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Correction of Bilateral Equinus Contracture in A Paraplegic Patient with the Ilizarov Technique

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Chein-Wei Chang

Correction of equinus contracture of feet offers the chance for ambulation. The case reported here describes a 34-year-old paraplegic woman with scald burn resulted in equinus contractures of both feet associated with extensive scar formation who received the Ilizarov external skeletal fixation for the equinus correction and completed the ambulation training program. This technique offers a new horizon in the correction of joints contractures and deformities in traumatized patient as well as in patient suffering from spinal cord injury.

Key words: Ilizarov technique, Equinus contracture, Spinal cord injury, Paraplegia

INTRODUCTION

The Ilizarov technique, with the circular external skeletal fixator, was pioneered in 1951 by a Russian orthopedist and traumatologist, Gavriill A. Ilizarov. Dr. Ilizarov discovered the law of tension-stress that gradual traction on living tissues create stress which can stimulate and promote the regeneration and active growth of certain tissue structures including skin, vessel, nerve, muscle and bone [1]. The clinical application for the technique includes the treatment of unstable fracture, congenital or traumatic pseudoarthrosis, joint contracture, long bone and joint deformity, limb length discrepancy, and achondroplastic and other forms of dwarfism [2]. The present report describes the clinical application of this method to a paraplegic patient with equinus contractures secondary to scald burn in both feet.

CASE REPORT

A 34-year-old divorced paraplegic woman on social welfare, was admitted to our hospital for pressure sores management in August 1990. She had suffered from spinal cord injury and received the Harrington rod instrumentation and posterior spinal fusion 4 years ago at another teaching hospital. The patient was discharged with no rehabilitation program implicated at that time due to financial reasons. An episode of scald burn injury occurred a month later deteriorated the existing equinus contractures associated with extensive skin scars. Though confined on wheel-chair, she managed activities of daily living independently. Physical examination on her admission revealed grade IV and V pressure sores at left ischial tuberosity and sacral area respectively, as well as bilateral equinus contractures of feet (fixed in 90 degrees plantar

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flexion) and scar formation directly over the heel cords (Fig. 1). Neurologically, L1 complete paraplegia was disclosed.

Two consecutive myocutaneous flap operations for pressure sores as well as intermittent catheterization program for her neurogenic bladder were performed successfully. Because of her relatively young age, good general condition and high motivation, we decided to further pursue the goal to achieve ambulation. Since the contractures were too severe to be stretched with ordinary manipulation technique, and there were bad scars over the heel cords, the Ilizarov external fixator was decided for the equinus correction.

Using the single Kirschner wire inserted through each talus as a rotational center, two pairs of wires were passed horizontally through the tibia and fixed under tension to the circular rings of the external fixator. Similar wires were then passed transversely through the calcaneal and metatarsal bone and each was fixed to a semicircular ring.

The tibial and foot fixation rings were then connected to each other using a pair of ankle hinges, the anterior pulling rod and the posterior pushing rod (Fig. 2). Since only sagittal correction was deemed necessary for this patient, no olive was used. No soft tissue or bony procedure was performed.

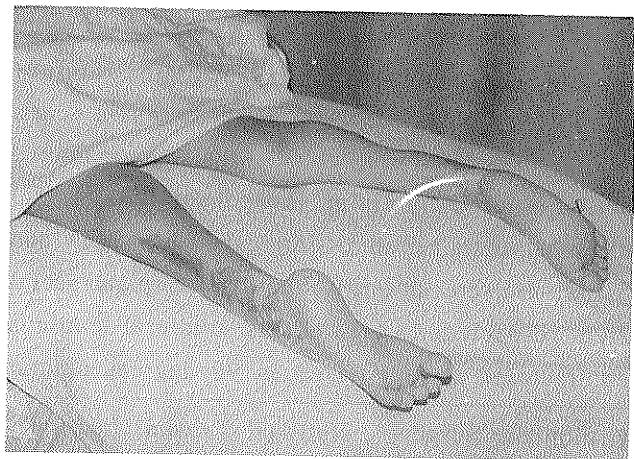


Fig. 1. Bilateral equinus contractures of feet and scar formation over the heelcords with prone position due to pressure sores.

The patient stood the operation well.

In the following two months, equinus contracture were gradually corrected by shortening the anterior rod until the feet were in 10 degrees of dorsiflexion (Fig. 3). The rate of shortening was initially 1 mm per day and was gradually adjusted to 3 mm per day. Pin-site infection, which was controlled by local care and oral antibiotics, interrupted the process momentarily. Short leg casts with rocker-bottom heels were applied immediately after the removal of the device (Fig. 4) and she started the

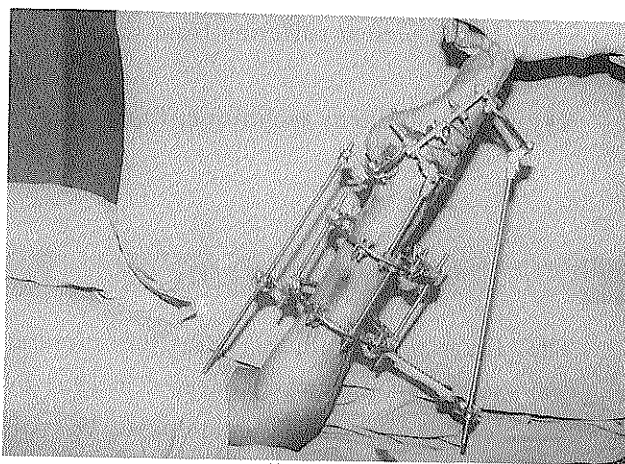


Fig. 2. The Ilizarov external fixator in position after the operation. The patient was in prone position.

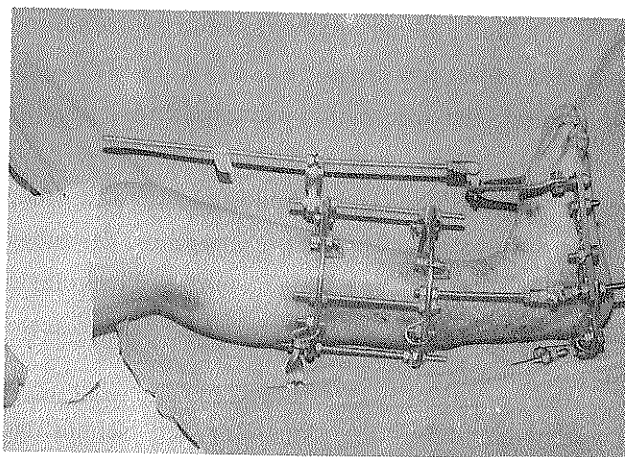


Fig. 3. Contracture correction to ten degrees of dorsiflexion. The patient was in supine position at this time.

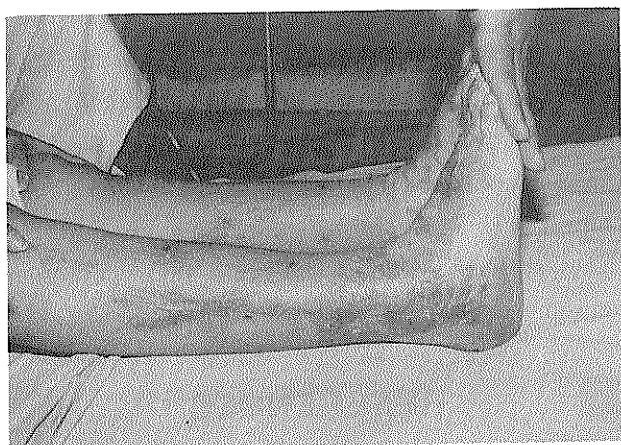


Fig. 4. After removal of the device.

ambulation program with her knee locked by gaiters to avoid kneeling. On the third month postoperatively, the short leg casts were changed to Knee-Ankle-Foot-Orthoses during the day (Fig. 5) and Ankle-Foot-Orthoses for night use and then she was



Fig. 5. Ambulation training in the parallel bar with KAFO.

discharged ambulation with four point gait using bilateral axillary crutches. After a follow up of two and a half years, the patient's condition remains the same and is free from recurrent contracture.

DISCUSSION

To our knowledge, this is the first case report of a paraplegia to receive correction of foot contracture by the Ilizarov technique. Although it took two months for our patient to complete the whole course of correction, the distraction could actually have been done by the patient at home. There were two reasons for this patient to stay in hospital. One was that she received the correction procedure immediately after she had flap operations for pressure sores and had to maintain the prone position for flap training. The other reason was that she had no suitable accommodation and was waiting for a special arrangement before we could discharge her from the hospital. The only complication our patient had, was a mild pin-site infection which interrupted the distraction procedure no more than a few days. Daily passive exercise of toes were recommended during this phase to avoid flexion contracture [3]. Steel KAFO was applied in daytime and plastic AFO during sleep after her discharge for the prevention of the recurrence of equinus as done in other reports [4].

Correction of foot deformities by the Ilizarov technique can be approached in two different ways—with or without osteotomy. The non-osteotomy method involves slow progressive correction through the joints and soft tissues of the foot. It is usually applied to the child younger than 8 years of age and has no severe fixed bony deformity, or to the adult with contracture of soft tissue, such as cavus of midfoot, varus of hindfoot and equinus of ankle. The osteotomy method is used when the foot has definite bony deformities and when the patient is older than 8 years of age [5,6]. In our case, non-osteotomy method was selected for the correction

of the equinus contracture. Through the anterior pulling rod and the posterior pushing rod, tension-stress effect was created which promoted soft tissue lengthening. And the result was satisfactory. The experimental investigations regarding the influence of the tension-stress effect on tissues have led to the hypothesis that there is a common genetic pool of hematopoietic and osteogenic stromal stem cells that is stimulated by the tension-stress effect [7]. More efforts, however, have to be made to elucidate the basic principles and characteristics of histogenesis when subjected to slowly steady distraction.

There are many options for the physiatrist to manage joint contractures produced by trauma, burns, inflammation or immobilization. The conventional therapies include ROM exercise, stretch, positioning, splinting, etc. Surgical treatments, such as tendon lengthening, tenotomy, osteotomy or joint replacement, are indicated in more complicated cases, but these procedures are technically more demanding and liable to complications such as skin necrosis, pseudoarthrosis, reduction of foot size, ligamentary laxity, scarring, non union, infection or vascular damage.

The Ilizarov technique, which is non-invasive and produces minimal complications, offers a new horizon in the correction of foot contracture and deformities. The circular fixator, which uses cross K wires for fixation, is extremely versatile, allowing for simultaneous correction of multiplanar and multidirectional deformities without the need of temporarily abstention of weight bearing on the feet. A thorough knowledge of the technique, the use of various hinges and fulcrums, cross-sectional anatomy as well as close monitoring of the patient and

even by slowing, stopping or diversing the distraction will prevent the rare complication of nerve or vascular injury related to the surgical technique or the distraction and get successful outcome. We foresee further clinical applications of the technique in contractures and deformities of other joints in patients suffering from spinal cord injury or other neuromuscular diseases in the days to come.

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應用伊利沙諾夫技術矯正下肢癱瘓 併雙側馬蹄足攣縮—病例報告

謝如蘭* 黃世傑** 連倚南 張權維

伊利沙諾夫技術可應用於肢體長短不一，骨折癒合不良、變形及關節攣縮等病患。本文報告一例脊髓損傷併下肢癱瘓，雙足呈馬蹄形攣縮及因燙傷造成嚴

重足部皮膚損傷之34歲女性病患，經接受伊利沙諾夫技術矯正其足部攣縮後，得以順利完成步行訓練之經歷。