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Case Report

Quantum Molecular Resonance (QMR®) for Delayed Inflammatory Reaction to Gluteal Hyaluronic Acid Filler: Case Report

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ABSTRACT

Injectable hyaluronic acid (HA) fillers are widely used in minimally invasive aesthetic medicine for facial and body rejuvenation, as well as for gluteal volumization and contouring. The extensive international use of fillers with various substances has revealed a considerable number of complications that must be recognized for both preventive and therapeutic purposes. The aim of this report is to describe a case of a severe inflammatory reaction occurring 21 days after the injection of 60 cc of HA per gluteal side in a patient who had undergone quadrantectomy for unilateral breast cancer eight months prior, with a negative total-body bone scan, no chemotherapy, and overall good physical and psychological condition. The patient was on tamoxifen therapy in preparation for adnexectomy/total hysterectomy; in agreement with her oncologist and at her request, tamoxifen had been suspended 15 days before the filler injections. The case demonstrated a rapid anti-inflammatory effect achieved exclusively through Quantum Molecular Resonance (QMR®) therapy. The treatment employed Quantum Molecular Resonance (QMR®) technology, widely used in regenerative medicine and physiotherapy for its anti-inflammatory and regenerative effects, mediated through the activation of adult stem cells. The non-invasive protocol consisted of six 20-minute sessions per side, with a 2-day interval between consecutive sessions. QMR® treatment resulted in rapid symptom improvement, with reductions in pain, erythema, and a sensation of tension, without the need for additional corticosteroid therapy. Guidelines for complications related to gluteal hyaluronic acid fillers typically include antibiotic therapy, corticosteroids, possible aspiration, or hyaluronidase. In more severe cases, surgical intervention may be required. In the present case, the patient explicitly requested to avoid corticosteroids. QMR® treatment produced an effective anti-inflammatory response, preventing fibrotic progression and allowing the preservation of the implant. The technology demonstrated both efficacy and scientific plausibility; however, further studies are needed regarding its indications. Nevertheless, this case suggests that QMR® may represent a valid alternative or a useful adjunct to conventional therapeutic strategies for filler-related complications.

INTRODUCTION

Gluteal augmentation and contouring using non-invasive or minimally invasive techniques are in high demand internationally, particularly among women. The most common approach involves injecting hyaluronic acid into the subcutaneous soft tissues, a minimally invasive procedure widely used for its long-lasting results and high tolerability, however, it is not entirely free of side effects and known complications.

Mortada and Alkadi (1) published ten articles between 2013 and 2022 on 168 patients, reporting an average duration of hyaluronic acid (HA) implants in the gluteal region of approximately 17–24 months. Among these patients, two experienced major surgical complications, five developed bruising and erythema, five presented with edema and inflammation at the injection site, and one patient exhibited gluteal contour irregularities.

Atiyeh and Ghieh (2) investigated various fillers, including polymethylmethacrylate (PMMA), poly-L-lactic acid, calcium hydroxyapatite, and HA, deliberately excluding silicone and methacrylate due to regulatory restrictions or contraindications. Adverse effects were rare and included edema, erythema, nodules, liquefaction, infection, and abscess formation; when the filler was correctly injected into the subcutaneous plane, the risk of embolism could be excluded. The authors concluded that gluteal augmentation with fillers is not as straightforward or risk-free as often advertised, and that an increasing number of inadequately trained professionals offer low-cost procedures.

Crabai and Campos-Martínez (3) conducted a multicenter, retrospective, observational study of 35 patients treated with HA fillers for gluteal augmentation at 4 Italian centers. At six months follow-up, 94% of patients and 100% of physicians rated the results as “good” or “very good.” Adverse events, generally mild to moderate, resolved within 2–7 days and included swelling, pain, and redness, with no significant differences between patients.

Carella and Ruggeri (4) emphasized the importance of combining clinical evaluation with ultrasound imaging to determine filler type, volume, and location, as well as to identify potential complications. Magnetic resonance imaging was reserved only for patients considered for surgical intervention. Appropriate local and systemic medical management led to the resolution of clinical symptoms such as edema, pain, and erythema. In contrast, in cases of infection or liquefaction, complete removal of the material prevented functional impairment.

Urdiales-Gálvez and Delgado (5) highlighted the advantages of HA over other injectable substances, noting (6) that between 2011 and 2015, HA injections increased from 1.6 million to 2.5 million procedures, with a corresponding rise in complications (7). However, proper patient selection and accurate product placement significantly reduce risks. However, other authors confirm that correct patient selection and accurate product placement significantly reduce risks (8).

Filler-related complications are classified according to severity (mild, moderate, or severe), vascular compromise (ischemic or non-ischemic), and onset (early or delayed) (9).

Rohrich (10) suggested categorizing complications as early (<14 days), late (14 days–1 year), or delayed (>1 year), while Signorini and Liew (11) proposed immediate (<24 h), early (24 h–4 weeks), and delayed (>4 weeks) categories.

Management of complications (12–13) depends on the clinical phase and may include corticosteroids, antibiotics (amoxicillin/clavulanic acid), NSAIDs, hyaluronidase, and aspiration with bacterial culture. Ultrasound imaging supports differential diagnosis between granulomas, edematous fluid collections, and inflammatory infiltrates (14–15). Some authors (16) recommend first-line antibiotics, such as fluoroquinolones combined with tetracyclines or macrolides, for 3–6 weeks, while discouraging the use of intralesional or systemic steroids unless severe reactions or recurrences occur. In general, a watchful waiting period of 48 hours to 2 weeks is advised before using hyaluronidase (17).

The aim of the present case report is to describe a case of delayed severe inflammatory reaction following gluteal HA injection in a 48-year-old female patient who underwent mastectomy eight months prior for oncologic treatment, followed by good recovery and tamoxifen therapy, which blocks estrogen receptors, reduces estrogen production, and inhibits the aromatase enzyme (18).

In a young woman, breast oncologic surgery can induce psychological distress and alter quality of life, particularly during the summer months. For this patient, 60 cc of HA (20 mg/ml per vial) were injected per gluteal side, with temporary suspension of tamoxifen for several weeks. To manage the inflammatory response, Quantum Molecular Resonance (QMR®) technology was used exclusively due to its potential anti-inflammatory and regenerative properties. This case report describes the non-invasive QMR® treatment, which resulted in rapid symptom improvement.

MATERIALS AND METHODS

In physics, a quantum of energy represents the smallest discrete and indivisible amount of energy that a system can transmit or receive, with its magnitude proportional to the frequency of the source signal. This principle provides the theoretical basis for technologies capable of selectively interacting with biological systems by applying controlled energy at specific frequencies.

It has been demonstrated that electrical energy can activate cellular processes without causing thermal damage by exploiting the interaction of electric fields with biological tissues. Such interactions can occur in the absence of hyperthermia, thanks to resonance phenomena with the target biological structures. In this context, Quantum Molecular Resonance (QMR®), a technology developed and patented in Italy, is utilized in the present case report. QMR® relies on the emission of low-intensity, alternating, multi-frequency (harmonic) electric fields, which can interact with biological systems without increasing the kinetic energy of atoms and, therefore, without causing a significant rise in tissue temperature outside the physiological range (19).

In QMR®, frequencies ranging from 4 MHz to 64 MHz can induce molecular resonance phenomena and selective biological interactions, producing clinically documented regenerative, anti-inflammatory, and anti-edema effects (20).

QMR® is also applied in surgical specialties for its low-temperature atraumatic cutting and controlled coagulation capabilities (21-23). In regenerative medicine, physiotherapy, and aesthetic medicine, the technology activates cellular and molecular processes without generating significant heat, producing anti-inflammatory, anti-edema, and analgesic effects, while promoting stem cell activation, reducing edema and pain, and improving tissue functionality (24-25).

Used in regenerative medicine, physiotherapy, and aesthetic medicine, where the full multi-frequency spectrum (4–64 MHz) is applied, QMR® can activate cellular and molecular processes without generating significant tissue heat. Clinical applications have demonstrated anti-inflammatory, anti-edema, and analgesic effects, as well as stimulation of stem cell activity, reduction of edema and pain, and improvement of tissue functionality (26).

The mechanism of action of QMR® has been demonstrated to affect gene expression related to extracellular matrix remodeling, angiogenesis, cellular migration, and regenerative processes.

Inflammation, or flogosis, is an innate defense mechanism (27) aimed at eliminating the cause of cellular or tissue damage and initiating the repair process. During the inflammatory response, macrophage colonies are stimulated by M-CSF, which induces the secretion of pro-inflammatory cytokines that drive hematopoietic stem cells to differentiate into monocytes and subsequently into M0 macrophages. Upon stimulation with lipopolysaccharide (LPS), M0 macrophages polarize into pro-inflammatory M1 macrophages, which participate in primary tissue repair; upon stimulation with interleukins IL-4 and IL-13, polarization toward M2 macrophages occurs, exerting anti-inflammatory effects. M2 macrophages remove cellular debris and produce factors essential for tissue reconstruction.

QMR® promotes increased VEGF expression, reduced matrix metalloproteinase activity, and decreased production of pro-inflammatory mediators, along with a significant reduction of inflammatory infiltrate, leading to clinical improvement in pain and symptoms. Quantum Molecular Resonance facilitates modulation of reparative processes by reducing M1 macrophage activity and enhancing M2 macrophage activity, thereby decreasing inflammation and promoting harmonious tissue regeneration through the activation of adult stem cells (28).

CASE REPORT

The aim of this work is to describe a case of severe inflammatory reaction following gluteal hyaluronic acid injection in a patient with a previous oncologic history. The peculiarity of this case lies in the rapid anti-inflammatory response achieved exclusively with Quantum Molecular Resonance (QMR®) therapy.

The patient was a 48-year-old woman in generally good health, with one child delivered via eutocic birth. She had used combined estrogen-progestin hormones for contraception for twelve years. At age 40, she

underwent mastopexy and had periodically received hyaluronic acid injections in the face without any adverse effects or complications.

In 2024, she underwent a quadrantectomy with radiotherapy for stage IA luminal A breast carcinoma (0.6 mm), followed by tamoxifen therapy and semiannual follow-ups. The patient reported a general decline in body tone and requested gluteal augmentation in preparation for the summer season.

After consultation with her oncologist, tamoxifen therapy was temporarily suspended for 15 days, and hyaluronic acid implants with CE medical certification (20 mg/ml per vial, 60 cc per side) were placed using standard sterile technique. No other therapy was prescribed. The patient remained asymptomatic for approximately four weeks, when a bilateral inflammatory reaction appeared in the superolateral quadrants of the gluteal region, with erythema, severe pain, and a sense of tension.

Antibiotic therapy with amoxicillin/clavulanic acid 875/125 mg three times daily for five days was immediately initiated. Ultrasound and color Doppler evaluation revealed a small fluid collection, which was aspirated and sent for microbiological culture; results were negative. The patient was afebrile, but VAS/NRS pain scores were 8 on the left and 7 on the right (29). Corticosteroid and NSAID therapy were proposed, but the patient preferred to avoid them upon resuming tamoxifen therapy, expressing a desire to try Quantum Molecular Resonance (QMR®) therapy, as a friend had previously achieved excellent results with QMR®. In our prior experience, a similar case of a gluteal filler reaction improved following 5 QMR® sessions (Fig. 1).

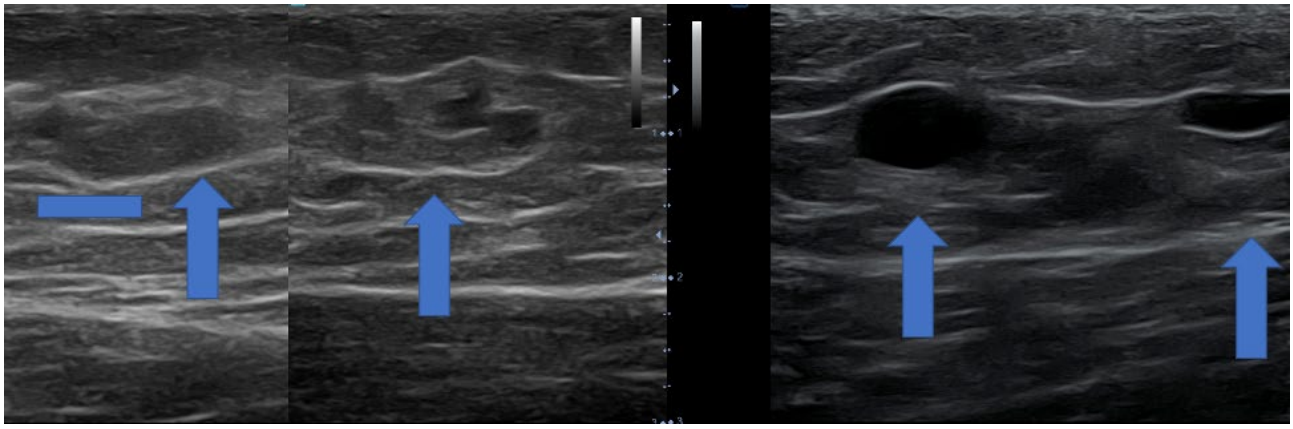

Fig. 1. *Gluteal filler reaction in the right buttock four weeks after implantation in a patient with stable scleroderma not under therapy, improved after five QMR® sessions with preservation of the implant.*

For these reasons, it was decided to continue antibiotic therapy only and to initiate immediate non-invasive treatment with QMR®, administered every 2 days for 20 minutes per gluteus, for a total of 6 sessions. The Rexonage 3 device (Telea Medical, Italy) was used.

After cleansing the skin with soap and water and disinfecting with benzalkonium, without any anesthetic pretreatment, the “Handpiece” was applied using a neutral emulsion as a coupling medium at a continuous power setting of 35 (nominal power). The applicator was moved slowly and evenly over the entire inflamed area, pausing on nodules, without the need for post-treatment cooling. Subsequently, two single-use adhesive contact electrodes were applied per side for 10 minutes at a continuous power of 28 (nominal power value) to better diffuse the anti-inflammatory effect. No specific at-home instructions were given other than maintaining normal activities and avoiding direct sun exposure.

After two sessions, clinical evaluation revealed general improvement, particularly in pain and erythema, although a bilateral sense of tension persisted, especially on the left. VAS/NRS scores were 6 on the left and 3 on the right. In the right gluteus, the patient reported progressive improvement after just two sessions, with

the VAS score reaching 0 by the fourth session, accompanied by the disappearance of pain, tension, and palpable nodules (Fig. 2, 3).

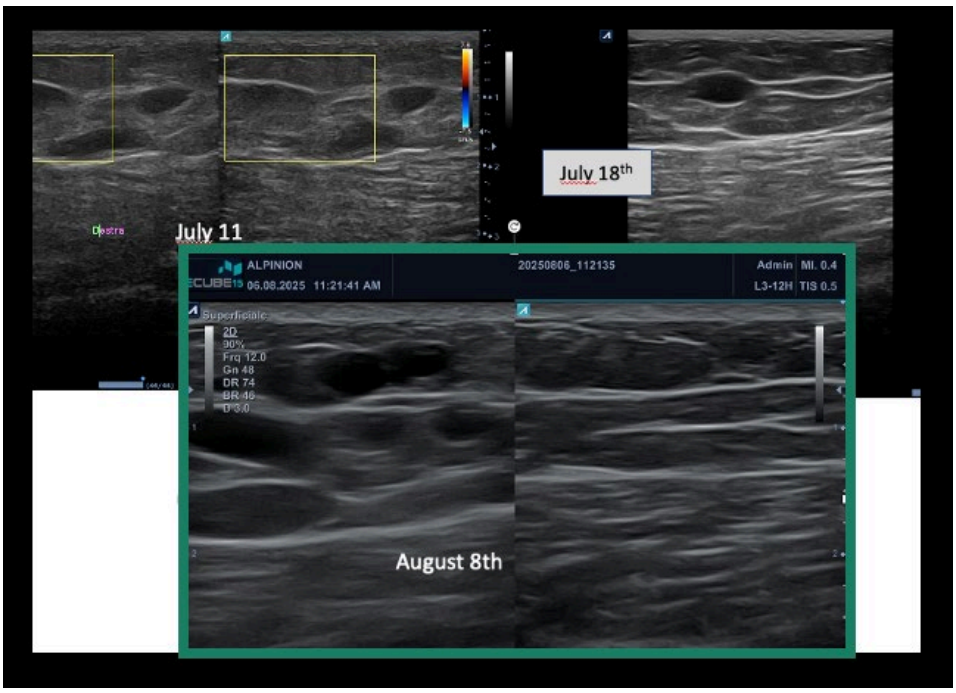

Fig. 2. *In the right gluteus, an inflammatory reaction is evident, which markedly decreases after one week, with tissue returning to normal after four sessions.*

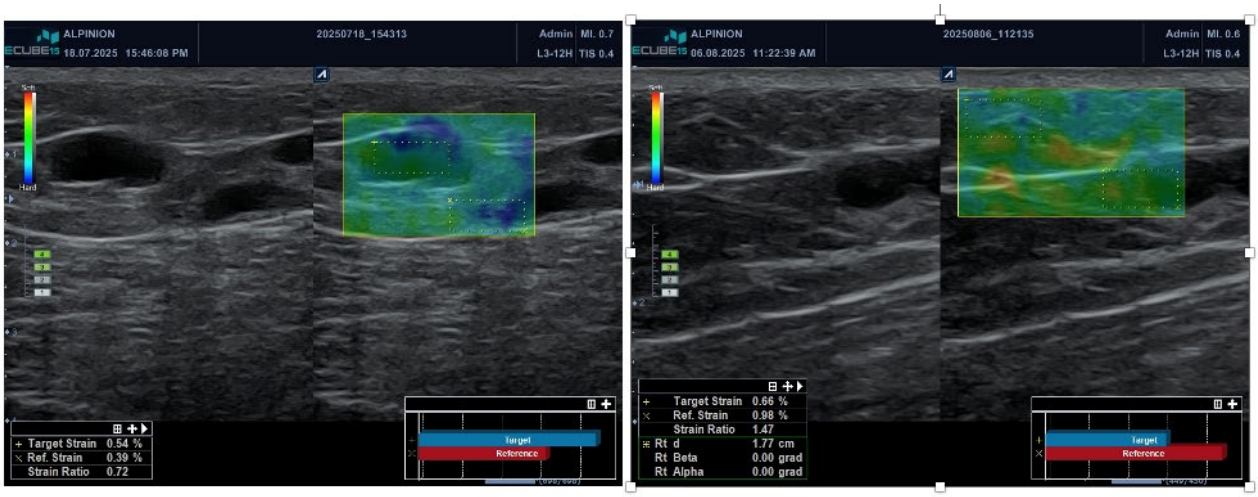

Fig. 3. *Color Doppler elastosonography of the right gluteus showing progressive improvement, reduction of nodular fibrotic changes, and preservation of the implant.*

The left gluteus, which was more tense and inflamed, showed no vascular alterations but did exhibit inflammatory fibro-edematous changes in the tissue surrounding the hyaluronic acid material, with subcutaneous panniculitis more pronounced in the fibrous septa. After two sessions, the patient reported improvement, with a VAS score of 6 and a significant reduction in pain and tension. By the fourth session, with a VAS of 2, pain progressively decreased, reaching 0 at the end of treatment, with complete resolution of tension and absence of palpable nodules (Fig. 4–7).

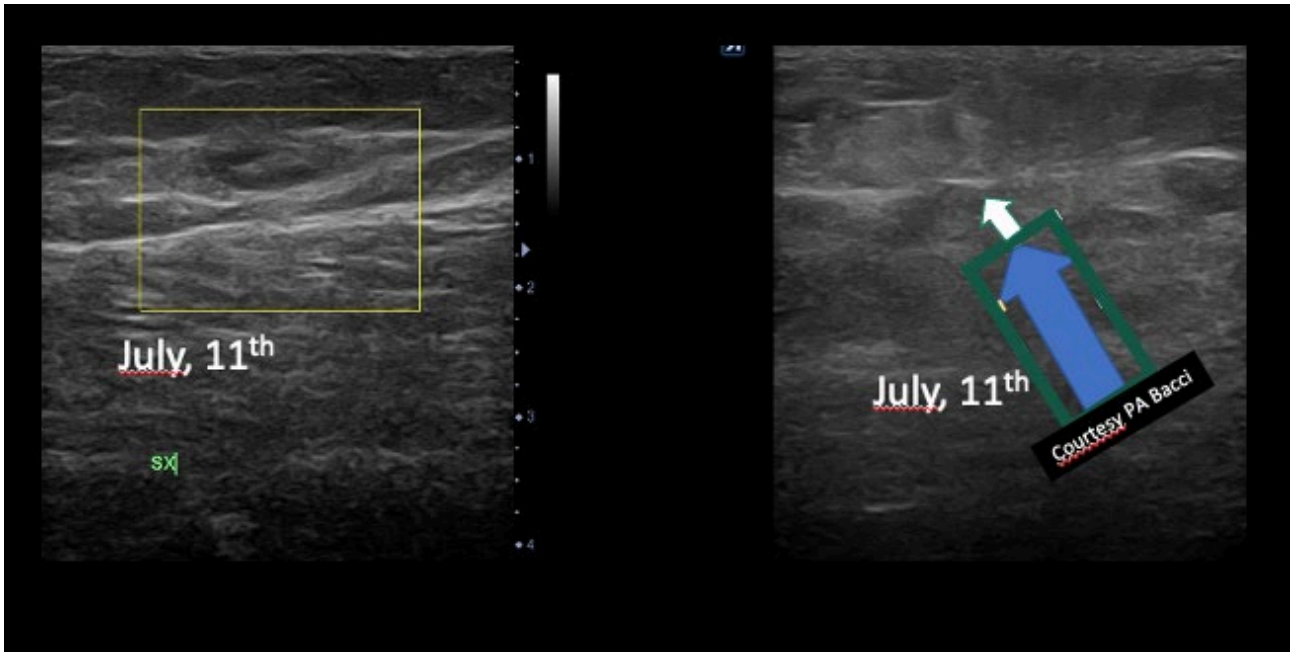

Fig. 4. *The left gluteus shows a pronounced inflammatory reaction, highlighted on the right side of the image.*

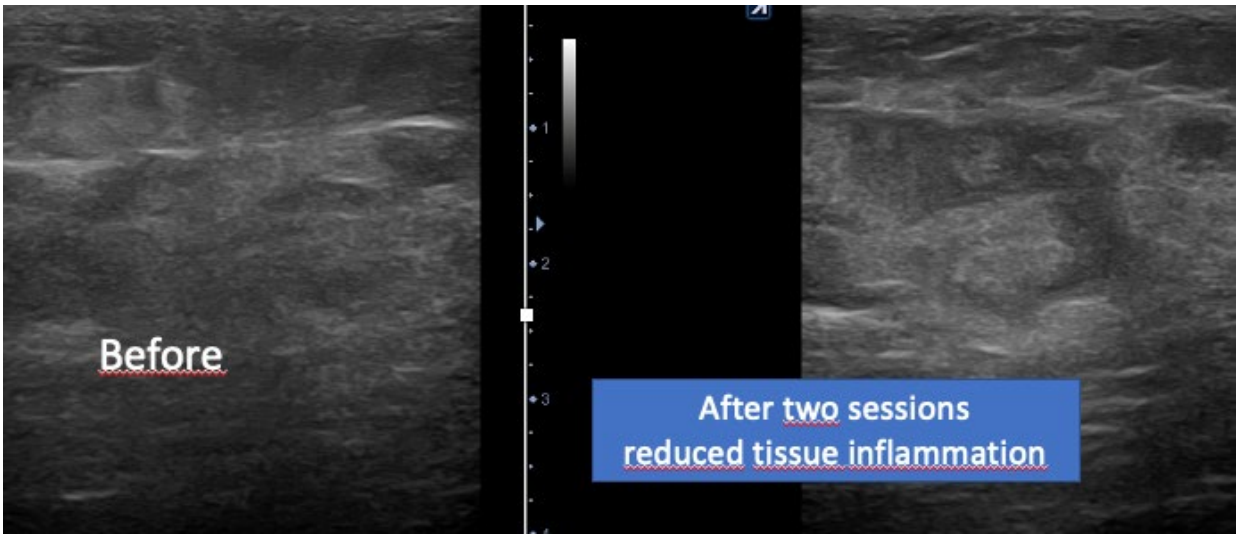

Fig. 5. *The left gluteus shows improvement of inflammation as early as the second session, although mild pain and erythema persist.*

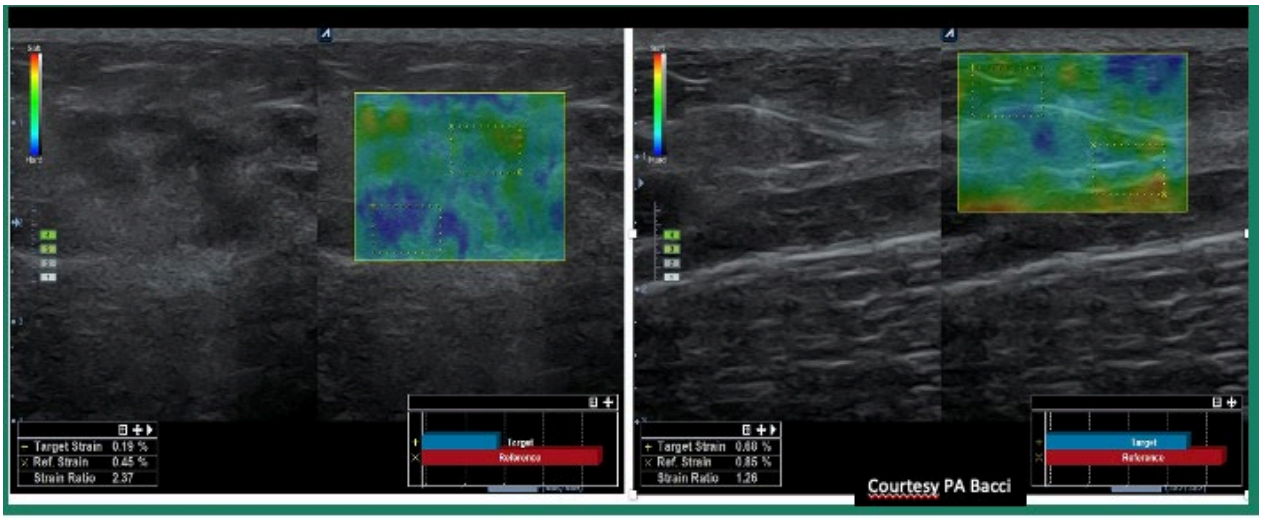

Fig. 6. *Post-treatment color Doppler elastosonography of the left gluteus showing improvement, with no fibrotic evolution of nodules and preservation of the implant.*

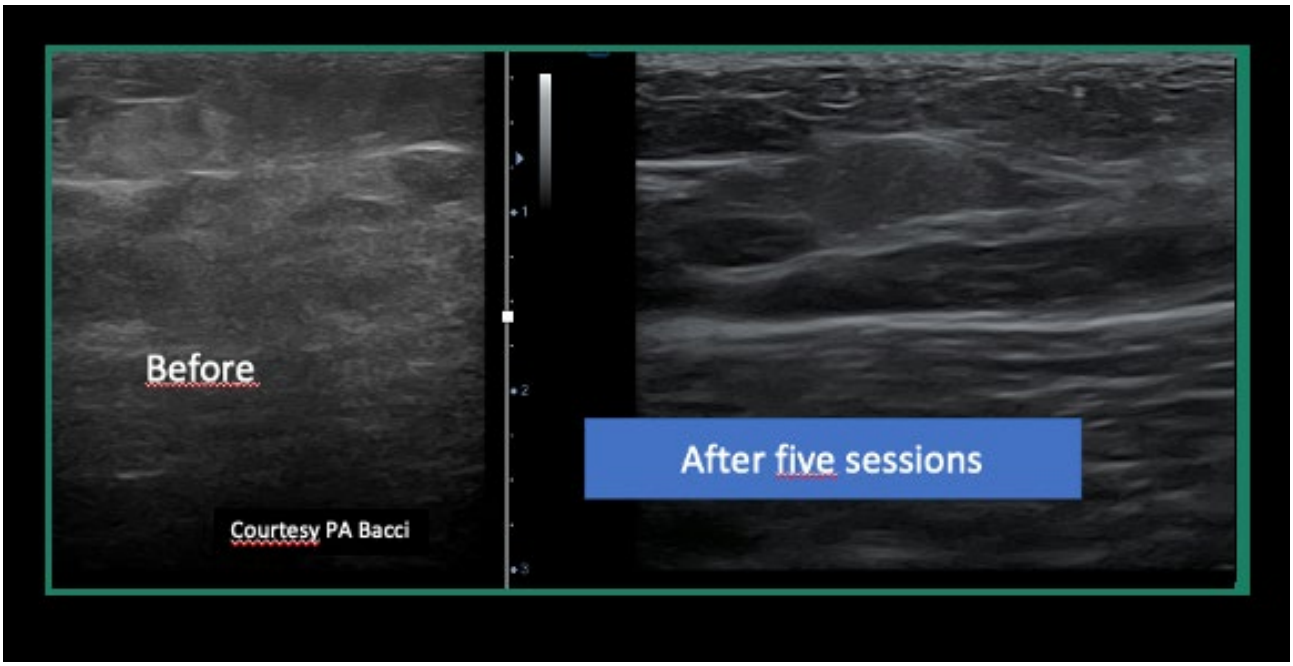

Fig. 7. *The left gluteus shows marked improvement at the end of treatment, with no fibrotic evolution of nodules and preservation of the implant.*

The non-invasive treatment demonstrated favorable results in a short time, significantly reducing pain, erythema, and a sense of tension, while avoiding the need for corticosteroid or NSAID therapy. Clinical and ultrasound evaluation 1 week after the end of treatment confirmed the absence of pain, tension, or nodules, with bilateral VAS scores of 0. Figure 8 illustrates the progression of improvement, particularly between the second and fourth QMR® treatment sessions, as documented by the VAS/NRS scale (Fig. 8).

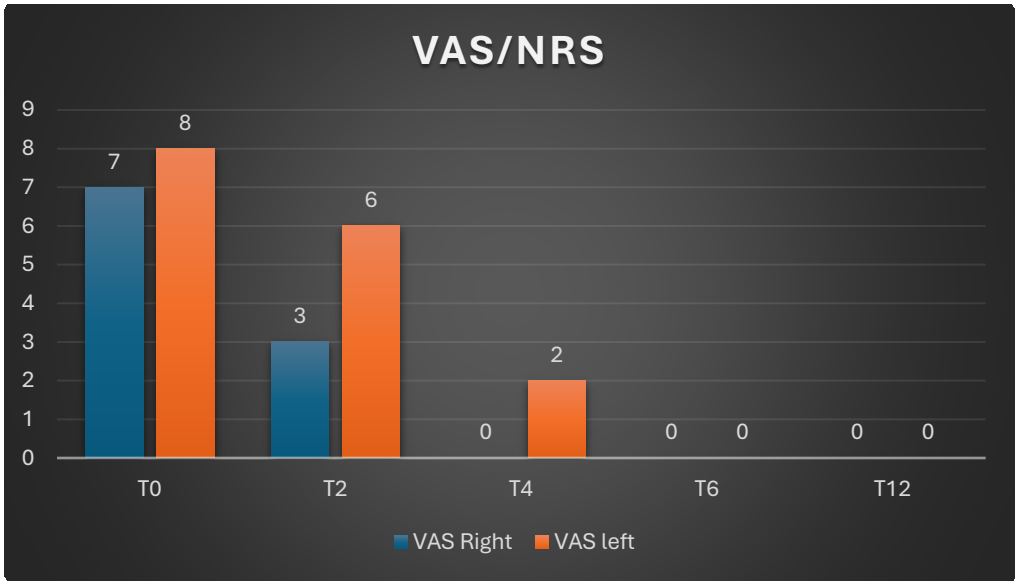

Fig. 8. *The VAS/NRS scale demonstrates rapid improvement in pain and inflammation from the second to the fourth session.*

Quantum Molecular Resonance (QMR®) was employed as a treatment with potential anti-inflammatory effects mediated through immunomodulation, reducing M1 macrophage activity and promoting polarization toward M2 macrophages, thereby facilitating inflammation resolution and harmonious tissue regeneration. These effects allowed symptom control without the need for NSAIDs or corticosteroid therapy, reducing the risk of fibrotic progression in delayed filler-induced inflammation.

Four weeks after the end of treatment, the clinical outcome remained stable, and the patient reported a high level of satisfaction.

DISCUSSION

De Santis and Cassuto (30, 31) report that fillers can trigger inflammatory reactions, sometimes causing significant functional and social impairment. Most therapeutic options used are non-specific anti-inflammatory treatments targeting a poorly defined immune response of unknown cause. In their studies, a minimally invasive intralesional laser treatment using an 808-nm diode laser with a 300-micron microfiber was employed, demonstrating the ability to remove the foreign material and inflammatory reaction. However, material removal often left facial asymmetry and visible depressions. To restore facial aesthetic units, fat grafting was performed in these patients, with a minimum six-month follow-up demonstrating treatment efficacy in 92% of cases.

The aim of our treatment, instead, was a non-invasive approach with QMR® to reduce inflammatory symptoms (pain, erythema, and tension) and prevent the formation of fibrotic nodules. Symptoms improved rapidly without the use of NSAIDs or corticosteroids; no fibrotic progression occurred, and the implant remained intact.

In a previous study, Hong, Han, and Yang (32) described a non-invasive approach to reduce inflammatory reactions and granuloma formation from gluteal fillers, using high-intensity focused ultrasound (HIFU) combined with QMR®. The patient was a 52-year-old woman with recurrent hard nodules from poly-L-lactic acid and hyaluronic acid fillers, which had appeared four months earlier and were unsuccessfully treated with hyaluronidase and systemic antibiotics. The technology aimed to reduce inflammation and stimulate tissue regeneration via stem cells, using sixteen low-intensity frequencies between 4 MHz and 64 MHz, without

generating heat in deep tissues. The authors attributed therapeutic success to tissue remodeling induced by electrical energy.

In our case, treatment reduced pain and edema, but, most importantly, controlled the fibrotic evolution of the inflamed tissue, preventing nodule and scar formation (33).

From an immunological perspective, a growing number of studies have highlighted the role of M2 macrophages in resolving inflammation and promoting soft tissue regeneration. Recent evidence confirms that the transition from pro-inflammatory M1 phenotypes to pro-reparative M2 phenotypes is a critical step for modulating the inflammatory microenvironment and preventing fibrosis. Experimental studies published in recent years also suggest that non-thermal biophysical stimuli, including QMR®-related technologies, can influence this polarization by modulating TNF-α, IL-1β, IL-10, and TGF-β secretion (34, 35).

Polarization toward M2 phenotypes has been associated with a reduction of pro-inflammatory mediators and an increase in regenerative growth factors, including TGF-β, VEGF, and IGF-1, with potential benefits for neovascularization and extracellular matrix (ECM) reorganization. Some experimental studies also indicate that QMR® may modulate key pathways, such as NF-κB and possibly STAT3, which are central regulators of macrophage activity. Such modulation could reduce pro-inflammatory activation and promote anti-fibrotic gene expression, although these mechanisms require confirmation in controlled studies (36).

ECM remodeling is a key factor in the development of fibrosis and soft-tissue complications. As highlighted by Karsdal et al., the ECM is not merely a structural scaffold but actively participates in fibrosis progression (37).

The use of QMR® may help reduce matrix metalloproteinase (MMP) expression, limit collagen degradation, and help prevent the perpetuation of inflammation. At the same time, it promotes the synthesis of type I and III collagen in a regular distribution, counteracting the disorganized accumulation typical of scar fibrosis (38).

Moreover, QMR® appears to favor physiological tissue remodeling by increasing VEGF expression and activating resident stem cells, mechanisms already described in response to other biophysical stimuli, with potential benefits for microcirculation and local perfusion (39, 40).

Compared to other therapeutic approaches, QMR® offers several advantages. Unlike corticosteroids, which provide rapid anti-inflammatory effects but carry risks of local immunosuppression, fat necrosis, and skin atrophy, QMR® is not associated with these events and promotes a more durable regenerative impact (41).

Compared with NSAIDs, which selectively act on the prostaglandin cascade via COX inhibition, QMR® acts upstream, modulating cellular pathways and regulating the cytokine cascade (42, 43).

Hyaluronidase remains the standard for managing complications from hyaluronic acid-based fillers; however, this approach does not prevent fibrotic evolution of granulomas, often necessitating corticosteroid injections or surgical interventions (44).

CONCLUSIONS

The purpose of this case report is to share the effectiveness of Quantum Molecular Resonance (QMR®) in the non-invasive treatment of delayed inflammatory reactions to hyaluronic acid gluteal fillers. Traditionally, management of such complications includes antibiotic therapy, corticosteroids, possible aspiration or hyaluronidase use, and, in severe cases, surgical intervention.

In the reported case, the patient requested to avoid corticosteroid therapy; therefore, QMR® was employed, resulting in a rapid and complete anti-inflammatory response without proliferative fibrotic evolution and with preservation of the implant.

The already documented anti-inflammatory and regenerative actions of QMR® in gynecology, orthopedics, rehabilitation, and tissue engineering justify interest in a method capable of directly transferring energy to

atomic bonds without inducing tissue hyperthermia. This bioelectronic stimulation alters the molecular energy state of tissues, activating regenerative cellular and molecular processes (44).

Being non-invasive and free from local thermal increase, QMR® is indicated for regenerative treatments in aesthetic aging-related conditions, physiotherapy, and non-invasive clinical medicine, due to its ability to modulate inflammation and regulate stem cell gene expression during reparative processes.

This case report originates from the observation of a positive outcome in a specific clinical case, demonstrating QMR® as a potential adjunct to conventional therapies or a biologically targeted alternative in selected cases. The present publication aims to reflect on the physical and biological mechanisms underlying the therapeutic result, providing a molecular rationale to support early use of QMR® in filler-related complications or other conditions characterized by inflammation and risk of fibrotic scarring.

FUTURE PERSPECTIVES

In light of the results observed in this case, future research should include multicenter studies on larger populations to verify the effectiveness of QMR® in managing inflammatory reactions to fillers and to reduce potential biases inherent in single-case observations. Randomized controlled trials comparing QMR® with conventional treatments such as corticosteroids, hyaluronidase, and physical therapies will be essential. Further investigation of the mechanism of action should include targeted histological and molecular analyses to clarify M1/M2 macrophage modulation and involvement of NF-κB and STAT pathways. In vitro studies on fibroblasts and stromal cells could provide detailed insights into the effects of QMR® on extracellular matrix remodeling. Finally, long-term follow-up will be necessary to assess the durability of outcomes, monitor potential fibrotic recurrences, and confirm implant integrity. Collectively, these research avenues will help define the clinical positioning and potential value of QMR® in regenerative aesthetic medicine.

Ethical Compliance

In compliance with medical ethics, appropriate patient information, and the Declaration of Helsinki on the protection of life, health, confidentiality, and human dignity, particularly in the context of a patient with a recent oncological history, informed consent regarding the aims, procedures, and rationale of the adopted strategy was obtained and shared in advance. This therapeutic strategy aimed to achieve the safest, least invasive resolution of the condition, with data published anonymously.

Conflict of Interest

This work relates to a clinical case of filler reaction treated with Quantum Molecular Resonance (QMR®), a technique used in neurosurgery, physiotherapy, dermatology, and regenerative medicine, which has already demonstrated efficacy in similar complications. The decision to publish this case was made to better understand the mechanisms of action underlying its effectiveness, requiring consultation with electronic bioengineers experienced in QMR. Gianantonio Pozzato is the inventor of the technology and holder of international patents, with extensive knowledge of the various QMR mechanisms, having co-authored several scientific publications on QMR across different medical specialties with multiple universities. Alessandro Pozzato and Elisa Bertoncello are electronic bioengineers dedicated to QMR research, employed by Telea Electronic Engineering S.r.l., Sandrigo (VI), Italy, the company holding the rights to use QMR® in regenerative and anti-inflammatory medicine. Irene Favaro is an electronic bioengineer in Telea, dedicated to Oncology Research. Telea Electronic Engineering S.r.l. did not provide funding and had no role in study design, data collection, analysis, or interpretation, manuscript preparation, or publication decisions; their

involvement was limited to technical consultation and review on QMR® technology to clarify mechanisms of action. All other authors declare no conflicts of interest.

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