

CASE STUDY

V-VAS™ ORTHOSIS: A NEW CONCEPT IN UNLOADER KNEE ORTHOSIS DESIGN

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The use of custom or off-the-shelf unloader knee orthoses in both single and double upright design configurations have been successfully used in the management of patients with medial compartment osteoarthritis of the knee. The mechanism to achieve this is a three point pressure system that creates the offloading of the affected compartment. How this offloading is achieved, is through a fixed or an adjustable structural frame being used as a counterforce to an adjustable strap(s) and/or an adjustable condylar pad that act as a corrective force. In more recent designs, a lengthening adjustment has been added to the proximal upright that allows for an angular shifting of the forces to create the offloading affect.

Studies have shown that the offloading forces exerted by these devices are successful in relieving pain in those patients with uni compartmental osteoarthritis during weight-bearing activities. Although these designs have been successful, many times there is a certain degree of intolerance to the unloader knee orthosis that is experienced by the patient. This intolerance is typically due to a higher concentration of pressures being exerted by the strap or condylar pad, which can limit duration of use. As offloading adjustments are being made in the double upright designs, the frame configurations of the unloader orthosis do not follow a natural progression as oriented to the long axis of the leg when viewed in the coronal plane. As the corrective forces are applied to obtain the optimal offloading affect, there is an inability to distribute these forces proportionally through the leg. This leads to an inability to better match the center of rotation of the leg as viewed in the coronal plane, which can further limit compliance. In addition, the three points of pressure used in both designs are applied by laterally or medially shifting the femur and/or tibia to offload the affected compartment. This lateral or medial shift causes a certain amount of shear to the mechanical knee joint(s) resulting in a varying degree of binding within the mechanical joint(s). This mechanical binding can further restrict the patients ability to freely flex and extend their knee during various activities of daily living. This shifting of the uprights and binding of the mechanical joint(s) that are felt by the patient can decrease the ability for the patient to comply with a single or double upright unloader knee orthosis.

The Varum Valgum adjustable stress (V-Vas™ Orthosis)¹ custom unloader knee orthosis is a new concept in treating patients who present with medial or lateral compartmental arthropathies. Its custom design incorporates several unique features that increase the effectiveness and compliance for the patient who is in need of an unloader orthosis.

Instead of using a narrow frame as seen on most all double and single upright designs it uses a total contact cuff on the thigh and tibia along with a unique adjustable self-aligning polycentric joint system to create four points of pressure instead of three. With two points of pressure being applied as a counter force (located at the proximal and distal ends of the thigh and tibial cuffs on the affected side of the leg) and two points of pressure applied as the corrective force (located at the distal and proximal ends of the thigh and tibial cuffs respectively on the non

1 V-Vas™ Orthosis is fabricated and distributed by Anatomical Concepts Inc., Poland, OH 44514-3250

affected side of the leg) to offload the affected compartment, there is no need for a condylar pad.

As compared to the single upright design, the use of a counterforce strap is not necessary once again, due to the four points of pressure used to create the bending offloading moment. This unique bending offloading moment is reproducible with each application and eliminates the subjectivity of a counterforce strap or condylar pad that are inherent in other designs. Its self-aligning polycentric hinge design, features an efficient and effective means of linearly adjusting the varum or valgum angle (depending on which compartment is affected) without causing mechanical joint binding. This is a very patient and practitioner friendly design due to the mechanical joint allowing for non-mechanical like bending of the knee and never needing re-squared. The V-Vas™ Orthosis has been very effective in the clinical management of patients with symptomatic medial compartment osteoarthritis. Other successful applications include, lateral compartment osteoarthritis, abnormal genu valgum alignment with up to 30° of semi-flexible deformity non-operative tibial plateau fractures, failed hardware or reconstruction of the tibial plateau, tibial plateau and or femoral condyle spacers and post total knee arthroplasty.

The V-Vas™ Orthosis is currently available in a custom design. The finished design consists of a polypropylene constructed posterior opening thigh and tibial cuff that include a corrugation, to increase transverse plane integrity. The V-Vas™ Orthosis is secured to the extremity via a Velcro® popliteal strap, wrap around thigh and distal tibial cuff straps. The thigh and tibial cuffs are connected via a medial and lateral self-aligning polycentric knee joint. One of the self-aligning joints (placed on the affected side of the leg) has the ability to be lengthened linearly at its proximal and distal ends. The lengthening can be adjusted proportionally or disproportionately proximally (thigh) and/or distally (tibia) to accommodate varying proportions of soft tissue compression. This linear (lengthening) adjustment is achieved via a counter clockwise rotation of the adjustment screw. The opposing self-aligning polycentric joint in the V-Vas™ Orthosis design is static and functions as a fulcrum to the adjustable self-aligning polycentric joint.

This ability to lengthen the upright in a linear motion allows for an anatomically correct varum or valgum bending offloading moment to be applied to the femur and tibia through the soft tissues via the thigh and tibial cuffs respectively. The ability to lengthen the adjustable upright either proportionally or disproportionately is how the optimal bending offloading moment is achieved. The bending offloading moment when adjusted correctly will decelerate or stop the lateral or medial thrust that is associated with knee arthropathy instability. It is the bending offloading moment and the self-aligning joint capabilities that is unique only to the V-Vas™ Orthosis joint system, leading to improved compliance and pain reduction.. The joint construction consists of a polycentric design that allows for a medial or lateral pivoting motion in the coronal plane. This pivoting motion is achieved through the use of two spherical bearings that are at each axis within the joint head. This design feature not only allows for uninhibited flexion and extension to 180°, but an ability to compensate for varying degrees of angulations as viewed in the coronal plane within the joint head. This ability to pivot accommodates the elongation of either the proximal and/ or distal upright, resulting in the self-aligning feature.





Figure 1. Shows an increase in the lateral condyle space of 5° or 5mm in a full weight-bearing position while wearing the V-Vas™ Orthosis offloading custom knee orthosis.



Figure 2. Shows the collapsed lateral condyle space in a full weight-bearing position when no orthotic intervention is used.

Suspension and anti-migration are accomplished through a removable silicon laden popliteal strap pad, thigh and tibial cuff pads.

Recent Case Study: 51 year old male, 5'11" tall and weighing 220 pounds

The radiographs of the treated leg showed a 5° or 5 mm improvement in lateral condyle separation while fully weight-bearing, using the V-Vas™ Orthosis (Figure 1) versus the radiograph of the non-treated leg (Figure 2). This bending offloading moment of the lateral compartment allowed this patient to ambulate with minimal pain while wearing the orthosis. Ultimately, wearing the V-Vas™ Orthosis allowed the patient to return to the workplace in the same capacity prior to his injury as a flight attendant.

There are many design options available to those patients needing offloading knee orthoses. We know from reviewing literature that offloading orthoses are both ethical and very effective. Their application will minimize use of medication, delay arthroplasty in the younger patient and control pain in those patients with co-morbidity. They are also used as a pre-operative tool or post operative tool to determine the success of a surgical technique or offloading of the operative compartment respectively. As health care professionals we should strive for optimal outcomes when recommending various designs. Compliance, effectiveness and efficiency in design are all key factors in achieving this optimal result in the current healthcare arena. The unique features in this new design specifically improve compliance and are an efficient and effective alternative used to achieve optimal patient outcomes.

References

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About Joseph W. Whiteside, CO/LO

Joseph W. Whiteside CO / LO has over 25 years of experience in the clinical management of patients with knee arthropathies and bowing deformities.

About Anatomical Concepts Inc. USA

Since 1990, Anatomical Concepts has developed industry-leading medical devices, custom-fit and custom-fabricated orthoses for both upper and lower extremities. Anatomical Concepts Inc. is the manufacturer and distributor of the V-Vas™ Knee Orthosis (KO) and Knee Ankle Foot Orthosis (KAFO). It is a team of practitioners, designers, and manufacturers utilizing advanced technology to develop superior products that not only deliver effective outcomes, but present ease-of-use for the medical professional. The company is the original concept developer of the PRAFO®, or Pressure Relief Ankle Foot Orthosis, used in medical facilities internationally.

Anatomical Concepts is headquartered in Poland, OH, and provides medical devices, services, and consulting both nationally and internationally. The company's innovative product line has inspired the procurement of eleven US product patents. Providing solutions for medical professionals and helping to improve patient outcomes is still the driving force behind the corporation. Anatomical Concepts, Inc. products are FDA registered and also carry the CE marking. All products, including the ELLIOTT™ and ELLIOTT II™, are designed, manufactured, and trademarked by Anatomical Concepts, Inc.

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