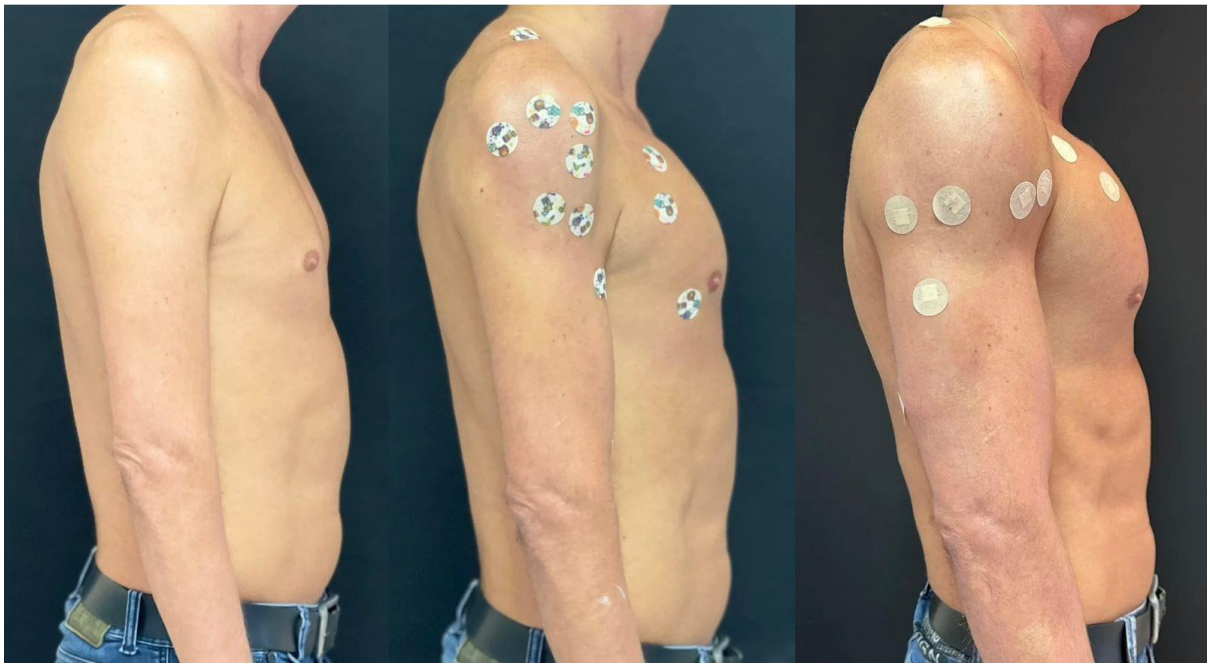

Figure 2: Before, during and immediately after the 4th procedure. Side view.

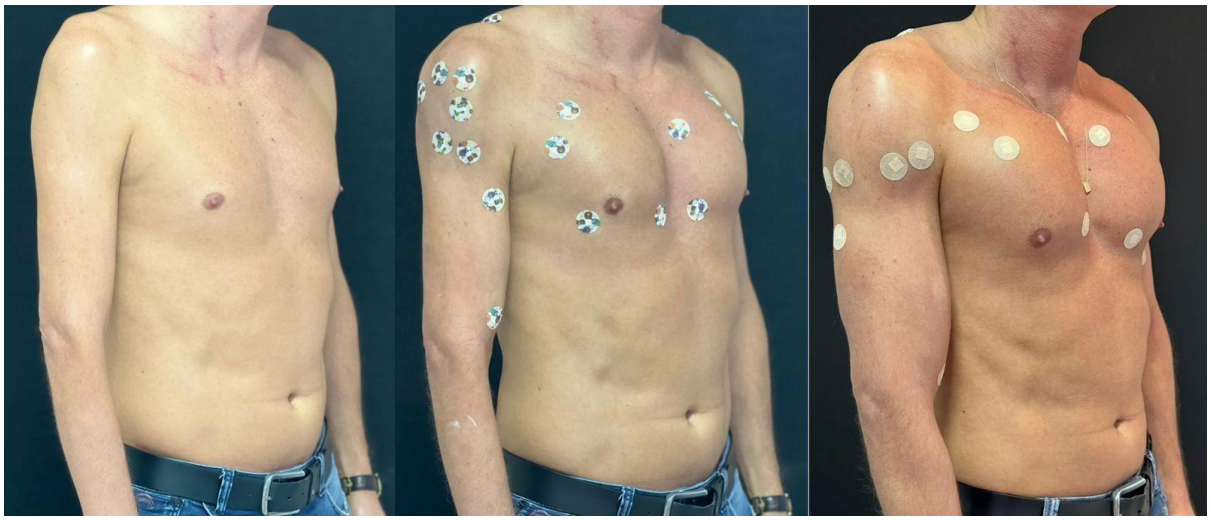

Figure 3: Before, during and immediately after the 4th procedure. Anterior diagonal view.

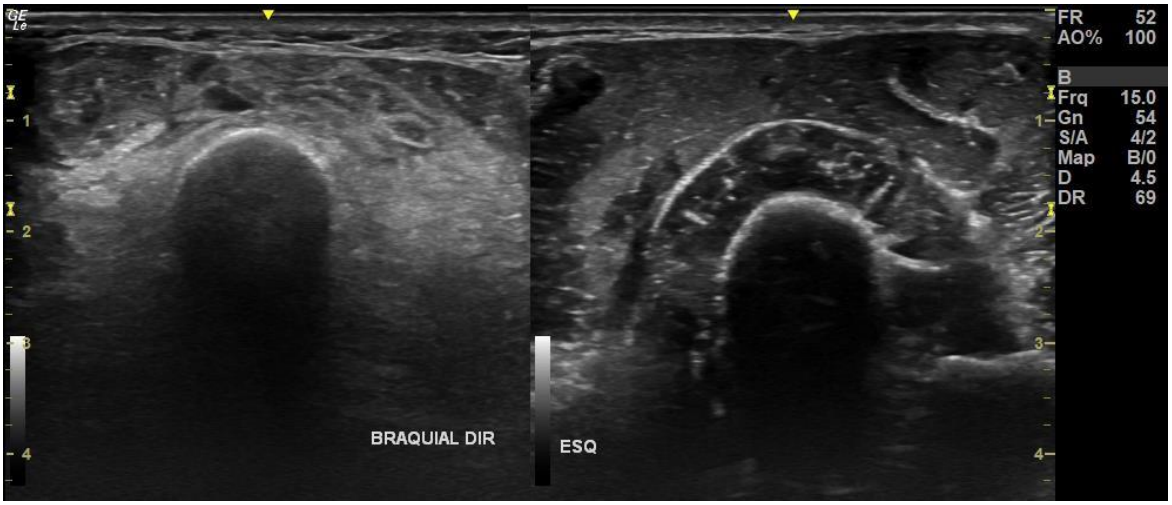

Figure 4: Right and left brachialis muscle in the transverse direction. Right brachialis muscle with increased echogenicity and heterogeneity as well as loss of the usual fibrillar pattern of the musculature due to the presence of intramuscular polymethylmethacrylate.

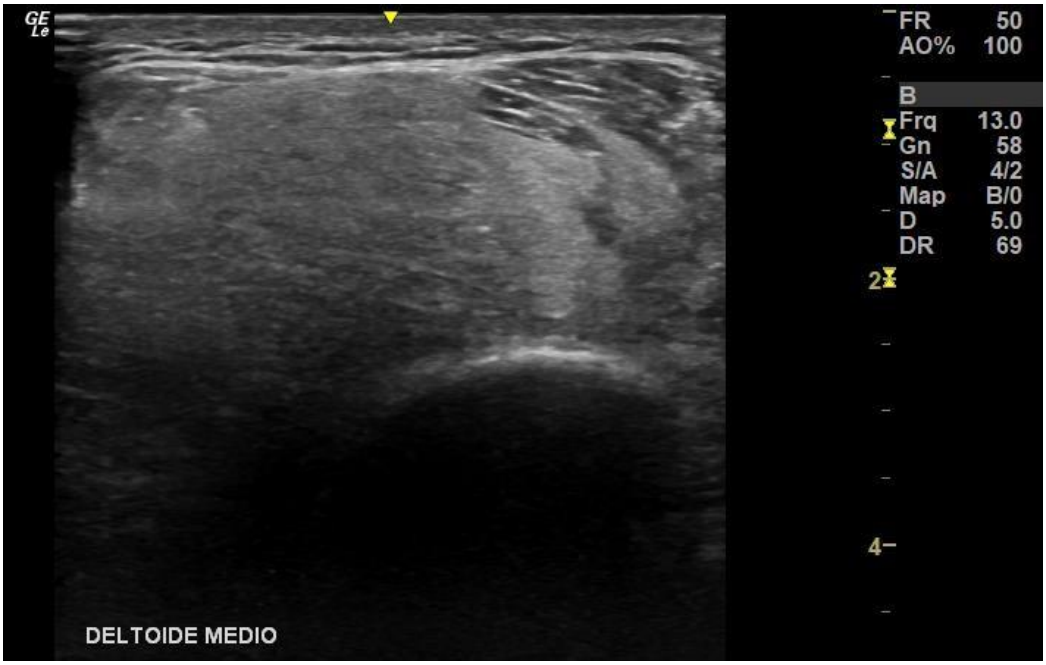

Figure 5: Deltoid muscle showing loss of the usual fibrillar pattern on ultrasound (6-15 mHz linear transducer) and increased diffuse echogenicity due to the presence of intramuscular exogenous filler (pmma).

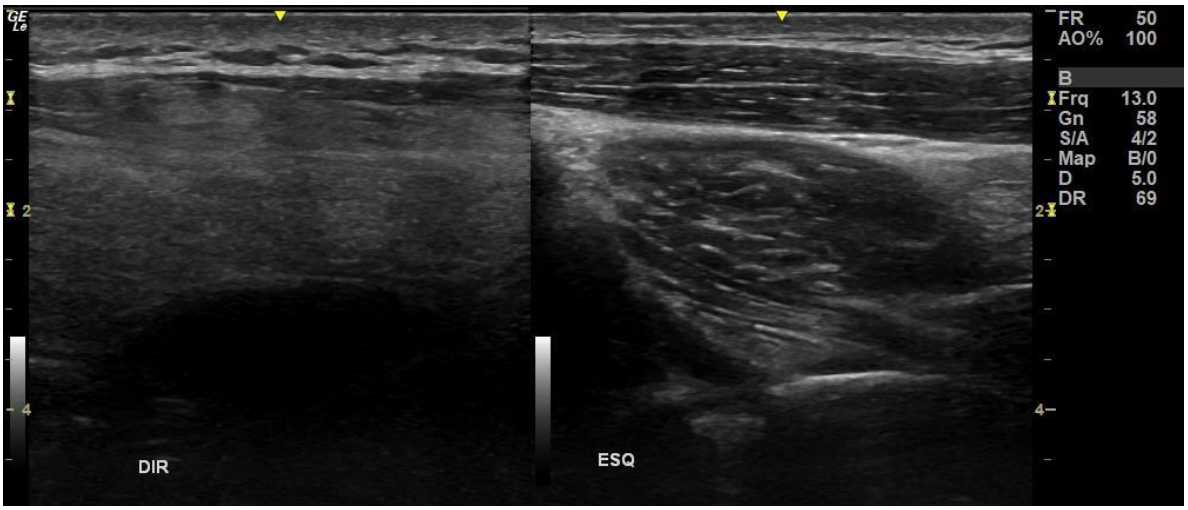

Figure 6: Right and left biceps muscles in the longitudinal direction. Right biceps: increased echogenicity and heterogeneity with loss of the usual fibrillar pattern of the musculature due to the presence of intramuscular polymethylmethacrylate.

Table 1: Volumes used in treatment.

	Volume (ml)				
Muscle	**1st procedure**	**2nd procedure**	**3rd procedure**	**4th procedure**	**Final**
Right pectoral	141ml	-	12ml	39ml	192ml
Left pectoral	120ml	-	-	51ml	171ml
Right biceps	30ml	-	30ml	30ml	90ml
Left biceps	-	-	-	18ml	18ml
Right deltoid	48ml	-	39ml	27ml	114ml
Left deltoid	-	-	-	24 ml	24 ml
Right trapezius	18ml	-	-	15ml	33ml
Left trapezius	15ml	-	-	15ml	30ml
Trapezius ascending portion	-	-	-	30ml	30ml
Right triceps	-	27ml	21ml	6ml	54ml
Right forearm	-	-	-	30ml	30ml

After 7 days, the patient complained of induration with the possibility of an extra muscular nodule. New blood tests were requested and Montelukast sodium 10mg (1 tablet per day for 20 days) and Allopurinol 100mg (1 tablet per day for 20 days) were prescribed.

After the final procedure (54 days), the patient returned to the clinic for a check-up. He reported headache, a nodule in the right anterior deltoid (not apparent), and tiredness when playing football.

The blood test revealed a slight elevation in serum calcium levels. He claimed that everything was normal in his daily life, but he had been taking vitamin D in a multivitamin without knowing it. The pain and fatigue were associated with changes in calcium and the use of vitamin D. He was advised to reduce serum calcium according to the protocol published by Bortolozo et al. (2023) by interrupting the multivitamin use and to begin with Prednisolone 20mg (1 tablet per day for 20 days) to contain the inflammatory process, which, added to the use of Vitamin D, could have caused hypercalcemia and even renal failure [11]. After treatment, his serum calcium levels, together with his pain and tiredness, returned to normal.

Procedure

The procedure begins with the identification and marking of the muscular limits to be filled. This is followed by applying an anesthetic patch and administering local anesthesia of 0.75% diluted Xylocaine via cannula. Only then is filling performed with 30% Polymethylmethacrylate (PMMA), intramuscularly, deposited by retro injections with the aid of a malleable cannula (18G) and with a blunt atraumatic tip at an angle of 90º. The skin is punctured with a needle (18G) to avoid vascular or nerve injuries. These procedures were uneventful and did not require any incisions or stitches.

Prescription of medications

These medications were prescribed after each procedure: injectable Betamethasone suspension (1ml IM) and Enoxaparin sodium 40mg (0.4ml SC) administered in the clinic. For self-administration, these were prescribed: Rivaroxabana 10mg (1 tablet per day for 10 days), Cefadroxil 500mg (1 tablet every 12 hours for 8 days), Ketoprofen 50mg (1 tablet every 6 hours for 5 days), Dipyrone sodium 1g (1 tablet every 6 hours for 3 days), Cyclobenzaprine hydrochloride 10mg (1 tablet at night as needed for pain), Esomeprazole magnesium 20mg (1 tablet every 12 hours for 7 days), Acetaminophen + Codeine Phosphate (1 tablet every 8 hours as needed for pain).

Discussion

This study presents the case report of a patient with misshapen sequelae from a ruptured BP treated with non-absorbable PMMA filler. In addition to causing specific sequelae, BP ruptures often leave physical and psychological marks that profoundly affect patients' self-esteem and emotional well-being. These aesthetic changes can contribute to psychological damage especially in male patients who are increasingly seeking ways to recover their body contour.

Among the available aesthetic procedures, body fillers offer substantial advantages compared to surgical procedures such as liposuction, autologous grafting, or silicone implants. Because they are minimally invasive, filling can be performed in an outpatient setting and without the need for general anesthesia or hospital care, thus reducing the risk of infection, anesthetic complications, and extensive scaring [12,13].

PMMA has been widely used as a non-absorbable filler material, and its use is supported by robust studies demonstrating its safety and effectiveness. Recently, Danuza et al. published a study with 4,725 cases of gluteal filling with an adverse event rate of just 2.1%, which is considerably lower than the complications associated with surgical procedures (10.5%) [13,14]. These data reinforce the guidelines for the use of PMMA in aesthetic treatments.

In the presented case, the use of PMMA was essential in restoring muscular proportionality between the affected and unaffected limbs, resulting in a visible improvement in physical appearance. This result highlights the importance of a careful assessment of the patient's individual characteristics, such as tissue compliance, to avoid overcorrections and ensure a natural result. A precise technical approach with respect for anatomical limitations are crucial to the success of the procedure and for patient safety.

Despite positive outcomes, there is a notable lack of studies on aesthetic fillers used on the upper limbs in the current literature, especially for men. Most existing publications focus on specific fillers for areas such as buttocks and thighs, predominantly in women. This bias suggests a gap in knowledge that needs to be explored given the increased male demand for body contouring procedures.

Conclusion

We demonstrated a successful treatment with PMMA to correct unsightly sequelae in a patient with traumatic brachial plexus injuries by restoring muscular proportionality and improving physical appearance. Carrying out these procedures requires a careful assessment of the patient's individual characteristics to ensure that results are safe, compatible, and natural in appearance.

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