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CASE REPORT



## Resolution of post-traumatic lumbar disc herniation following diamagnetic therapy: a case report

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### ABSTRACT

Lumbar disc herniation is a common cause of low back pain leading to significant functional impairment. High-intensity, low-frequency pulsed electromagnetic field (Diamagnetic therapy) gained attention to treating several diseases. We report a 47-year-old man with severe post-traumatic low back pain radiating bilaterally to the lower limbs (VAS: 8; Douleur-Neuropathique-4: 5/10). MRI showed an annulus fibrosus fissure and a partially extruded left paramedian L4–L5 disc herniation compressing the dural sac. Pharmacological treatments (NSAIDs, corticosteroids, opioids, muscle relaxants) and physical therapy (Capacitive and resistive electric transfer therapy) provided no benefit. At presentation to our Pain Room, clinical findings included positive Lasegue at 30°, bilateral Valleix signs, paraspinal tenderness, and significant quality-of-life impairment (SF-36). The patient underwent a full course of diamagnetic therapy after providing written informed consent and following ethics committee approval. After 16 sessions (twice weekly, 20 minutes each; high-intensity fluids off/biostimulation), the VAS score decreased to 0/10 and the Douleur-Neuropathique-4 to 0/10, with MRI evidence of herniation resorption. This case illustrates that diamagnetic therapy improved the patient's clinical condition in refractory post-traumatic low disc herniation, supporting its potential as a promising noninvasive option for selected patients, although further controlled studies are required to confirm its efficacy.

### PLAIN LANGUAGE SUMMARY

Low back pain is very common and can strongly affect a person's daily life. Occasionally the pain is caused by a slipped or herniated disc in the spine, which can press on nerves and lead to pain spreading to the legs. Many patients improve with medicines and physical therapy, but others do not. We describe the case of a 47-year-old man with very severe lower back pain and pain radiating to both legs. He tried several treatments (i.e. anti-inflammatory drugs, corticosteroids, muscle relaxants, painkillers, and physical therapy) but none of them helped. A magnetic resonance imaging (MRI) scan showed a herniated disc in the lumbar spine. Because his symptoms persisted, he started a noninvasive treatment called diamagnetic therapy, which uses controlled electromagnetic fields to reduce inflammation and pain. After two months of treatment, his pain disappeared completely. He was able to move his back again, and the MRI scan showed that the herniated disc had gotten smaller. He remained pain-free three months later, and no side effects were reported. This case suggests that diamagnetic therapy may be a clinically efficacious and safe option for patients with disc herniation who do not respond to standard treatments. More research is needed to confirm these findings in larger groups of patients.

### ARTICLE HISTORY

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### KEYWORDS

Low back pain; acute pain; quality of life; herniated disc; pulsed therapy

## 1. Introduction

Lumbar disc herniation represents one of the most severe forms of disc pathology [1], often occurring at a relatively young age and resulting in low back pain (LBP) [2]. LBP may manifest with a wide range of symptoms, from nociceptive – inflammatory pain to neuropathic features such as tingling, numbness, and pricking sensations, leading to impairing patients' quality of life and increasing public health costs [3]. According to the North American Spine Society guidelines [4], non-surgical management is the first-line treatment for patients with disc herniation and lumbar radiculopathy. Educational and psychological interventions, exercise therapy, and pharmacological treatment may be recommended [5]. Commonly used medications in primary

care include nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, muscle relaxants, and opioids [6]. In cases of mixed pain with a neuropathic component, serotonin – norepinephrine reuptake inhibitors (SNRIs), tricyclic antidepressants (e.g., duloxetine and amitriptyline), and anticonvulsants (i.e., gabapentoids) are considered appropriate therapeutic options [7,8]. To minimize the risk of adverse drug reactions, non-pharmacological treatments, such as laser therapy, capacitive and resistive electric transfer (TECAR) therapy, and diamagnetic therapy, can be added to reduce pain and discomfort [9–11]. High-intensity, low-frequency pulsed electromagnetic field (PEMF) (Diamagnetic therapy), exerts a unique physical effect that enables the movement of water molecules within tissues

### Article highlights

- A 47-year-old man presented with severe, disabling post-traumatic low back pain, radiating bilaterally to the lower limbs, with both nociceptive and neuropathic components (VAS 8; DN4 5/10).
- Lumbar MRI revealed a fissure of the annulus fibrosus and a left paramedian L4–L5 disc herniation, partially extruded and compressing the dural sac, with a sagittal protrusion length of 16.10 mm.
- Conventional treatments – including NSAIDs, corticosteroids, opioids, myorelaxants, and TECAR therapy – failed to provide any clinical benefit.
- Diamagnetic therapy was initiated after full ethical approval and informed consent, and the patient completed the treatment without adverse events.
- Significant clinical improvement was observed by the end of treatment, with complete pain resolution (VAS 0/10), disappearance of neuropathic symptoms, normalized spinal mobility, and negative Lasegue test.
- Follow-up MRI demonstrated a reduction in the L4–L5 disc herniation, supporting the radiological effectiveness of the therapy.
- The patient remained asymptomatic at 3-month follow-up, showing durable clinical benefit and excellent treatment adherence.

[12,13]. We previously documented the beneficial effects of diamagnetic therapy in LBP [14], demonstrating improvements in pain and quality of life. More recently, we reported the resolution of cervical myelopathy on magnetic resonance imaging (MRI) following diamagnetic therapy [15]. Diamagnetic therapy achieves clinical efficacy through a triple mechanism of action: an anti-inflammatory effect mediated by cytokine reduction, including modulation of adenosine receptors and nuclear factor kappa-light-chain-enhancer of activated B cells (NF- $\kappa$ B) [16–18]; an anti-edematous effect involving pro-angiogenic activity, reduction of inflammation, and fluid mobilization through diamagnetic forces [19–21]; and a neuroprotective effect, which is particularly beneficial in the presence of neuropathic pain [22–24]. Therefore, this technique could be useful in patients with pain edema and inflammation.

While spontaneous low disc herniation resorption occurs in ~66% at 1 year [1], therapy-attributed cases are rare [25]; this is the first report of diamagnetic-induced resorption with serial MRI.

In this study, we provided a case of disc resorption using diamagnetic therapy in a patient with acute post-traumatic lumbar disc herniation inducing LBP. The study followed the principles of the Declaration of Helsinki and was approved by the Calabria Regional Ethics Committee, Italy (approval number 53/2025).

## 2. Case presentation

A 47-year-old Caucasian man (height 173 cm, weight 73 kg, BMI 24) presented on 25 March 2025 to the Pain Medicine Unit of Dulbecco University Hospital in Catanzaro, Italy, with a two-month history of severe lower back pain (visual analogue scale (VAS): 8) (Figure 1). VAS, measures pain intensity on a 10-cm line, where 0 represents “no pain” and 10 represents “worst imaginable pain.” The patient history revealed that on 14 February 2025, after a padel match, he developed acute low back pain radiating to the posterior thighs and calves bilaterally. The symptoms worsened with bending, sitting, and walking, and were relieved only in the supine position. He experienced significant sleep disturbance and reported inability to perform daily activities and work. After one week of unsuccessful NSAID therapy, he underwent a neurosurgical evaluation. Radiological spine evaluation ruled out a spine fracture; lumbar disc herniation was suspected, and a lumbar MRI was recommended. On 13 March 2025, MRI showed an annulus fibrosus fissure with a partially expelled left paramedian L4–L5 disc herniation compressing the dural sac and partially involving the ipsilateral foraminal canal. The sagittal protrusion of the L4–L5 intervertebral disc, measured on a PACS (Picture archiving and communication system) workstation, was 16.10 mm (Figure 2(A)), while the spinal canal diameter on axial view measured 12.16 mm (Figure 2(B)). A diagnosis of post-traumatic extruded lumbar disc herniation was established, and surgery was suggested. However, as the patient declined surgery; a conservative approach was recommended to reduce the LBP. This included corticosteroids (betamethasone 4 mg every 12 hours) and muscle relaxant (thiocolchicoside 4 mg every 12 hours), without benefit. Ten days later, NSAIDs (paracetamol 1000 mg every 12 hours and diclofenac 150 mg every 12 hours) and opioids

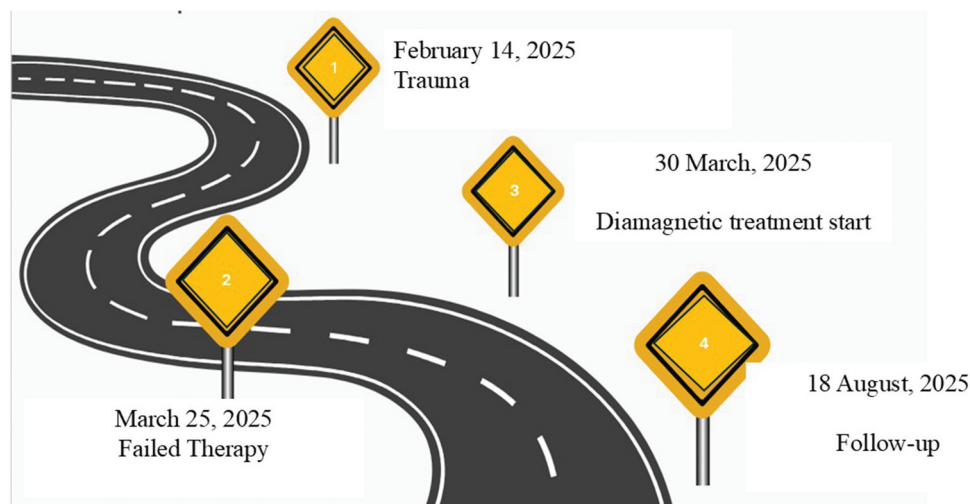
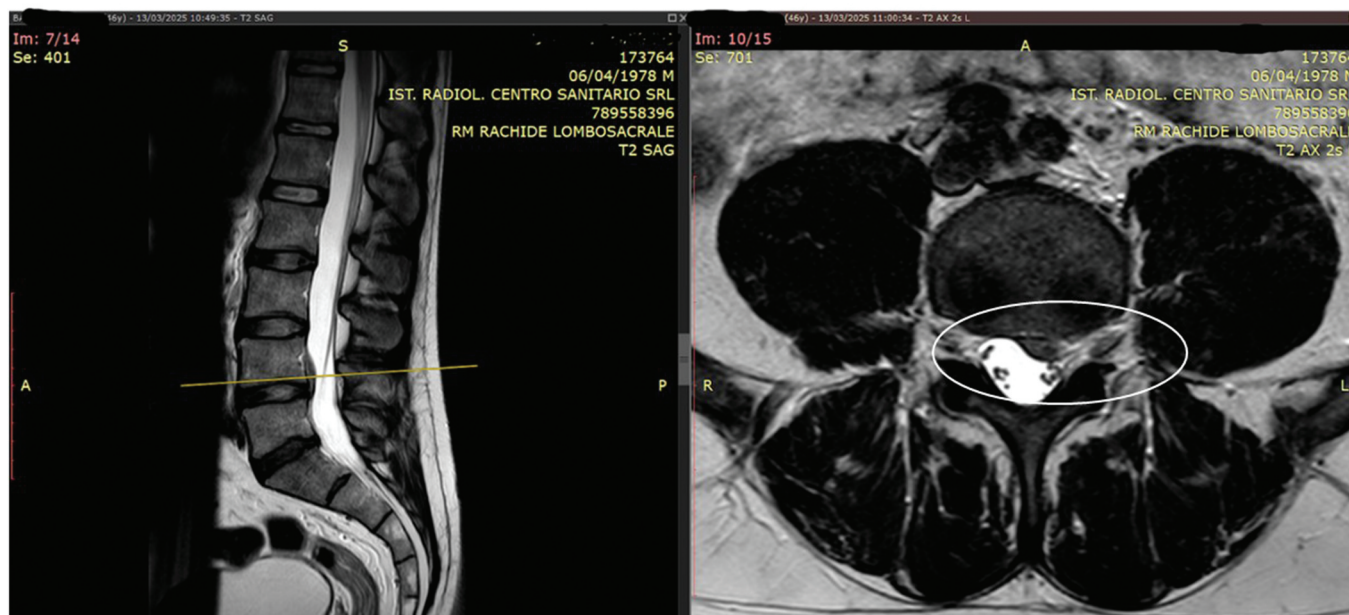


Figure 1. Timeline of lumbar disc herniation treatment.



**Figure 2.** Magnetic resonance imaging (March 13, 2025). Sagittal view revealed a central disc extrusion at L4/L5, causing severe spinal canal stenosis and compression of the descending L5 nerve roots bilaterally within the central canal. Axial view revealed at L4/L5, a severe-sized central disc extrusion, causing severe spinal compression of the descending L5 nerve roots within the central canal (white circle).

(tramadol 100 mg daily) were added, with no improvement. The patient also underwent five sessions of TECAR therapy, without clinical benefit. He therefore sought our consultation on 25 March 2025. History was unremarkable for genetic or familial disorders, traumatic events, fractures, surgical interventions, or other chronic medical conditions. Clinical examination revealed limitations of lumbosacral mobility, including an inability to perform forward trunk flexion or engage in weightlifting, bilateral positive Valleix signs between L3 and L5, severe lumbar discomfort, and tenderness in the paraspinal region. The Lasegue test was positive at 30° bilaterally. Tinel's sign and the supination test were also positive. Piriformis syndrome was excluded, as both Freiberg's sign and the piriformis test were negative. Motor strength, muscle tone, Achilles tendon reflexes, sensory function, and pathological reflexes in both lower limbs were normal. Pain was radiated to both legs, and exhibited both nociceptive and neuropathic components (Douleur Neuropathique 4 (DN4): 5/10). The Short Form Health Survey 36 (SF-36) showed a severe decline in quality of life (Table 1). The diagnosis of post-traumatic disc herniation – induced low back pain was confirmed, and the patient subsequently commenced diamagnetic therapy (CTU MEGA 20®;

**Table 1.** Evaluation by Short Form Health Survey 36 questionnaire during the admission (T0) and two months later (end of diamagnetic treatment: T1). Student t test was used to evaluate the difference between T1 and T0.

Items	T0	T1	p
Physical functioning	40	90	<0.01
Role limitations due to physical health	0	100	<0.01
Role limitations due to emotional problems	0	100	<0.01
Energy fatigue	50	65	<0.01
Emotional well being	52	88	<0.01
Social functioning	37.5	75	<0.01
Pain	22.5	90	<0.01
General health	35	70	<0.01
Health change	0	50	<0.01

**Table 2.** Diamagnetic therapy protocol. The treatment starts in moving liquids in the target area, modulate pain, stimulation of peripheral nerves. Magnetic flux density was 86 millitesla at the site of treatment.

Treatment	Time	Intensity
Liquids Off	5 minutes	Extra: 60% Intra 20%
Biostimulation Cartilage Bone	5 minutes	6 Hz
Biostimulation Nerve Slow	5 minutes	4 Hz
Pain Control	5 minutes	Neuropathic 6 Hz

Periso SA, Pazzallo, Switzerland), scheduled over an 8-week period (one session per week; eight sessions in total) using a combined protocol (see Table 2). Each 20-minute session was conducted with the patient in the prone position. The patient was fully informed about the therapeutic protocol, and written informed consent was obtained prior to treatment initiation.

During the treatment, the patient experienced progressive improvement in all symptoms. Two months later (T1, end of treatment), clinical evaluation showed complete resolution of pain (VAS 0/10) and neuropathic symptoms (DN4 0/10) (Table 1). Spinal mobility was 70° anterior flexion, 15° dorsiflexion, 30° left lateral flexion, 30° right lateral flexion, 30° left rotation, and 30° right rotation. Paraspinal tenderness and L4–L5 radicular pain had resolved. The Lasegue test improved to 90° bilaterally. On 30 May 2025, follow-up lumbar MRI demonstrated a reduction in the L4–L5 disc herniation (Figure 3). SF-36 scores also showed marked improvement in quality of life. At the 3-month follow-up (18 August 2025), the patient remained asymptomatic. No adverse events were reported, treatment was well tolerated, and adherence was complete. The patient provided oral informed consent for the publication of this case report

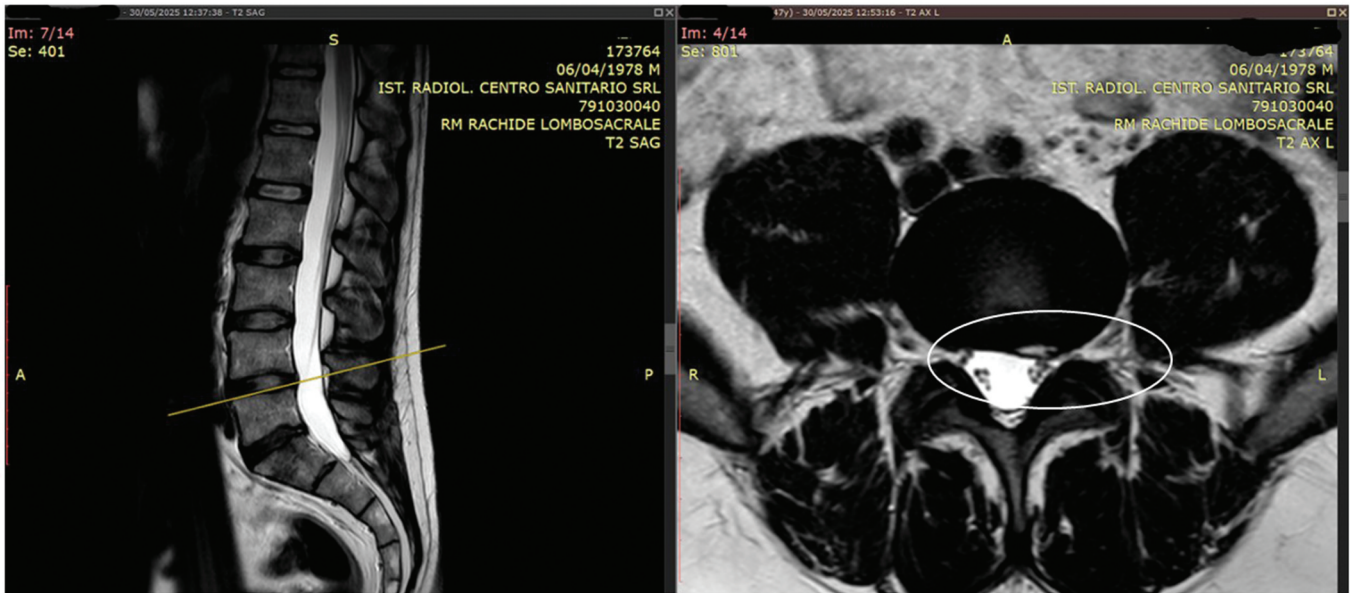


Figure 3. Magnetic resonance imaging (May 30, 2025) at follow-up. Lumbar spine revealed resorption of the L4/L5 disc extrusion (white circle).

### 3. Discussion

In this study, we report the case of a 47-year-old Caucasian man with symptomatic post-traumatic lumbar disc herniation and LBP who improved 2 months after beginning diamagnetic therapy. Traumatic lumbar disc herniation is an infrequent etiology of lumbar disc herniation, and its diagnosis can be confirmed when trauma is recognized as the principal causing factor; nevertheless, certain conditions must be met: (i) spinal fractures at the motion segment corresponding to the suspected traumatic lumbar disc herniation must be ruled out; (ii) moderate or severe degenerative changes, as well as degenerative spinal instability characterized by progressive disc height loss at the involved lumbar segment, should be excluded [26]; (iii) degenerative osteophytes at the affected motion segment must also be ruled out, given their potential to perforate the dura and result in trans- or intradural sequestration [27]; (iv) indicators of marked lumbar instability (e.g., advanced spondylolisthesis, spondylolysis, or significant scoliotic deformities) must be excluded.

In our patient, history and MRI excluded the presence of spine fracture and/or degenerative manifestation; therefore, the diagnosis of traumatic disc herniation was confirmed.

Traumatic lumbar disc herniation can cause symptoms like low back pain, sciatica, paresthesia, and muscle weakness in the legs [28]. Sciatica associated with acute LBP typically follows a favorable natural course, with recovery occurring within 2 weeks to 3 months in most patients [29]. However, in some individuals, pain persists for more than 12 months [30], while in others it progresses to a chronic condition with recurrent symptoms throughout life. In our patient, MRI confirmed a lumbar disc protrusion. Consistent with data from the literature, when the maximal cranio-caudal diameter of the disc fragment exceeds the diameter of its base at the level of the parent disc, the lesion can be classified as an extrusion [31]. To

reduce the risk of chronic pain and neurological impairment, a multidisciplinary approach is often optimal, as it improves quality of life, minimizes the risk of drug-related adverse effects, and prevents possible relapses [32]. For patients with acute or chronic LBP, with or without sciatica, the American College of Physicians recommends prioritizing non-pharmacological treatments (e.g., including massage, acupuncture, exercise therapy, superficial heat therapy, or spinal manipulation) before pharmacological interventions [33]. In this case, pharmacological treatment with corticosteroids, NSAIDs, and opioids did not produce clinical improvement; therefore, non-pharmacological management with diamagnetic therapy was initiated, resulting in clinical benefit. Recently, it has been suggested that morphological abnormalities do not always correlate with pain, and symptomatic recovery does not necessarily parallel radiological improvement or disc resorption [34]. Pain arises from a complex interplay of mechanical and metabolic factors [35]. At the site of herniation, inflammatory cytokines and tumor necrosis factors released by immune cells – such as macrophages within degenerating discs and herniated material – may trigger an immune response. Exposure of nerve roots to these irritants can lead to axonal ischemia and radicular pain [36,37]. Alongside neurophysiological mechanisms and mechanical loading, inflammation is considered a key contributor to the pain associated with disc herniation and may also play a role in disc resorption [38]. Diamagnetic therapy is a safe and effective treatment modality, with active cancer and pacemaker implantation being the only absolute contraindications [39]. The effects of PEMFs appear to be attributable to several mechanisms: (i) anti-edematous activity, through the modulation of water, ions, and biological tissues by a water-repulsive effect [40]; (ii) anti-inflammatory action, via modulation of inflammatory pathways [41]; and (iii) promotion of peripheral nerve regeneration through effects on brain-

derived neurotrophic factor (BDNF) and S100 gene expression [42]. Moreover, diamagnetic therapy is particularly valuable within multimodal treatment approaches, as it allows clinicians to reduce drug dosages, as discussed in our previous studies [14,43,44].

Although anti-inflammatory effects have been observed in experimental models, systemic inflammatory markers (i.e., C-reactive protein and erythrocyte sedimentation rate) were in the normal range in this patient, consistent with the majority of acute LBP cases related to disc herniation [45]. While inflammatory markers are typically elevated within the herniated disc itself [46], tissue samples were not obtained before or after treatment in this case. The anti-edematous properties of diamagnetic therapy may also contribute to disc herniation reduction, given that the intervertebral disc is predominantly composed of water [47]. It is noteworthy that spontaneous resorption of lumbar disc herniation is common, occurring in more than 60% of cases, particularly in the acute setting. Therefore, larger clinical studies are required to assess the comparative effectiveness of diamagnetic therapy versus placebo or standard care for improving clinical outcomes [48]. Since large-scale clinical trials are still lacking, diamagnetic therapy has been employed in the management of painful symptoms associated with spinal disorders [15] and various other pain conditions [49–51], demonstrating both efficacy and safety. However, this is the first clinical evidence not only describing symptomatic improvement but also demonstrating lumbar disc herniation resorption. This finding is likely associated with the effect of diamagnetic therapy on fluid dynamics, given that the lumbar disc is predominantly composed of water.

#### 4. Conclusions

In this case report, we documented in a patient with disc herniation-induced LBP unresponsive to other treatments, the effect of diamagnetic therapy on both clinical condition and MRI imaging. Randomized controlled trials with larger sample sizes are necessary to confirm the generalizability of this treatment.

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#### Author contributions

**Vincenzo Rania:** Conceptualization, Writing original draft; **Davide Stanà:** Methodology; **Gianmarco Marcianò:** Methodology; **Cristina Vocca:** Writing original draft; **Caterina Palleria:** Conceptualization, **Luca Gallelli:** Conceptualization, Methodology, Writing review and editing, Supervision

#### Disclosure statement

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#### Ethical declaration

The patient was informed about the protocol, and written informed consent was obtained before starting the treatment. The study follows the principles of the Declaration of Helsinki and it was also authorized by the Calabria Regional ethic committee, Italy, number 53/2025.

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