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Global postural re-education in the postoperative physiotherapeutic approach to distraction osteogenesis

Reeducación postural global en el abordaje fisioterapéutico postquirúrgico de osteogénesis por distracción

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Abstract

We present the case of a 16-year-old female patient, a native of La Paz, Bolivia, who underwent osteogenesis due to bilateral tibio-fibular distraction with the aim of correcting *genu valgus* and promoting a planned increase in height. Two months after surgery, the patient manifested severe pain in both lower limbs (VAS 9/10), marked muscle retractions, paresthesia's in the feet and a significant functional limitation, without clinical improvement despite having received 15 sessions of conventional physiotherapy based on local heat, massage therapy and electroanalgesia with transcutaneous electrical nerve stimulation. Given the poor evolution, an approach based on global postural re-education was implemented, according to Philippe Souchard, aimed at making retracted muscle chains more flexible, restoring postural control and normalizing gait. The program included 20 sessions (three per week, for 2 months), with progressive postures of global postural reeducation treatment adapted to pain tolerance. The patient showed a favorable evolution, with decreased pain (VAS 9 to 2), improvement of joint range, recovery of independent gait, postural correction, normalization of distal sensation and increased functional independence. This case shows the effectiveness of the physiotherapy approach through global postural re-education in the postoperative rehabilitation process of bone lengthening, highlighting its positive impact on the patient's comprehensive recovery.

Key words: Distraction osteogenesis, global postural re-education, physiotherapy, *genu valgus*, postoperative pain.

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Resumen

Se presenta el caso de una paciente de sexo femenino de 16 años de edad, natural de La Paz-Bolivia, sometida a osteogénesis por distracción bilateral tibio-peronea con el objetivo de corregir *genu valgo* y favorecer un incremento estatural planificado. A los dos meses de la cirugía, la paciente manifestaba dolor severo en ambos miembros inferiores (EVA 9/10), retracciones musculares marcadas, parestesias en pies y una limitación funcional significativa, sin mejoría clínica pese a haber recibido 15 sesiones de fisioterapia convencional basadas en calor local, masoterapia y electroanalgesia con estimulación nerviosa eléctrica transcutánea. Ante la escasa evolución se implementó un abordaje basado en reeducación postural global, según Philippe Souchard, orientado a flexibilizar cadenas musculares retraídas, restablecer el control postural y normalizar la marcha. El programa incluyó 20 sesiones (tres por semana, durante 2 meses), con posturas progresivas de tratamiento de reeducación postural global adaptadas a la tolerancia al dolor. La paciente mostró evolución favorable, con disminución del dolor (EVA 9 a 2), mejoría del rango articular, recuperación de la marcha independiente, corrección postural, normalización de la sensibilidad distal y aumento de la independencia funcional. Este caso evidencia la efectividad del abordaje fisioterapéutico mediante reeducación postural global en el proceso de rehabilitación post operatoria de alargamiento óseo, destacando su impacto positivo en la recuperación integral de la paciente

Palabras clave: Osteogénesis por distracción, reeducación postural global, fisioterapia, *genu valgo*, dolor postquirúrgico.

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Introduction

Distraction osteogenesis is a surgical technique that enables bone lengthening through the progressive and controlled separation of a previously osteotomized bone. This procedure, based on the principles described by Ilizarov[1], is widely used in the treatment of limb length discrepancies, angular deformities, and even for aesthetic purposes such as height augmentation[2-6].

However, this process generates significant biomechanical and physiological stress, both from the surgical trauma itself and from the sustained tissue traction over several weeks[7]. These factors may lead to pain, paresthesia, muscle contractures, postural alterations, motor control loss, and, over time, muscle mass reduction[3,7,8]. Such consequences of tissue distraction have been extensively documented in the literature[6,7] and can prolong functional disability, compromise the patient's quality of life if not addressed comprehensively. This makes postoperative physiotherapeutic intervention essential[9].

In this context, physiotherapy plays a crucial role not only in pain relief but also in movement reeducation, postural recovery, and functional restoration. Global Postural Reeducation (GPR), proposed by Philippe Souchard[2], is a therapeutic strategy that views the body as an interdependent functional unit, acting on the muscular chains that determine posture and movement. Through sustained active stretching postures, it seeks to restore tonic balance, body symmetry, and biomechanical efficiency[2].

Accordingly, we present the clinical case of an ado -lescent patient with functional sequelae following distraction osteogenesis, in whom a GPR program was implemented with clinically relevant outcomes in terms of pain reduction, mobility, postural alignment, and gait improvement.

Case Presentation

A 16-year-old female patient, student, born and residing in La Paz, Bolivia, with no relevant pathological history, was diagnosed with bilateral *genu valgum*, evident since childhood, without having received prior orthopedic or physiotherapeutic treatment. At the onset of adolescence, the deformity became more pronounced, causing concern for the patient and prompting consultation with the trauma service, where surgical treatment was indicated. She underwent elective bilateral tibio-fibular distraction osteogenesis (Figure 1), with the dual purpose of correcting the angular deviation and achieving a planned height increase of 5 cm.



Figure 1 Bilateral bone distractor for tibio-fibular osteogenesis

Following surgery, the patient attended weekly orthopedic follow-up visits for adjustment of the bone distractor and progressive lengthening. However, after two months she developed severe pain (VAS 9/10) in both lower limbs, accompanied by distal paresthesia's, stiffness, and Musculo-tendinous retractions predominantly affecting the ankle and knee joints, mainly due to the presence of the distractor device. These complications resulted in difficulty with independent postural changes (Figure 2), as well as marked limitations in standing and walking, even with the use of a four-point walker.



Figure 2 Functional limitation for postural change due to the use of a bone distracting apparatus

After completing 15 sessions of conventional physiotherapy prescribed by the orthopedic team consisting of local heat application, massage therapy, and electroanalgesia with TENS without evidence of functional improvement or significant pain relief, the patient's mother sought a second physiotherapeutic opinion. From this point, the intervention described in the present study was initiated.

Initial Evaluation

During assessment, the following findings were observed: i) Severe retractions in the posterior muscular chain (hamstrings, triceps surae, and spinal erectors). ii) Hypertonia of the hip and knee flexors. iii) Posture with slight hip and knee flexion, loss of postural axis, and increased base of support in standing and gait. iv) Limited joint range of motion: knee extension -10° bilaterally, knee flexion restricted to 90° due to the distractor device, and ankle dorsiflexion -15° bilaterally (Figure 3). v) Claudicant gait with foot dragging, markedly reduced swing phase (practically absent), and unstable stance phase with forefoot contact at initial strike. vi) Sensory alterations with paresthesia's and dysesthesias in both feet. vii) Moderate dependence according to the Barthel Index (55 points).



Figure 3 Limitation of the articular range of the bilateral knee and ankle due to the use of a bone distractor apparatus

Psychologically, the patient expressed frustration, anxiety related to pain, and fear of movement (kinesiophobia), which further accentuated muscle rigidity and persistence of pain. Based on this, the following physiotherapeutic objectives were established: i) Reduce pain and normalize muscle tone. ii) Restore joint mobility and myofascial extensibility. iii) Reeducate posture and facilitate independent gait. iv) Reestablish functionality and autonomy in activities of daily living.

A program based on GPR was implemented, with a frequency of three sessions per week over two months (20 sessions), using different treatment

postures according to the patient's clinical evolution and pain tolerance. Progression was structured as follows:

Initial phase (sessions 1-5): Due to intense pain, the "standing against the wall" posture was used as the starting position, promoting body awareness and gentle posterior chain elongation without discomfort. Costo-diaphragmatic breathing and progressive relaxation were also practiced. Assisted gait reeducation was initiated with a walker for 1-2 meters.

Intermediate phase (sessions 6-10): With pain reduction (VAS 5/10), the "ballerina posture" (standing, leaning forward) was introduced, aimed at hip opening and elongation of the posterior–inferior chain. The focus was on improving eccentric control and lower limb alignment. Ambulation distance was increased to 3-5 meters with crutches.

Advanced phase (sessions 11-20): Progression to the "seated posture" with trunk flexion facilitated flexibility gains in hamstrings and gastrocnemius, as well as lumbar spine reeducation. Active pelvic control and balance retraining in standing and gait were emphasized, with greater pain tolerance enabling independent ambulation over longer distances (>10 m). In the final three sessions, stair ascent and descent were practiced with unilateral support (handrail, crutches, or assistance).

Throughout the process, respiratory techniques characteristic of GPR (elongation during expiration), guided manual correction, proprioceptive work, and conscious postural control were combined[10].

Results and evolution

As shown in Table 1, the clinical-evolutionary outcomes were as follows:

Pain: Progressive reduction from VAS 9 to 5 within the first five sessions, and VAS 2 from the 16th session onward.

Joint range of motion: Knee extension improved from -10° to 0°; ankle dorsiflexion from -15° to 0°.

Gait: Gradual recovery, initially with walker assistance, then with crutches, and finally independent ambulation >10 m. Additionally, the patient achieved stair ascent and descent with unilateral support.

Posture: Transition from trunk, hip, and knee flexion with anterior support (walker) to neutral, aligned bipedal stance.

Sensitivity: Complete normalization of paresthesia's.

Functionality: Improvement in the Barthel Index, progressing from moderate dependence to near independence (95 points).

Table 1 Results of clinical and functional evolution

Parameter evaluated	Home	Final	Observed Change
Pain (EVA)	9/10	2/10	Significant decrease in pain
Knee extension	-10°	0°	Full Recovery
Ankle dorsiflexion	-15°	0°	Normalization of joint range
March	3 m with walker	>10 m without assistance	Functional recovery
Posture	Hip and knee flexion	Neutral and aligned	Postural correction
Sensitivity	Paresthesias	Normal	Sensory recovery
Barthel scale	Moderate dependence	Almost independent	Global improvement

Discussion

This case illustrates the functional and postural consequences derived from bilateral tibio-fibular distraction osteogenesis, where prolonged bone traction and partial immobilization of the lower limbs induce tonic-muscular imbalances, joint stiffness, and loss of motor control, affecting the body globally.

In this context, physiotherapeutic intervention plays a crucial role in comprehensive rehabilitation during the use of the distractor device and after the surgical procedure[7]. However, the available literature mainly focuses on physical therapy directed at the operated segment[11]. Conventional physiotherapy, centered on passive modalities, does not adequately address postural reorganization or movement reeducation, which explains the slow functional recovery observed in many patients.

GPR provided a holistic and integrative approach, acting on shortened muscular chains and secondary biomechanical compensations. The individualized progression of postures, adjusted to the patient's tolerance, promoted sustained functional recovery consistent with the principles of movement physiology and neuromuscular control[2,12].

The favorable evolution observed aligns with the findings of Coglianese et al.[13], who reported significant improvements in pain, flexibility, and postural control in patients with chronic musculoskeletal disorders. From a biomechanical perspective, GPR contributes to tonic-postural reorganization and neuromuscular efficiency by restoring optimal muscle length and normalizing the tension length relationship[2]. This process reduces joint overload and improves movement economy, facilitating the recovery of functional gait and balance patterns.

Furthermore, the active and conscious approach stimulates proprioception, sensorimotor reeducation, and body integration key aspects in rehabilitation following bone lengthening procedures, as also highlighted by Pillastrini et al.[12]. In this case, improvements in gait, pain reduction, and recovery of functional independence demonstrate the effectiveness of the method, with benefits not only physical but also emotional and motivational.

Thus, GPR consolidates itself as a physiotherapeutic strategy that transcends conventional symptomatic intervention and promotes global recovery of human movement, in line with current principles of evidence-based and functionality-oriented physiotherapy[2].

Conclusions

Distraction osteogenesis, used for the correction of angular deformities and height augmentation, is a procedure that generates significant functional and postural repercussions due to prolonged and progressive bone traction.

Physiotherapeutic intervention plays an essential role in comprehensive rehabilitation and in maintaining bone health during the use of the distractor device and after the surgical procedure.

The approach based on GPR demonstrated clinically significant improvement in post-distraction osteogenesis treatment, with evident outcomes in pain control, postural reeducation and restoration, as well as in gait recovery and functional independence (Table 1).

GPR not only alleviated pain but also restored the patient's confidence in movement, sense of control, and bodily well-being, highlighting its physical, emotional, and motivational benefits. This case underscores the need for contemporary physiotherapy to transcend the exclusive use of passive modalities, incorporating active, educational, and

personalized strategies that foster body self-awareness and holistic patient recovery.

Funding Source

The author declares that the study funds were his own.

Conflicts of interest

The author declares that he has no conflict of interest related to this clinical case

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Ethical considerations

The study was carried out in accordance with the ethical principles of the Declaration of Helsinki14. Informed consent was obtained from the patient and her mother for the use of clinical data for academic purposes, guaranteeing confidentiality and anonymity. There were no conflicts of interest or financial compensation.

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