Curr Pediatr Res2022; 26 (6): 1454-1457 *ISSN 0971-9032*
www.currentpediatrics.com

A new procedure for spastic varus/equinovarus foot in children with cerebral palsy: DePuy mitek ® bone micro-absorbable suture anchors.

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Received: *03 June, 2022, Manuscript No. AAJCP-22-65427;* ***Editor assigned:*** *06 June, 2022, PreQC No. AAJCP-22-65427 (PQ);* ***Reviewed:*** *16 June, 2022, QC No. AAJCP-22-65427;* ***Revised:*** *22 June, 2022, Manuscript No. AAJCP-22-65427(R);* ***Published:*** *29 June, 2022, DOI:10.35841/0971-9032.26.6.1454-1457.*

Abstract

We present a new bone micro-absorbable suture anchor technique for spastic varus/equinovarus foot in children with cerebral palsy. Among children, cerebral palsy is the most common serious physical disability. While spasticity is the most common form of hypertonia in Cerebral Palsy (CP) and is experienced by up to 80% of people with CP. Patients with spastic cerebral palsy often have abnormal walking posture due to long-term high muscle tension in the lower limbs, and have pointed feet and varus deformities. A common surgical treatment for spastic varus/equinovarus foot in children with cerebral palsy is tibialis anterior tendon transposition to rebuild ankle dorsiflexion function.

Previously, the transferred tibial anterior tendon was routinely fixed with bone metal suture anchors, which may cause discomfort such as restricted movement after operation, and the long-term indwelling of the anchors in the body, may lead to anchor displacement, slippage, trauma and fracture involving the anchors leading to the risk and complications of anchors removal. Because the sensitivity and mobility of the patient's toes are relatively high, it is required to minimize the damage to the tissues around the tendons and ligaments, and the absorbable suture anchor is the most delicate micro-absorbable anchor at present, and it is not easy to cause postoperative complications and discomfort such as restricted movement.

Therefore, we try to use this anchor in clinical practice, and find that the effect is satisfactory, and it also avoided the above-mentioned risks and complications of long-term indwelling of the anchors in the body. Therefore, the bone micro absorbable suture anchor of the spastic varus/equinovarus foot in children with spastic cerebral palsy is an effective technique that does not require hardware removal and is an alternative treatment option to bone metal suture anchors fixation.

Keywords: Micro absorbable suture anchor, Spastic varus/equinovarus foot, Cerebral palsy, Spasticity, Tibialis Anterior Split-Tendon Transposition, CP-MMA.

Accepted on 18th June, 2022

Introduction

According to the American foot deformity association, the spastic varus foot makes up about 38% of the foot deformities in spastic Cerebral Palsy (CP) unilaterally and 20% in bilaterally. It is mainly due to the imbalance of muscle force distribution, which leads to plantar flexion contracture of the foot, limited dorsiflexion of the ankle joint, adducted and supination deformity of the forefoot, and Achilles tendon contracture,manifested as walking on the lateral edge of the foot or toes on the ground, abnormal gait. The flexible spastic varus foot in cerebral palsy is commonly corrected with split-tendon transfers of the tibialis anterior. The goal of this study is to present the DePuy Mitek ® bone micro-absorbable suture anchor, a new technique for spastic varus/equinovarus foot that associates the advantages of surgical fixation with no need for hardware removal. Our hypothesis was that the results of this technique would be similar to those by bone metal suture anchor fixation [1,2].

Materials and Methods

We reviewed a 7 year-old boy with spastic cerebral palsy (Figure 1) who underwent left lower extremity adjustment of muscular strength and tension surgery (CP-MMA) in our hospital in August 2020, using micro-absorbable bone anchors for transposition of the tibialis anterior split-tendon to correct the varus deformity and reconstruct the ankle dorsiflexion function. The follow-up was continued, and the curative effect was satisfactory [3].

Figure 1. A 7 year old child with spastic cerebral palsy (monoplegia) mainly presented with left foot tiptoe, toes on the ground with varus deformity.

Surgical technique

Anesthesia was induced in the patient positioned prone. Under sterile conditions, a lower limb tourniquet was applied on the child's lower leg below the knee. The Achilles tendon was lengthened by 3 cm by percutaneous Achilles tendon elongation, extending the ankle dorsiflexion to 110°. The Tibialis Anterior Tendon (TAT) was exposed through a 4 cm incision in the medial foot where TAT was inserted [4].

Next, the 75% TAT was cut. And the second metatarsal bone was exposed through a lateral longitudinal skin incision in the dorsum of foot. Two bone micro-absorbable bone anchors were fixed to the hole drilled by electric drill. The TAT was extracted through the subcutaneous tunnel and adapted onto the bone anchors. Finally, the ankle was placed in functional position with a gypsum splint and all incisions were closed (Figure 2) [5].

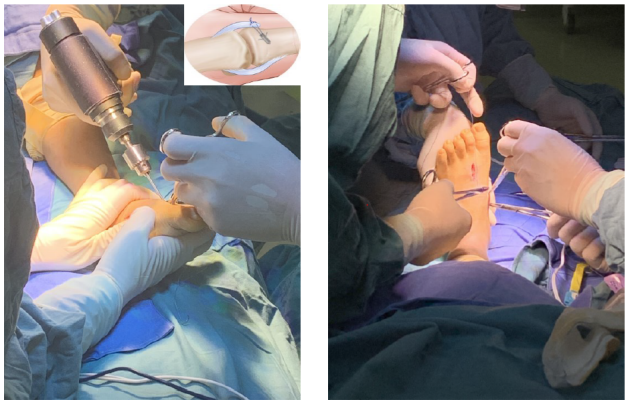

Figure 2. Intraoperative photo of cerebral palsy muscle strength muscle tension adjustment method.

Results

After two weeks, the sutures were removed from the wound, and the family members of the child were informed that they should be immobilized with the plaster splint for at least 6 weeks. He was discharged to a rehabilitation facility in non-weight bearing status. In fact, from the fifth day after the operation until the boy was discharged from the hospital, we asked the rehabilitation therapist to perform bedside training, mainly lower limb strength training and hooking training. Follow-up was conducted five and a half months after the operation, and the changes before and after the operation were compared through three-dimensional gait analysis (Table 1 and Figures 1 to 6), and it was found that the postoperative recovery effect was very satisfactory [6].

Parameters	Right		Left	
	Preoperation	Posoperation	Preoperation	Posoperation
Stretched-Ankle dorsiflexion	4	5	-7	25
Bent-Ankle dorsiflexion	19	20	-4	30

Table 1. Comparison of bilateral ankle dorsiflexion angle before and after operation in knee extension and knee flexion data from Shanghai Yueyang Gait Laboratory.

Figure 3. The DePuy Mitek ® bone micro-absorbable suture anchor.

Figure 4. Preoperative X ray of left foot and follow up X rays of the left foot after surgery.

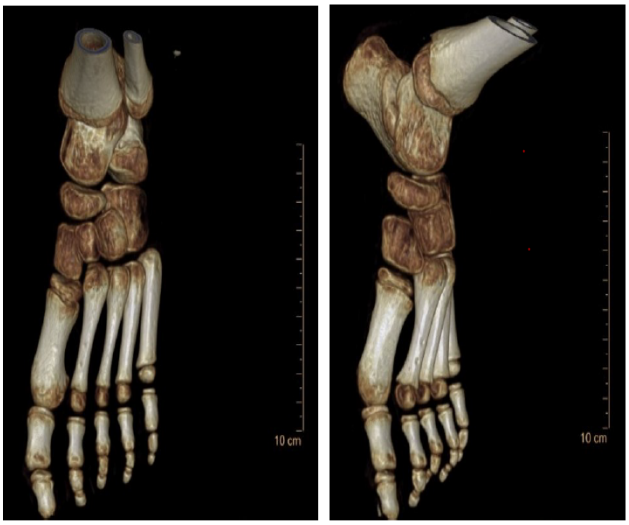

Figure 5. CT 3D reconstruction of left foot after operation.

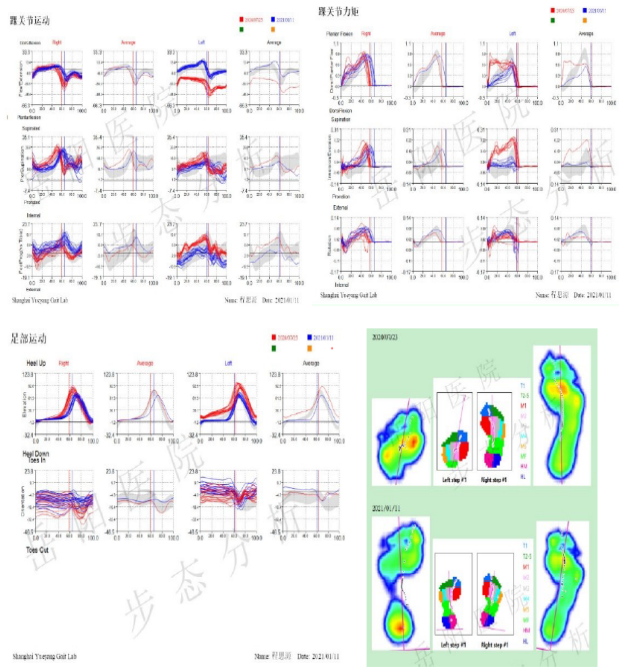

Figure 6. Comparison of bilateral ankle motion, ankle moment and foot motion before and after surgery data from Shanghai Yueyang Gait laboratory.

We did not observe any postoperative complications such as pain or instability. This snail baby (the nickname of the child with cerebral palsy) has almost no abnormality in sports with children of the same age after nearly a year of rehabilitation exercises, and could participate in various activities in physical education classes and outdoor sports [7].

Discussion

This study confirms that bone micro-absorbable suture anchor of the spastic varus/equinovarus foot in children with cerebral palsy are a reliable technique and that the result are equivalent to those of the reference metal suture anchors fixation technique. The strong points of our study are the original technique [8].

The limits to our study were the retrospective observations and early attempts and the small size of the study population (We have done a total of 6 children with cerebral palsy with varus feet, a total of 8 spastic feet with micro-absorbable bone anchors, and the remaining cases are still under follow-up) [9].

Up to now, through our follow-up, the child has not experienced any discomfort or complications after surgery. Previously, the transferred tibial anterior tendon was routinely fixed with bone metal suture anchors (Figure 7), which may cause discomfort such as restricted movement after operation, and the long-term indwelling of the anchors in the body, may lead to anchor displacement, slippage, trauma and fracture involving the anchors leading to the risk and complications of anchors removal [10,11].

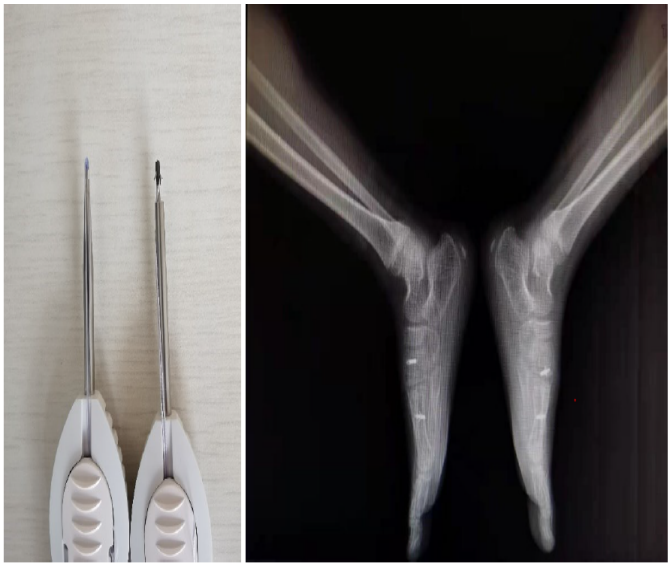

Figure 7. Comparison of micro absorbable suture bone anchor and metal bone anchor and x-ray of foot after metal bone anchor s implantation.

Conclusion

Bone micro-absorbable suture anchors are a feasible technique in clinical practice with results that are equivalent to those of conventional techniques. It is not worried about the risk of complications of taking the anchor in the future, because the body is made of the absorbable material polylactic acid. This is an obvious advantage for cost and morbidity. Learning the surgical technique requires a learning curve, and it must be rigorously applied.

Disclosure of interest

There are no competing interests between the authors.

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