Preliminary Outcome Using a New Free Motion Offloading KAFO for Postoperative Management of Hemiepiphysiodesis in Adolescent Tibia Vara

Joseph W. Whiteside CO/LO

ANATOMICAL CONCEPTS, INC.
1399 E. Western Reserve Road, Poland, OH 44514-3250 • (800) 837-3888
www.anatomicalconceptsinc.com

Introduction

Surgical treatment of adolescent tibia vara (Blounts disease) is the predominant approach for realignment[1]. Osteotomy is the most common approach but because of potential complications associated with it, gradual correction by hemiepiphysiodesis should be considered an alternative. Hemiepiphysiodesis is recommended in those patients who have <15°of varus deformity, two years of skeletal growth remaining and have less than 1cm of limb shortening[2]. Studies have shown that limb realignment is not as predictable in Blounts disease patients with hemiepiphysiodesis[3-5]. Risk factors related to failure in achieving more normal alignment include obesity, preoperative mechanical axis > 60mm, and a medial proximal tibial angle <76° [6]. The application of a custom molded Offloading Knee Ankle Foot Orthosis (OKAFO) to offset associated varus thrust of the knee along with the predictability of failure in a patient who would be deemed at risk based on current practices is the focus of this case study. The question is whether or not the use of an OKAFO would be complimentary to the hemiepiphysiodesis when documented risk factors to fail are present.

Methods

In one case study A - Patient A is a female diagnosed with adolescent tibia vara at age 10 + 6. She had a positive history of vitamin D deficiency and was premenarchal. Her mechanical axis deviation measured 67mm and the tibial angle measured 70°, both being risk factors associated with failure. It was the choice of the managing orthopedic team to proceed with a lateral proximal tibial hemiepiphysiodesis and a medial distal tibial hemiepiphysiodesis with custom OKAFO to offset varus thrust. Patient had no previous history of any invasive or non invasive treatment. The orthotist and pediatric orthopedist decided to proceed with a KAFO rather than a Knee Orthosis to better offset the external rotary forces secondary to the lateral thrust that was occurring during the gait cycle. The OKAFO of choice was of a new design, the V-Vas™ (Varum Valgum Adjustable Stress (VOKAFO). The VOKAFO was preferred because of its double upright unlocked free motion design and its ability to create an optimal bending moment to counter the varus thrust.

The specific design features of the V-Vas (figures a - 1-5) include 5/32" polypropylene posterior opening thigh and tibial cuffs to simplify the donning and doffing process. A removable terry cloth lined open cell foam lining encompasses the inside of the thigh and tibial cuffs; it is designed to be removed for washing. Oklahoma ankle joints, both medial and laterally allow relative dorsiflexion and plantarflexion while providing adequate M-L and rotational stability of the ankle and foot (figure a-1). The medial and lateral ankle joint assures that the corrective forces are maximized proximally (it has been observed in the clinical setting that the use of only one medial or lateral ankle joint reduces the effectiveness of the proximal corrective forces). The ability to provide the corrective forces leading to the resolution of the skeletal malalignment is achieved through the unique design of the V-Vas™ Joint system. Success is attained through the joint's ability to isolate measured tibial (*figure a-2), femoral (*figure a-3) and or tibio-femoral alignment (*figure a-4) either independent or dependent of each other as viewed in the coronal plane (*infantile variation shown for illustration purposes only). Optimal adjustment of the tibial and or femoral angle is achieved with the use of a hex head ball driver (figure a-5). It is believed that the resulting effect of the V-Vas™

Joint Systems dynamic adjustability capabilities provides a bending moment. This bending moment is what maintains the four point correction not only in full extension as do traditional designs, but throughout the full range of knee motion that is unique to the V-Vas™ Joint System. The unique mechanisms inherent to the overall design is what is at the heart of the VOKAFO's ability to exert the controlled corrective forces necessary to achieve the positive outcomes to date and provide a more natural environment for the developing adolescent.

Figure a-1

Figure a-2

Figure a-3

Figure a-4

Figure a-5

Preliminary Results

The initial radiographs confirmed the diagnosis of adolescent tibia vara (figure b-1) and physical exam identified a gait with exaggerated varus thrust. She was referred to the local orthotist for cast impression and associated measurements for the VOKAFO, sent for custom fabrication and the patient was fitted post operatively with his new VOKAFO. Anatomical Concepts, Inc. USA is the fabricator and distributor for the V-Vas™ Joint System VOKAFO. Orthotic treatment was initiated at the age of 11 years. At the age of 11+1, a follow up radiograph (figure b-2) was obtained. Eight months later at the age of 11+9 an additional follow radiograph was obtained (figure b-3) showing significant improvement of the medial downward slope of the tibial plateau. Improvement in varus alignment was noted as well. After sixteen months into her treatment, a follow up radiograph was obtained during the visit (figure b-4). The radiograph showed continued decreased medial slope of the tibial plateau. Additionally, the varus alignment was measured at 11°, a 12° improvement over the initial preoperative measurement of 23°. At this follow up visit, it was necessary to re measure for a new VKAFO due to growth and normal wear and tear. A decision was made by the orthopedist to remove the distal tibial plate to offset overcorrecting the alignment of the ankle.

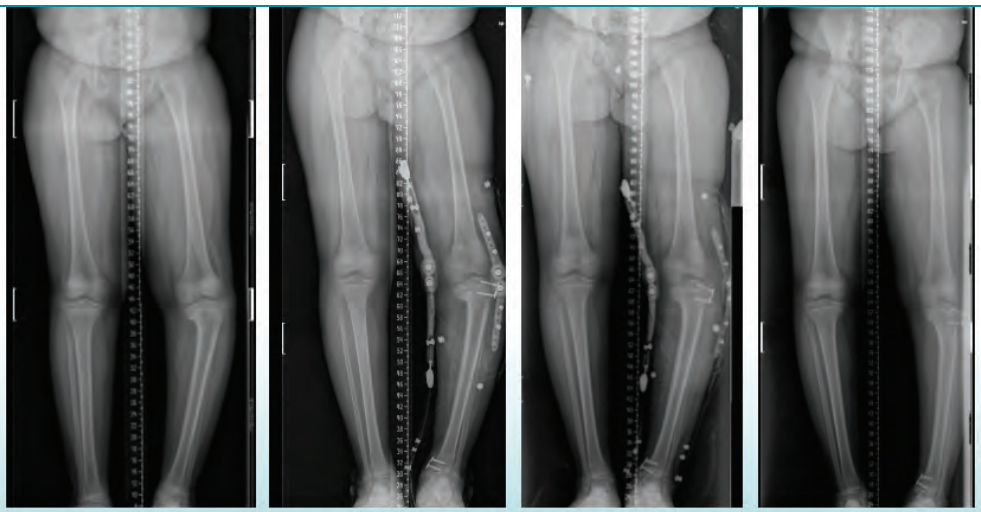

Figure b-1 Figure b-2 Figure b-3 Figure b-4

Conclusion

At this preliminary stage in the patient's treatment, the use of the VOKAFO has shown favorable results in obtaining ongoing realignment of the tibia even though the patient had risk factors associated with failure for the surgical procedure of choice. The hemiepiphysiodesis with the additional application of the VOKAFO to offset the varus thrust associated with this specific case we feel has led to the positive outcomes thus far. Lowering the medial compartment peak pressures that cause growth inhibition of the epiphysis suggested by the Heuter-Volkmann principle7, 8 most likely plays a role. Paramount to maximizing outcomes is the individual design selected and the experience of the team managing the patient. Additionally experience of the treating orthotist, compliance by the family and physicians input play a major role in the ultimate outcome. This study confirms to date, that the V-Vas™ Joint System, associated features of the VOKAFO and the associated compliance with this specific design has resulted in the optimal outcome and treatment in a non traditional application postoperatively. As of the writing of this paper no current radiographs or follow up has been documented. We are looking forward to eventual final radiographs and follow up to report final outcomes.

In principle, the use of the VOKAFO has its application in patients showing lateral thrust during gait analysis and should be considered in conjunction with less invasive and possibly more invasive surgical procedures. Preoperative management may be a consideration to focus on decreasing pain, promoting weight loss and possibly offsetting further joint instability associated with lateral thrust. Further study with a larger number of patients and long term study will be necessary to add further validity to the findings of this individual case study. The VOKAFO is a new and effective way of augmenting postoperative management of lower extremity bowing deformities and should be a primary consideration when treating such deformities in order to achieve good correction and improve patient comfort and compliance.

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Joseph W. Whiteside CO / LO has 25 years of experience in the clinical management of the neuro rehab patient.