Design of a Variable Stiffness Ankle Foot Orthosis

By
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B.A.Sc., Queen's University, 2018

Thesis

Submitted in partial fulfillment of the requirements for the
Degree of Master of Science in Biomedical Engineering at Brown University

PROVIDENCE, RHODE ISLAND

May 2020

This thesis by Ashton Joseph Stoop is accepted in its present form
by the program in Biomedical Engineering as satisfying
the thesis requirements for the degree of Master of Science

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Acknowledgements

It's been nearly two years since stepping foot on campus to start this degree, and now as it comes to a bitter-sweet end, I wanted to take a moment to reflect on this period of time that zoomed by me and left in such a hurry.

Dad, you have always been my biggest mentor and critic. There were so many small moments that have helped to build me up as an engineer and problem solver, whether it was giving me toy tools to help you build the shed in the backyard when I was 3, or telling me that my math is wrong and that's why my simulation isn't working. There isn't enough room on this page to give the credit that is deserved.

Aaron and Sophie, there is no way that the past 2 years would have looked remotely that same had I not met you both during orientation. For better or for worse, you flipped my world upside down and gave me a new place to land. You were there with me for a lot of late nights and early mornings, times to grind and times to play, and ultimately, all of my trials and tribulations since the day we met. You were the driving force behind keeping me on course and motivated to finish this degree.

Evan, this project came out of our many months of complaining about ugly, stigmatizing AFOs, talking to startups around Toronto to see what people were working on, and deciding that we should take a crack at making something better. You have always been so willing to help me build any idea, no matter how outlandish it may have once seemed.

Gary, thank you for teaching me more about orthotic device design in the first 2 minutes of meeting you than I could have learned in the past 2 years from reading books and papers.

Professor Bull, I know that I've been a pest to you since we first met, always bugging you with ideas, but you were an instrumental part of my learning. I really appreciate all of your guidance and the way that you let me learn by doing, whether it was trying a more systems based approach in our ID class, or letting me hammer away at some parts in the BDW and helping me course correct along the way. I have always been one to learn by trying, and you never failed to give me that platform.

Dr. Kofron, you were such a prominent figure in my life at Brown from day 1. From the start, you introduced me to this new world of biomedical engineering that I was not yet familiar with, and you made sure that I was set up for success. I appreciate that you were always quick to introduce me to people or opportunities that could help me, and that you were there for not only myself, but every student in BME to be a mentor or a friend, depending on what was needed that particular day.

Dr. Crisco, first and foremost I want to say thank you for being my advisor. I know that I can be a difficult student to work with, but you always supported my decisions and helped to bail me out of tough situations more than once. You made me reflect on how I conduct myself as a student, young professional and as a person. As a mentor, you provided me with the guidance, criticism, and support that I **needed** to make it through this project, and I will carry these lessons forward with me.

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Abstract of "Design of a Variable Stiffness Ankle Foot Orthosis", by Ashton Joseph Stoop, ScM., Brown University, May 2020

Introduction: Ankle-foot-orthoses (AFOs) are common interventions for treating foot drop in patients post stroke. Current designs for passive AFOs are either optimized for heel strike and push off with a low stiffness, or for heel off with high stiffness. The goal of this study is to create a variable stiffness ankle foot orthosis (VSAFO) which can have an adjustable stiffness profile to allow for low stiffness at heel strike and push off, as well as high stiffness at heel off.

Methods: An AFO modifier was designed to be combined with a base flat blade AFO in order to meet the VSAFO design requirements. The modifier has two variations: one was made with a thermoplastic elastomer gel and the other was made with an extruded polystyrene foam. The modifiers are placed on the blade of the AFO and can be tuned to five different levels of resistance. The modifiers were tested in combination with three AFOs to determine how it affected their stiffness profiles.

Results: The findings from this study showed that the modified AFOs could meet some of the design requirements, but not all: 1) all of the combinations were able to achieve the required range of motion, 2) the modifiers were able to steadily increase AFO stiffness in RD and half of the combinations were within the required range, but they could not steadily increase stiffness in DF and none of these combinations were within range, 3) none of the combinations were able to show the required increase in stiffness from RD to DF, 4) all of the combinations (except for one) did not increase stiffness in RPF and 5) both of the modifiers weighed less than 300g.

Discussion: While the VSAFO designs did not meet all of the requirements, the results did show some promise. It was able to increase stiffness in RD and, to some extent, DF without increasing stiffness in RPF. This alone is promising because it means that there is the potential to have a higher stiffness for the ankle at heel off, while keeping a low stiffness for heel strike and push off.

Intro

An ankle-foot-orthosis (AFO) is a commonly prescribed device for people who have suffered from a cerebrovascular accident (CVA), also known as stroke[1]. Every year in the United States there are more than 610,000 stroke cases from new patients, and an estimated 20% of those patients will develop a condition called foot drop[2,3]. Foot drop is typically cause by damage to the peroneal nerve and it leaves the ankle in an abnormally flexed downward and inward position (equinovarus deformity)[4]. The lack of flexor muscle control presents problems in every phase of the gait cycle (GC), causing compensation strategies from the knee and hip, which leads to less efficient gait and more stress on the subsequent joints, high levels of pain and increased likelihood of falling[5–7].

Background

The ankle joint is a complex system connecting the lower leg and the foot. While the ankle is capable of very complex motions, for simplicity, it is typically defined in terms of flexion. The flexion directions are defined such that dorsiflexion signifies the upward travel of the foot (lifting your toes) and plantar flexion signifies the ankle's downward motion (dropping your toes)[5]. The degree of ankle flexion defined by the term ankle angle, where 0° flexion occurs when the shank is vertical, also known as the neutral position[8]. In this paper, a positive ankle angle will represent the ankle being in the dorsiflexed position, while a negative ankle angle will represent the plantar flexed position.

Gait is the "manner of moving the body from one place to another by alternatively and repetitively changing the location of the feet"[9]. There are many forms of gait such as walking, running, stair climbing, and many types of pathological gaits. The specific emphasis of this paper is the study of walking. Gait is cyclic and is therefore typically described by a gait cycle (GC), breaking down events into percentages of the cycle (Figure 1). Gait cycle typically begins with heel strike at 0%, and ends with heel strike of the ipsilateral foot at 100% or 0% of the following cycle[5,10,11]. The gait cycle is then divided into two periods: stance and swing. During stance, the foot has contact with the ground and is weight bearing, and during swing the leg is getting back into position for heel strike of the following cycle. The stance phase makes up the initial 60% of the gait cycle, and is where the physical properties of an AFO are most critical, as they have a large impact on lower-limb kinematics[5,12].

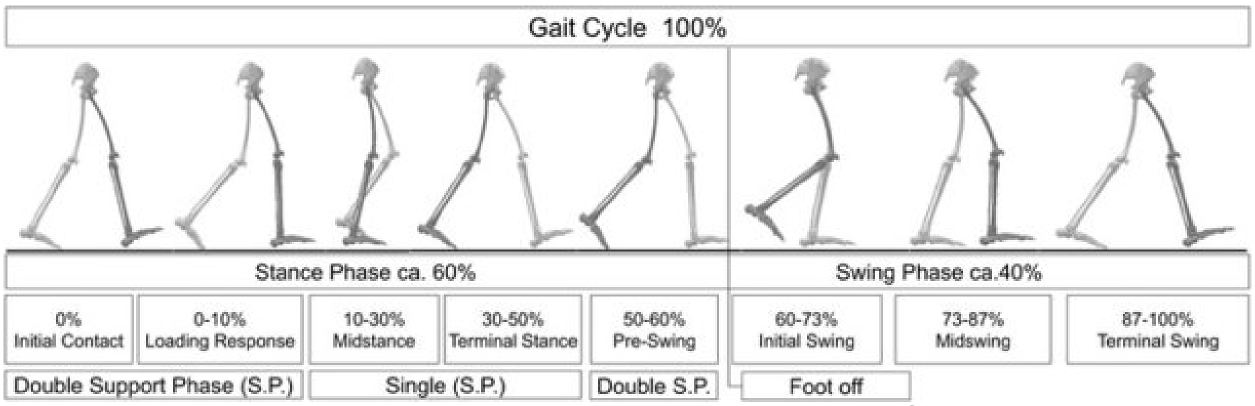

Figure 1: Classification of a normal gait cycle (modified, initial image by Perry 1992, p. 2–4)[5]

In biomechanics, the stance phase is often broken up into four sub-phases: loading response, midstance, terminal stance and pre-swing, which are used to describe the specific tasks of the lower limb[5,10–12]. In the clinical setting, it is more common to refer to these same sub-phases as the four "rockers" of stance phase which are: heel rocker (0-10% GC), ankle rocker (10-30% GC), forefoot rocker (30-50% GC) and toe rocker (50-60% GC) (Figure 2). The purpose of each rocker is the production of tibial advancement[12].

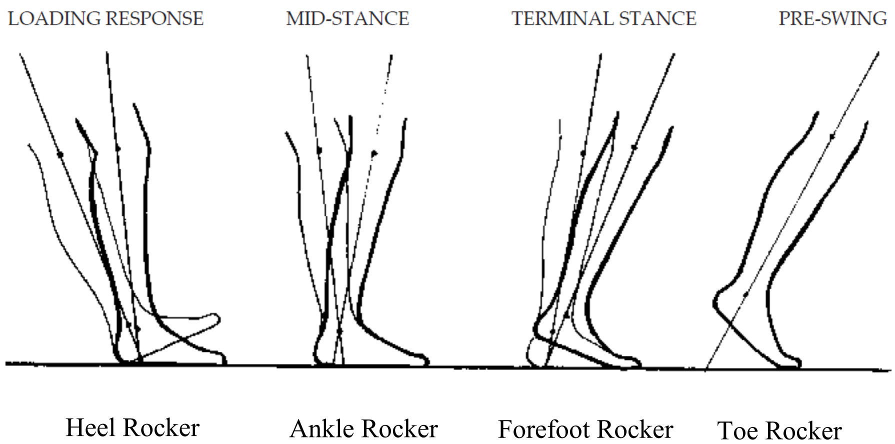

Figure 2: Stance phase of gait described by the four rockers. The purpose of each rocker is to create forward progression of the tibia, as described by Elaine Owen (modified, initial image from Owen, 2014)[12]

Normative gait dictates that during heel rocker, the ankle should be at 0° flexion (shank perpendicular to foot) during heel strike, followed by the foot slowing falling to the ground. With an able-bodied person, the dorsiflexor muscles slow the lowering of the foot to the ground and help with forward tibial advancement. For stroke patients with weakness in their dorsiflexor muscles, the foot will quickly hit the floor immediately after heel strike causing a slapping noise (foot slap). In some cases, the forefoot of the affected limb will strike the ground before the heel. During the ankle rocker, the foot is in full contact with the floor, and the tibia pivots over the ankle from a plantar flexed to a dorsiflexed position. While the dorsiflexor muscles (tibialis anterior and extensor digitorum longus) pull the shank forward, the plantar flexor muscles (soleus and gastrocnemius) resist this motion, storing energy to be released in pre-swing (Figure 3). During the forefoot rocker, the ankle becomes virtually locked in dorsiflexion as the dorsiflexors and plantar flexors are engaged. This stiffness causes the heel to rise, forcing the knee into extension in order to further tibial advancement. During the toe rocker, the ankle quickly moves from a dorsiflexed to plantar flexed position, allowing for the release of the energy stored in the plantar flexors[5,12].

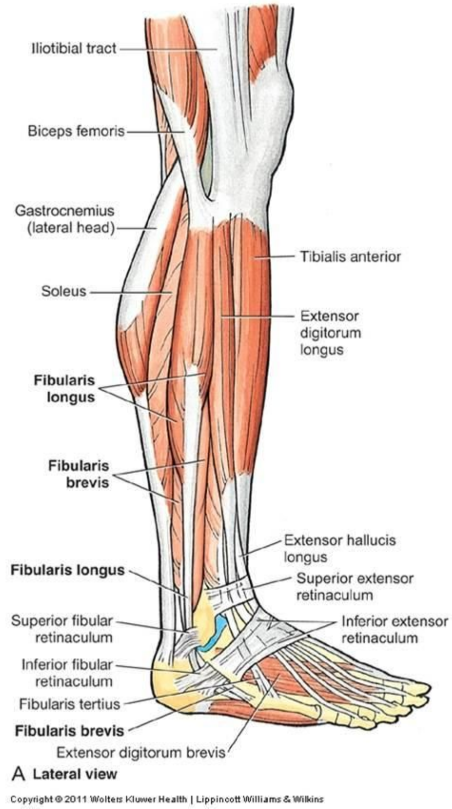

Figure 3: Musculature diagram of lower leg, ankle and foot (Image from STUDYBLUE)[13]

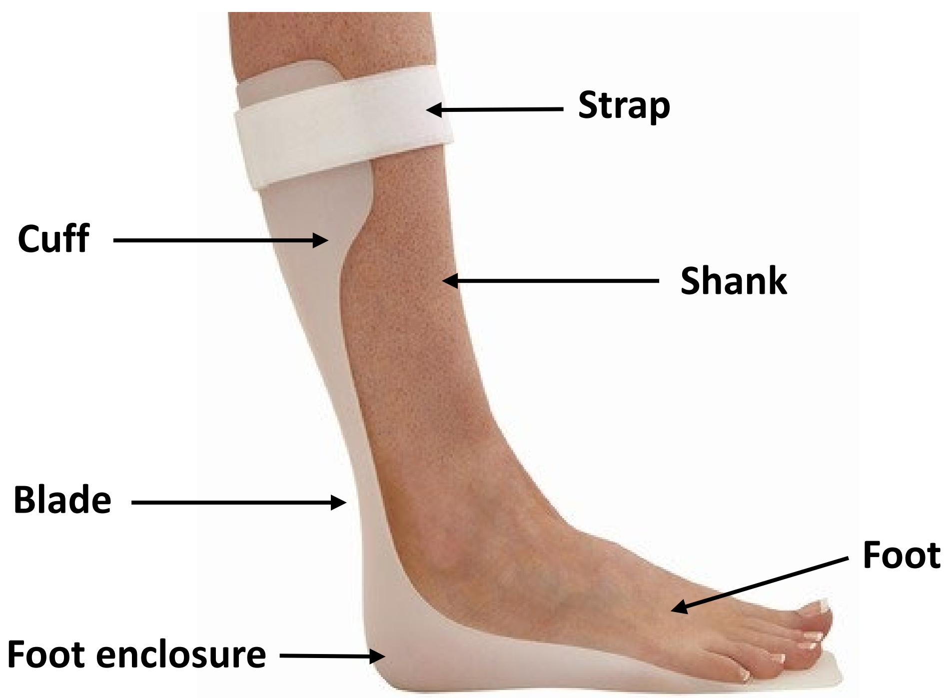

Figure 4: Diagram of ankle foot orthosis being worn, and its components (modified, initial image from quizlet [14])

When an AFO is worn, it alters the kinematics of the entire limb. The AFO is made up of a plastic piece which has a foot enclosure, blade and cuff, and there is a strap which attaches to the cuff (Figure 4). During the heel rocker, the AFO provides plantar flexor resistance at heel strike to keep the ankle around 0° and prevent the foot from slapping the ground, therefore aiding in forward advancement of the tibia. While it is important to have enough plantar flexion resistance to prevent slap foot, it has been found that too much resistance, which is cause by high stiffness, will cause a decrease in the peak plantar flexion angle, and an increase in knee flexion[15–17]. This increased knee flexion causes an increase in the peak knee extension moment which can cause stress on the knee extensor muscles and has the potential to create fatigue and future pathologies[18]. During the ankle rocker, the AFO provides dorsiflexion resistance to store energy in place of the weak plantar flexor muscles. During the forefoot rocker, the AFO provides a very high dorsiflexion resistive moment to emulate the plantar flexors, which have a rapid rise in resistance around 43% GC[5]. During the toe rocker, the AFO provides an assistive moment to the ankle, bringing it from a dorsiflexed position towards the neutral angle. The AFO then has resistance in plantar flexion, which is an issue causing limitations in the user's ability to push-off.

In addition to choosing a proper AFO stiffness when prescribing AFOs, it is critical to set an appropriate neutral angle to satisfy the individual user's needs[5,19]. The AFO neutral angle is the ankle angle at which no forces are exerted on the AFO[20]. The neutral angle of an AFO can have significant impacts on the kinematics of the entire lower limb, forcing the ankle into its own alignment. The neutral angle of the AFO therefore dictates the neutral position of the ankle[21]. The neutral angle is determined by the position of the ankle when the patients mold is set. The AFO is then formed around that mold, and therefore that neutral angle.

In this thesis, we will use five regions of motion to describe the position and direction of motion of the ankle and AFO, which describe its position and moment being applied about the human ankle (Figure 5). Assistive plantar flexion (APF) occurs when the ankle is in a plantarflexed position and moving towards the neutral position. Resistive plantar flexion (RPF) occurs when the ankle is a plantar flexed position and is moving further into plantar flexion. Assistive dorsiflexion (AD) occurs when the ankle is in a dorsiflexed position and is moving towards the neutral position. The occurrence of the ankle being in a dorsiflexed position and moving further into dorsiflexion is broken up into two regions: Resistive dorsiflexion (RD) and Dual flexion (DF). RD occurs from the neutral position up to 8° dorsiflexion, and DF occurs from 8° and beyond. This motion is separated into RD and DF because of unique properties of the ankle in the DF region which has a large dynamic stiffness and demonstrates dorsiflexion motion at slow, and plantarflexion motion at fast gait speeds[22,23]. The terms assistive and resistive are used to describe the AFOs contribution to ankle motion. In an assistive motion, the AFO is providing a moment in the same direction of the ankle's instantaneous angular velocity, while in resistive motion the AFO provides a moment in the opposite direction of the ankle's instantaneous angular velocity (Figure 6). These regions of motion show how to relate the stiffnesses of an AFO back to the walking gait cycle.

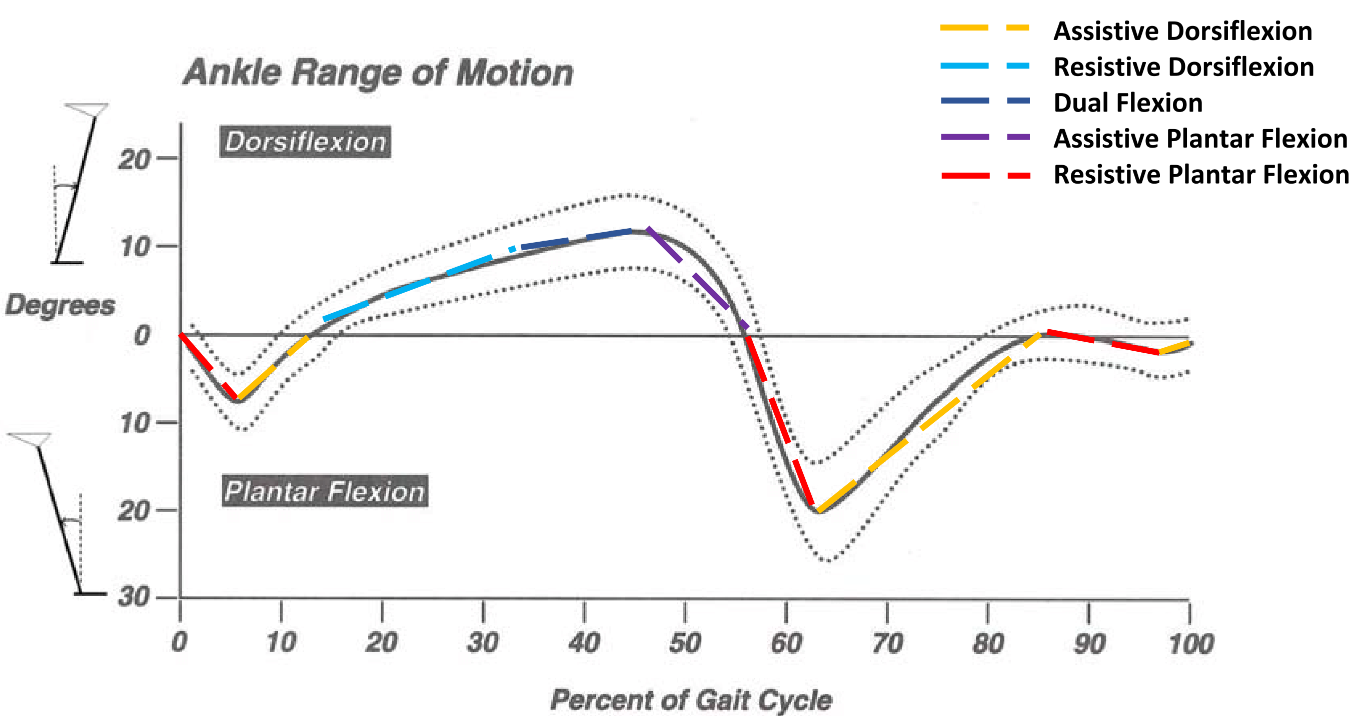

Figure 5: Five regions of motion for assessing AFO stiffness. The regions of motion are defined based on the ankle position and the contribution of the AFO to ankle motion. Assigning regions of motion to the gait cycle allows for translating the ankle-moment data of an AFO back to gait cycle.

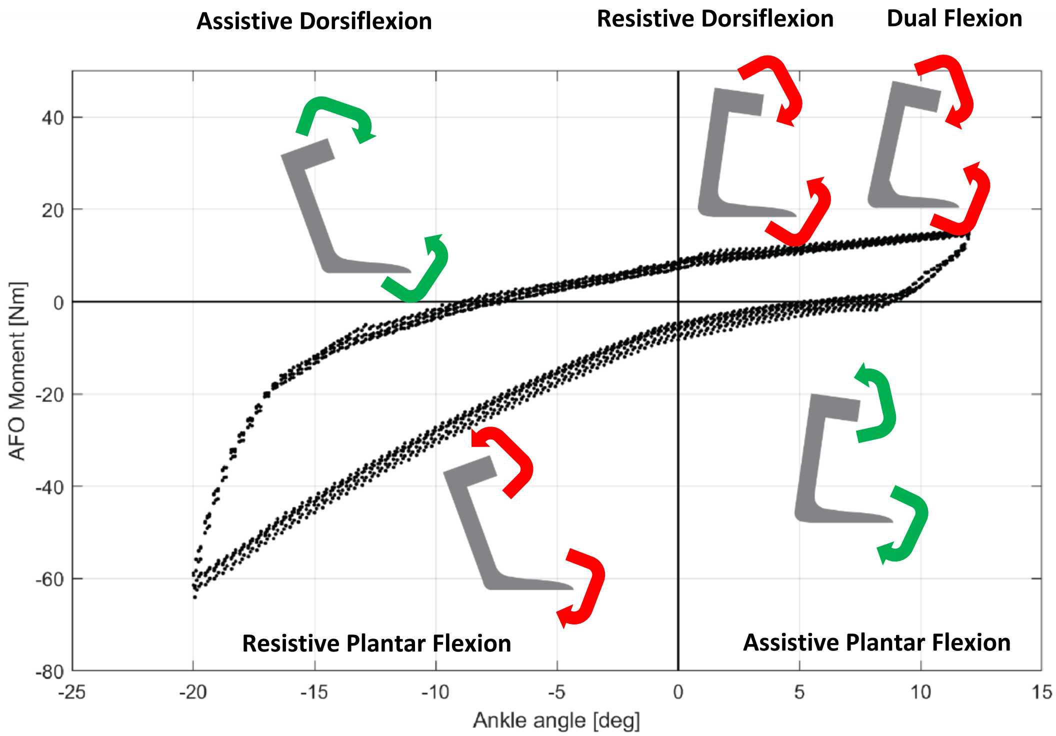

Figure 6: Five regions of motion of the AFO. Assistive regions occur when the AFO applies an moment about the ankle which is in the same direction that the ankle is moving (green arrows), a resistive region occurs when the AFO applies a moment about the ankle opposite to the direction that it is moving (red arrows). The five regions of motion are Assistive Dorsiflexion (-20° to neutral angle), Resistive Dorsiflexion (neutral angle to 8°), Dual Flexion (8° to 12°), Assistive Plantar Flexion (12° to neutral angle), Resistive Plantar Flexion (neutral angle to -20°).

The ideal AFO would be able to optimize for each of these rockers simultaneously, matching the angle-moment curve of the human ankle[24–29]. The ideal stiffness for each independent region of motion is as follows: AD) -0.2 Nm/° to -1.3 Nm/°[18,19], RD) 1.4 Nm/° to 3.5 Nm/°[19,23], DF) 4.2 Nm/° to 10.5 Nm/°[19,23], APF) -1.4 Nm/° to 4.0 Nm/°[19,23], RPF) 0.2 Nm/° to 1.3 Nm/°[19,20].

Currently, the design of passive AFOs optimize for either heel or forefoot rocker. AFOs designed for heel rocker tend to have a low stiffness to allow for push off in toe rocker, and to avoid a decrease in the peak plantar flexion angle, while increasing knee flexion at heel strike[15–17]. AFOs designed for forefoot rocker tend to have high stiffnesses to induce heel rise and knee flexion in the ankle rocker to forefoot rocker transition. When designing for one of these rockers, there are limitations in the others.

AFOs designed for heel rocker don't have enough stiffness in forefoot rocker and cause an unstable knee flexion, while AFOs designed for forefoot rocker have a stiffness so high that little to no power can be generated at push-off[5,12]

In addition to passive AFOs, there are many mechanical AFOs being used by patients, and many active AFOs being developed in labs across the globe (Figure 7). Spring-hinged AFOs are sometimes chosen as an alternative to passive AFOs because of their ability to vary the AFO stiffness in RD/DF. While the ability to vary stiffness on a patient-specific basis is desirable, spring-hinged AFOs have some limitations: they are bulky, the springs are prone to breaking, and they are limited to a maximum stiffness of 2.2 Nm/° in RD/DF [30]. Active AFOs have shown some promise with early designs being able to reduce metabolic cost of foot drop users by up to 25%[31], however, they also have their limitations: These designs are bulky, heavy, bulky and need a power source[31–33].

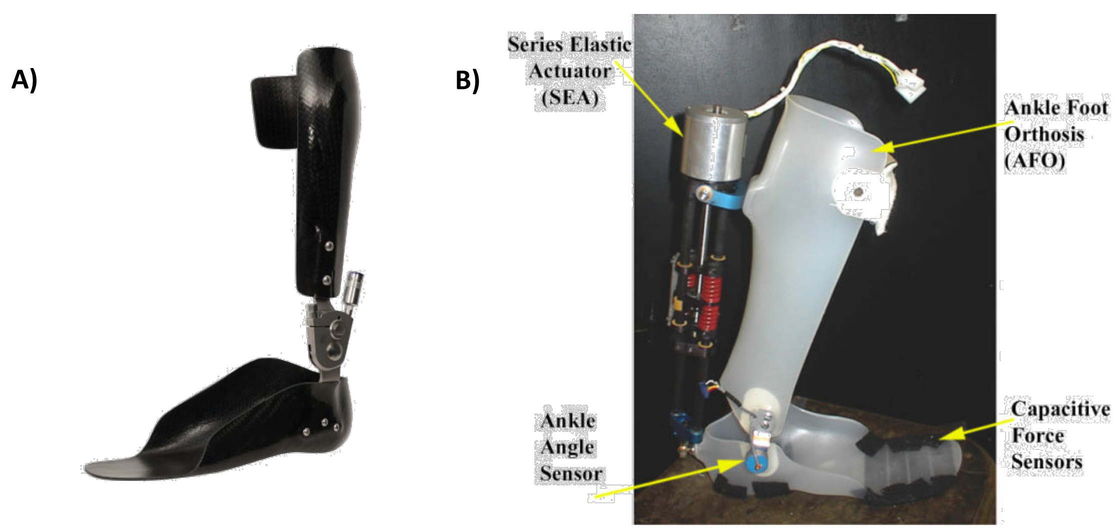

Figure 7: A) A spring-hinged ankle foot orthosis with a Becker Triple Action ankle joint (image from Becker Orthopaedics[34]). B) An active ankle foot orthosis developed at the University of Illinois (image by Blaya et. Al [33])

Needs Statement

Drop foot is the inability to lift the foot due to damage to the peroneal nerve, leaving reduced or no ability to dorsiflex the foot. A common cause of foot drop is damage to the nerves due to stroke, which affects over 600,000 new patients each year[2,3]. Current interventions for treating foot drop include the use of passive AFOs, spring-hinged AFOs, and active AFOs, which all have their limitations, as discussed above. Foot drop patients are in need of an AFO which can adjust its stiffness profile to the needs of each specific user, improving ankle kinematics at heel strike, heel off, and push off.

In this study, we propose the design and use of an AFO Modifier that can be added to commonly used Flat Blade Ankle Foot Orthoses (FBAFO). The purpose of the Modifier is to alter the stiffness profile of the FBAFO by adding a mechanical system to the blade which can add rigidity to the system in some regions of motion. The term stiffness profile is defined as the set of stiffnesses in the five regions of motion of a given AFO. The Modifier was specifically designed to alter AFO stiffness in RD and DF while avoiding any changes in stiffness in RPF. In theory, having the ability to increase the stiffness of an AFO in RD and DF without increasing stiffness in RPF would allow for the ideal AFO characteristics when combined with an AFO that already has a low RPF stiffness.

Design Requirements

Based on these conditions, the following design requirements were developed for guiding and assessing the design of a variable stiffness ankle-foot orthosis (VSAFO). For the scope of this thesis, only the first five primary design requirements will be tested for verification.

Primary design requirements

The VSAFO must:

1. allow a range of motion (ROM) of 20° plantar flexed to 12° dorsiflexed.

Rationale: This is the dorsiflexion/plantar flexion range of motion of the ankle during normative gait[5].

2. Be adjustable to achieve a range of patient-specific ideal stiffnesses in resistive dorsiflexion (RD) and dual flexion (DF):
    a. Resistive dorsiflexion - 1.4 Nm/° to 3.5 Nm/°
    b. Dual flexion - 4.2 Nm/° to 10.5 Nm/°

Rationale: In RD, this is the range of AFO stiffness that is considered ideal for the ankle in dorsiflexion[19,23]. In DF, the plantar flexor muscle group provides a resistive moment three times greater than in early dorsiflexion, therefore the AFO should attempt to mimic this with three times the stiffness [5,23].

3. provide a 150% to 250% increase in stiffness from RD to DF.

Rationale: Not only must the AFOs hit the required stiffnesses in RD and DF, but the relative change between those two regions is also critical to ensure smooth transitions between rockers. The quasi-stiffness of the ankle in DF is 2.5-3.5 times higher than it is in RD[5,19,23].

4. have no increase in RPF stiffness.

Rationale: One of the major limitations with current AFOs is that the stiffness in RPF is too high for heel strike and push-off. We should avoid any increase in stiffness in this region of motion if possible[29].

5. have an added weight of less than 300g.

Rationale: Currently, the articulated hinges of mechanical AFOs weigh around 300g. If we can keep the added weight of this AFO below 300g, it would be able to compete with other mechanical AFOs.

Secondary design requirements

The following requirements have been defined based on the Rancho ROADMAP, a tool for AFO design and prescription developed by clinicians and researchers who are dedicated to creating the optimal brace for neurologic rehabilitation[35,36].

6. be biocompatible with skin
7. can be worn with different shoes
8. avoid pinching the skin
9. avoid creating pressure sores on the body

Stiffness Testing Devices

In order to verify the performance requirements of the VSAFO, a method for evaluating AFO stiffness is required. Typically, when referring to the "stiffness" of an AFO, it is referring to the "quasi-stiffness" which Shamei. et. al. defined as "the slope of the best linear fit on the moment-angle graph of a joint over a whole stride or specific phase of a stride"[23]. In this thesis, we will adopt this definition when testing for AFO stiffness. There have been several different methods used for testing AFO stiffness with no clear method being the gold standard. Some methods applied forces to the cuff of the AFO, perpendicular to the ground, determining a linear stiffness of the AFO which is not easily related to ankle moment [37]. Other methods applied moments to the AFO but did so without any foot/shank/ankle model inside, meaning that the stiffness is relative to the instantaneous axis of rotation of the AFO, and not relative to the hypothetical ankle joint[38]. We chose to create a stiffness testing device that could easily find angle-moment data of the AFO based on a pre-defined ankle flexion axis of rotation[39–41].

Methods

AFO Models for Testing

Six FBAFOs were fabricated to test their stiffness profiles. The FBAFOs were fabricated from replicate plaster positive models of a single patient, using various combinations of base and blade materials and thicknesses (Table 1). The plaster model was taken from a drop-foot patient with a height of 1.70 m and weight of 61.2 kg, and the model was set with a neutral angle of 0°. For each AFO, the blade and host materials were heated up to 350° F, the blade was placed along the posterior length of the plaster shank, followed by wrapping the host sheet around the whole plaster model and vacuuming the air out from between the plastic and plaster model. Once the model was cooled to room temperature, the vacuum was turned off and trim lines were cut to create the shape of the AFO. The trim lines were drawn by tracing a negative AFO model on to the plastic to ensure consistency.

Table 1: List of all Flat Blade AFOs tested. The AFOs were made using a combination of different host and blade materials and thicknesses.

Label	Host AFO Material	Host AFO Thickness	Blade Insert Material	Blade Insert Thickness
AFO A	Homopolymer Polypropylene	3/16"	Homopolymer Polypropylene	3/16"
AFO B	ProComp (7.2 g/m^2)	3/16"	ProComp (7.2 g/m^2)	3/16"
AFO C	ProComp (7.2 g/m^2)	3/16"	ProComp (17 g/m^2)	3/16"
AFO D	ProComp (7.2 g/m^2)	3/16"	ProComp (7.2 g/m^2)	3/16"
AFO E	ProComp (7.2 g/m^2)	3/16"	ProComp (34 g/m^2)	1/4"
AFO F	Homopolymer Polypropylene	3/16"	No Blade	

A small mechanical system, named the 'modifier', was designed to be added to any FBAFO to affect the stiffness profile as describe in the design requirements section (Figure 8). The modifier is a tensioning mechanism which is designed to reinforce the AFO and add stiffness during certain regions of motion, but not others. It attaches to the blade of the AFO and has a dial which can be tuned to 5 different levels of resistance, with L1 being the lowest resistance, and L5 being the highest resistance. Two different versions of the modifier were fabricated, the first was made with a 5 mm thick thermoplastic elastomer (TPE) gel, and the second was made with a 5 mm thick extruded polystyrene XPS foam. The mass of the gel modifier was 227 g, and the mass of the foam modifier was 214 g.

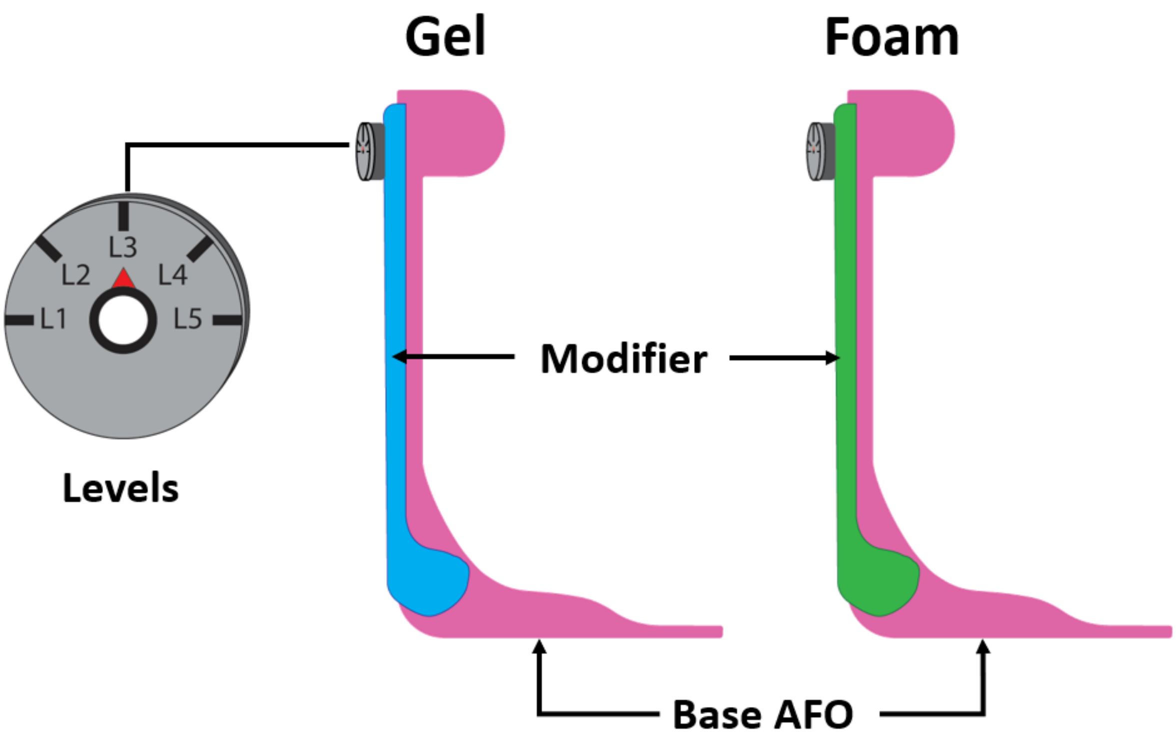

Figure 8: Diagram of Flat Blade AFO with Modifier added.

In addition to the 6 FBAFOs, 14 ankle-foot orthosis-modifier combinations (AFOMC) were created from mixing and matching various AFOs, modifiers, and modifier levels (Table 2). AFO A was chosen as the baseline model for this study as it was made from a homopolymer polypropylene, the material most used in FBAFOs for drop-foot patients. AFO A was combined with the gel modifier and tested at each of the 5 modifier levels and was then combined with the foam modifier and tested at each of the 5 modifier levels.

The stiffness testing was initially done on the 6 base AFOs to determine their stiffness profiles, to determine the models with the highest and lowest stiffnesses. AFO E was found to have the highest stiffnesses across each of the five regions of motion and was then chosen to be combined with the modifier at L5, for both modifier materials, to represent the upper bound of achievable stiffnesses of all AFOMCs. AFO F was found to have the lowest stiffnesses across each of the five regions of motion and was then combined with both gel and foam modifiers at L1, representing the lower bound of achievable stiffnesses.

Table 2: All AFO and AFO modifier combinations used for stiffness testing

Label	AFO Base	Material	Modifier Level
AFO A	AFO A	-	-
AFO A-L1G	AFO A	Gel	1
AFO A-L2G	AFO A	Gel	2
AFO A-L3G	AFO A	Gel	3
AFO A-L4G	AFO A	Gel	4
AFO A-L5G	AFO A	Gel	5
AFO A-L1F	AFO A	Foam	1
AFO A-L2F	AFO A	Foam	2
AFO A-L3F	AFO A	Foam	3
AFO A-L4F	AFO A	Foam	4
AFO A-L5F	AFO A	Foam	5
AFO B	AFO B	-	-
AFO C	AFO C	-	-
AFO D	AFO D	-	-
AFO E	AFO E	-	-
AFO E-L5G	AFO E	Gel	5
AFO E-L5F	AFO E	Foam	5
AFO F	AFO F	-	-
AFO F-L1G	AFO F	Gel	1
AFO F-L1F	AFO F	Foam	1

Stiffness Testing Device

A device for testing the stiffness of the AFOs was designed and developed to be used with an existing Instron 5882 Testing Machine (Figure 9). The device was made up of two aluminum linkages, connected by a hinge joint. The upper linkage was attached to the Instron load cell via a hinge joint. The lower linkage was connected to a hinge joint which was located at the approximate position of the ankle axis of rotation in the sagittal plane[39]. Attached to the lower cuff was a 3D printed model of the patient's shank, created by a loft of the cross-sectional areas of the plaster model at the upper and lower boundaries. Two holes were drilled through the bottom of the AFOs so that a foot plate could clamp it to the support plate.

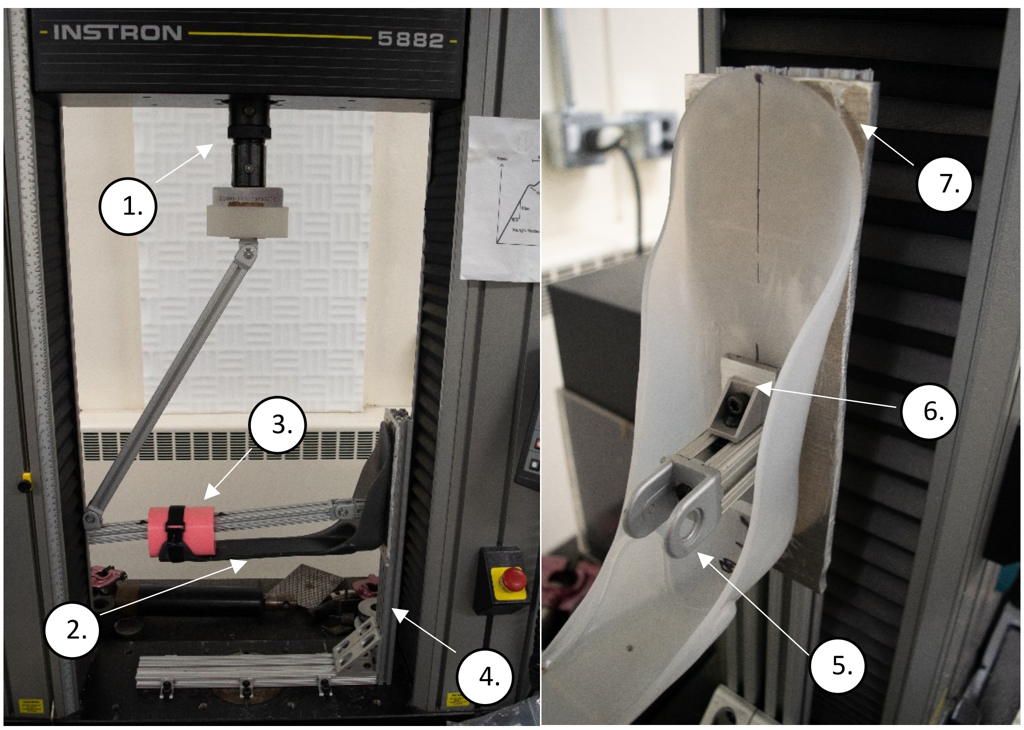

Figure 9: Detailed schematic of stiffness testing device. 1: Instron Load Cell, 2: AFO, 3: Shank model, 4: Support Frame, 5: Ankle Joint, 6: Foot Plate, 7: Base Plate.

Experimental Protocol

All the stiffness testing experiments were run in the Prince Engineering Laboratory at Brown University (Providence, RI). This test procedure was done in two separate stages, the first stage was to test the six FBAFOs and learn about their base stiffness profiles, while the second stage was to test the fourteen AFOMCs to learn the effects of the modifier. The AFO testing procedure remained the same in both stages of testing.

To start the procedure, the stiffness testing device was fastened to the base of the Instron 5882 (Instron, Norwood, MA), and the top linkage was disconnected from the load cell. The AFO being tested was placed in the testing device and bolted between the foot plate and the base plate. Based on the linkage lengths and the mechanical ankle joint position of the testing device, the heights of the Instron were calculated for the minimum and maximum extension, which correspond to ankle angles of 20° plantar flexion and 12° dorsiflexion, respectively. The initial position of the Instron during testing was set to the height halfway between the minimum and maximum calculated heights and the Instron was programmed to use a triangle waveform, which moved up and down by an equal amplitude from the midpoint. While the linkage was still detached from the load cell, the load and height of the Instron were zeroed. The linkages were then attached by the hinge joints, completing the system. The testing device was programmed to go through four cycles, moving through the entire dorsiflexion and plantar flexion ranges of motion, with a vertical travel speed of 2 mm/s, logging the force and position data at a frequency of 1.0 Hz. Three trials were taken for each AFO/AFOMC without removing the model from the testing device between trials.

Data Processing

The raw data from the Instron was processed to calculate the ankle-angle-ankle-moment curves of the AFOs. The angle-moment curves were calculated using MATLAB 2019b (MathWorks, Natick, MA). The reaction forces and moments in the testing device linkages were calculated using static equations, assuming quasi-static loading. The center-of-mass of each linkage was calculated by making an assembly model of the linkages, with the appropriate mass and volume properties, in SOLIDWORKS 2019 (Dassault Systèmes, Concord, MA). The moment of the AFO acting on the model shank, about the mechanical ankle joint, was calculated assuming that there were no losses in the system. The ankle-angle was calculated by solving for the position of the lower linkage based on linkage lengths, ankle axis location, and the instantaneous height of the load cell attachment.

The data from each trial was trimmed from 4 cycles down to the 3 between the peak plantar flexion angles in the first and fourth cycles in order to cut out the effects of loading and unloading in the system. The data was separated into 2 groups: the dorsiflexion direction and the plantar flexion direction, where the dorsiflexion direction occurs when the Instron is moving in the positive Y direction, and the plantar flexion direction occurs when the Instron is moving in the negative Y direction. The data was fitted with 5^{th} order polynomial curves to be used in data analysis.

Data Analysis

The stiffnesses of the AFOs were calculated for each of their five regions of motion (Figure 10). The angle-moment data was grouped into each of the five regions of motion, and a line was fitted to each region independently. The stiffness is the slope of that line given by:

$$M = k\alpha + z$$

where *M* is the moment of the AFO acting on the shank, *k* is the stiffness of the AFO in that region of motion, α is the ankle angle, and *z* is the Y intercept of the linear fit.

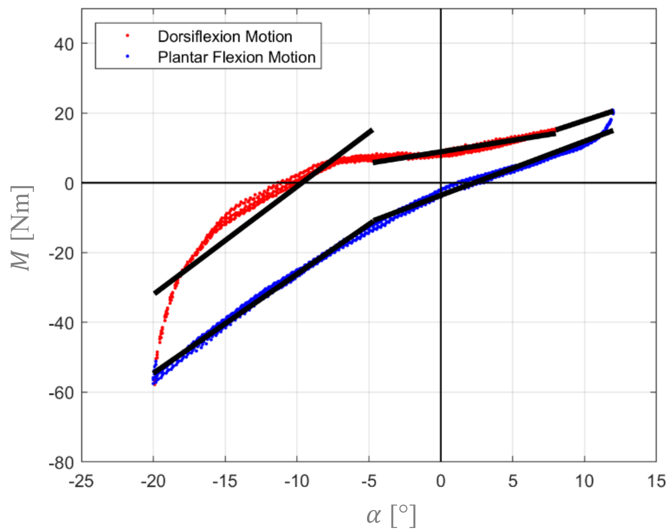

Figure 10: Ankle-Angle-Ankle-Moment plot of AFO A-L2G. The data was grouped into the 5 regions of motion, and a line was fitted to the data in each region to find the stiffness.

The uncertainty of the stiffness in each region was estimated by summing the experimental uncertainties in quadrature:

$$\delta k_{Total} = \sqrt{\delta k_{SE}^2 + \delta k_{setup}^2 + \delta k_{system}^2 + \delta k_{Modifier}^2}$$

where δk_{Total} is the combined uncertainty of the stiffnesses, δk_{SE} is the standard error between trials, δk_{setup} is the repeatability uncertainty from taking down and setting up the stiffness testing device, δk_{system} is the losses in the mechanical stiffness testing system, and $\delta k_{Modifier}$ is the repeatability uncertainty of adjusting the levels on the modifier between tests (Table 3). The uncertainty in setting up the testing device (δk_{setup}) was found by taking the standard error of the stiffness of AFO A between three trials when the AFO was completely disassembled and assembled from the testing device between each trial. The losses in the testing device system (δk_{system}) were found by running the test with no AFO in place and calculating the stiffness in each region based on these values. The uncertainty in the repeatability of adjusting the modifier levels ($\delta k_{Modifier}$), was found by taking the standard error across three trials on AFO A-L3G when the modifier was completely disassembled, reassembled, and untuned/retuned to the level 3 between trials. Finally, the standard error was found between the 3 trials for each AFO during testing.

Table 3: Uncertainty values from AFO stiffness testing

	Stiffness [Nm/°]				
	AD	**RD**	**DF**	**APF**	**RPF**
δk_{setup}	0.040	0.026	0.030	0.086	0.008
δk_{system}	0.018	0.043	0.097	0.042	0.032
$\delta k_{Modifier}$	0.018	0.015	0.012	0.013	0.020

The neutral angle for each AFO was calculated using the 5th order fits of the angle-moment curves. The neutral angles were found by taking the average of the ankle angles where the AFO moment is equal to zero in dorsiflexion and plantar flexion based on a 5th order polynomial fits. The error for each neutral angle was the distance between the calculated neutral angle and the neutral angles found in dorsiflexion and plantar flexion.

The energy loss of each AFOMC during testing was calculated to assess the effects of the hysteresis loop. The energy loss was found by taking the area between the 5th order polynomial fits of the dorsiflexion direction and plantar flexion direction datasets using a trapezoidal integration method over the tested range of motion. In addition to the loss, a loss-peak distance ratio was calculated to see the effects of the shape of the loop by accounting for the length and height of the loop:

$$\beta = \frac{\Delta E}{(F_{max} - F_{min}) * \Delta Y}$$

where β is the loss-peak distance ratio, ΔE is the energy loss from the hysteresis loop, F_{max} is the maximum Force of the AFO applied to the shank, F_{min} is the minimum force applied to the shank and ΔY is the distance between peak heights of the Instron during testing.

Statistical Analysis

Statistical analysis was performed on the stiffness data of AFO A and each of its combinations to determine differences among material properties and resistance levels of the modifiers. Difference across the modifier levels (5 Modifier levels + base AFO) and the two modifier materials were tested using a Sidak's multiple comparison two-way analysis of variance (ANOVA) in Prism8 (Graphpad, San Diego, CA). P-values of less than 0.05 were reported as statistically significant results.

A statistical analysis was also performed on the six base AFOs to determine the differences among the six base AFOs and the five regions of motion. The differences across the base AFOs and regions of motion were tested using a Sidak's multiple comparison two-way analysis of variance (ANOVA) in Prism8 (Graphpad, San Diego, CA). P-values of less than 0.05 were reported as statistically significant results.

Results

Base AFOs

Testing of the six base AFOs revealed that AFO E and AFO F had the highest and lowest respective stiffnesses across each of the 5 regions of motion (Figure 11). AFO E showed significantly larger stiffnesses in the AD ($p<0.0001$) and RPF ($p<0.0001$) regions (Table 8). AFO F showed significantly smaller stiffnesses in the AD ($p<0.0001$) and RPF ($p<0.0001$) regions (Table 7). Based on these values, AFO F was chosen to represent the lower bound of possible base AFO stiffnesses, and AFO E was chosen to represent the upper bound.

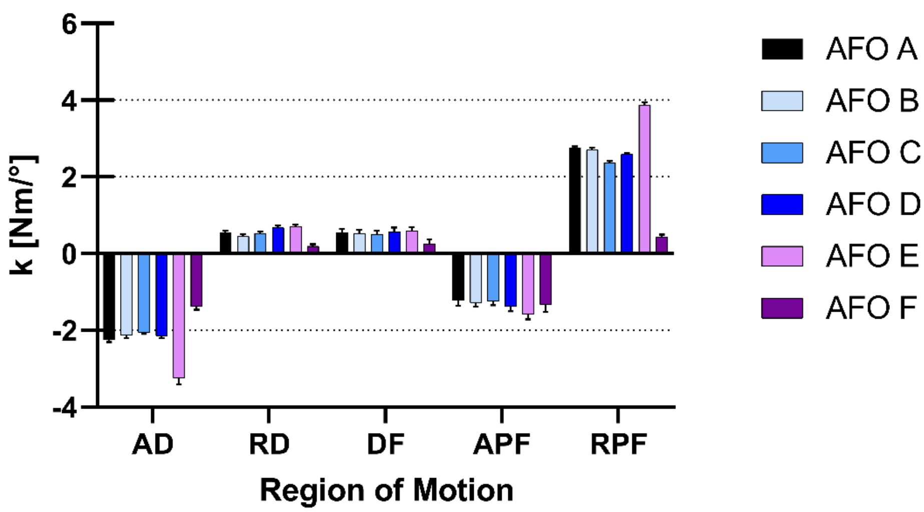

Figure 11: Stiffnesses of the Flat Blade AFOs in each of the five regions of motion. AFO E was found to have the highest stiffnesses across all five regions while AFO F was found to have the lowest stiffness across all five regions.

Design requirements

1) The VSAFO must allow a range of motion (ROM) of 20° plantar flexed to 12° dorsiflexed

Each of the AFOs tested were able to achieve the required range of motion of 20° plantar flexed to 12° dorsiflexed.

2.a) The VSAFO must be adjustable to achieve a range of patient-specific ideal stiffnesses in resistive dorsiflexion (RD) and dual flexion (DF): Resistive dorsiflexion - 1.4 Nm/° to 3.5 Nm/°

The results of testing the AFOMCs showed that increasing the modifier level increased the stiffness in RD and was able to fall within the required range of 1.4 – 3.5 Nm/° (Figure 12). For both the gel and foam modifiers, increasing the modifier level significantly increased the stiffness in RD at every adjustment except for L1 to L2 (p=0.8011 (Gel), p=0.1189 (Foam)) (Table 10). Five out of the ten AFO A modifier combinations achieved the required range of stiffness in RD. The range of stiffnesses found for all AFO A modifier combination in RD were 0.46 to 2.26 Nm/°.

2.b) The VSAFO must be adjustable to achieve a range of patient-specific ideal stiffnesses in resistive dorsiflexion (RD) and dual flexion (DF): Dual flexion - 4.2 Nm/° to 10.5 Nm/°

Unlike the trend in RD, there was not a significant increase in stiffness with each increase in modifier level in the DF region, and none of the AFO A modifier combinations fell within the required range of 4.5 – 10.5 Nm/°. The stiffness generally increased until a peak stiffness around L3/L4 and then began to decrease towards L5. The only significant change between individual modifier levels was a decrease from L4 to L5 (p=0.004 (Gel)) (Table 11). The range of stiffnesses achieved in DF was found to be 0.9-2.0 Nm/°, with the highest stiffness belonging to AFO A-L4G.

3) The VSAFO must provide a 150% to 250% increase in stiffness from RD to DF

While there were AFOMCs that showed increases from RD to DF, no combination was able to achieve the required increase in the range of 150% to 250% (

Figure 13). The range of percent change from RD to DF across the ten AFO A modifier combinations was -54% to 107%. There was typically a large increase at the smaller modifier levels, showing ≥100% increases in L1 and L2 for both modifier materials. The largest decreases occurred with a 54% decrease at L5 for both modifier materials.

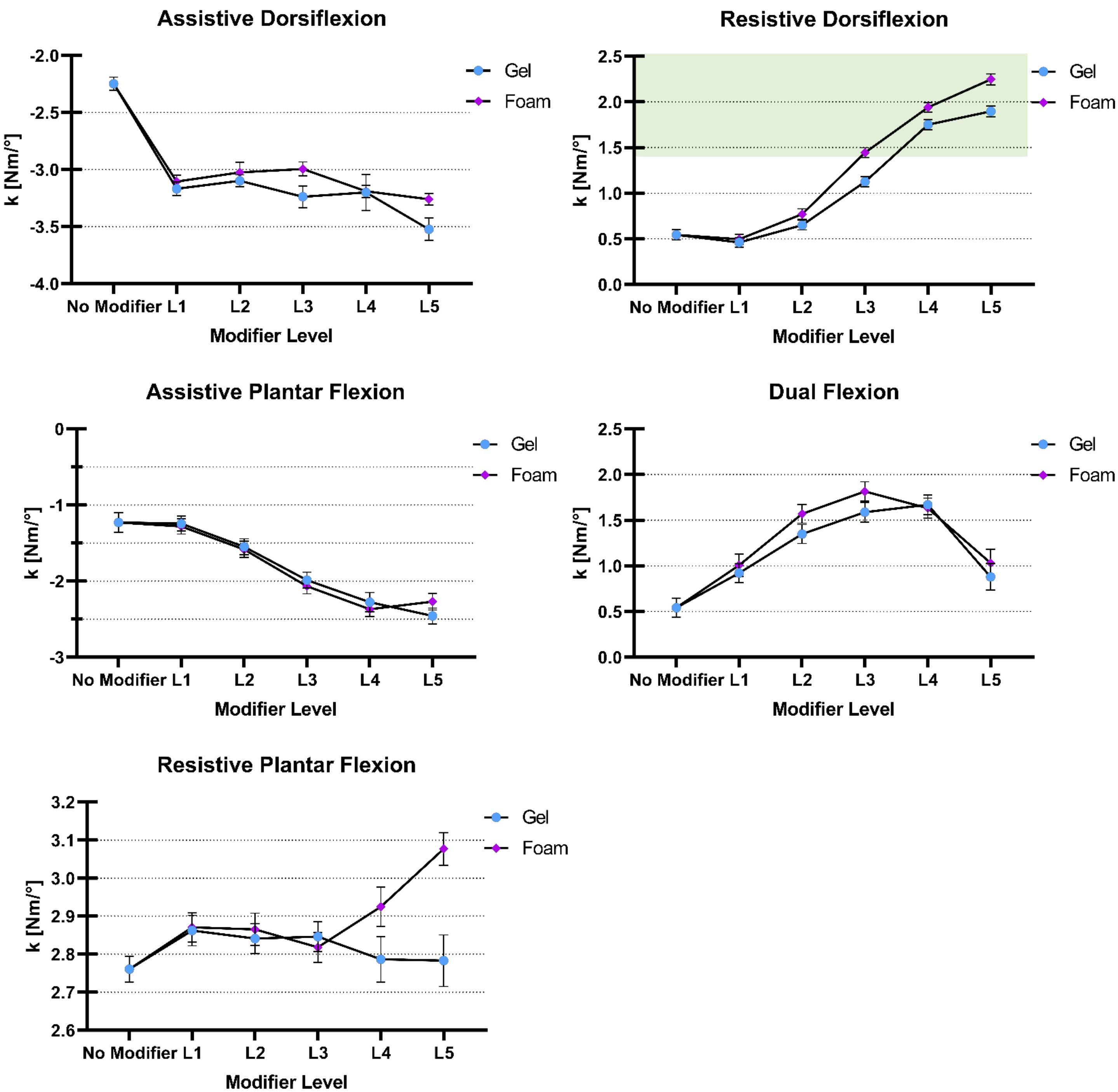

Figure 12: Stiffnesses of all AFO Modifier combinations, separated into the five regions of motion. Ranges specified in design requirements are shaded in green.

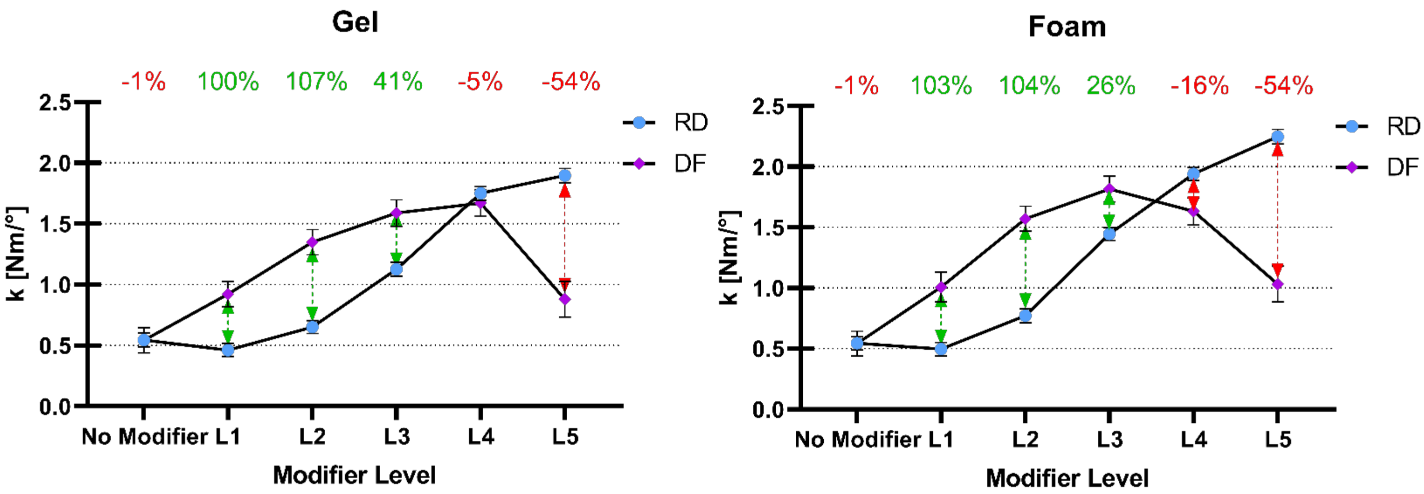

Figure 13: Stiffnesses for AFO A with both the Modifier materials in RD and DF. The plots show the percent change from RD to DF with increases being marked in green and decreases being marked in red.

4) The VSAFO must have no increase in RPF stiffness.

The stiffness in RPF did not increase significantly with the addition of the modifiers at any level, except with the foam modifier at level 5 (Figure 12). The RPF stiffnesses for all of the AFOMCs showed no statistically significant differences from the base AFO ($k = 2.75 \pm 0.03$), except for AFO A-L5F which increased to 3.08 ± 0.04 ($p=0.0032$) (Table 13). The AFO with the gel modifier did not see the same spike in stiffness at L5.

5) The VSAFO must have an added weight of less than 300g.

The mass of the gel modifier was found to be 227g, while the mass of the foam modifier was 214g.

Additional Findings

Overall, the modifier material had little effect on the overall stiffness profiles of AFO A. There were no statistically significant differences between materials at any of the modifier levels in AD, DF, or APF. In RPF, there were no significant differences between materials except at modifier level 5 where the stiffness of the foam modifier was much higher than that of the gel modifier (p=0.0078). RD was the only region to show multiple significant differences between materials, with the foam modifier having a higher stiffness than the gel modifier at L3 and L5 (p=0.03 and p=0.0112, respectively).

Neither the upper nor lower bound of AFOMCs were able to achieve a stiffness profile with the required stiffnesses in RD and DF. At the upper bound, both AFO E modifier combinations were able to achieve a RD stiffness within the required range, but the stiffness decreased in DF. In addition, they both had RPF stiffnesses larger than any of the other AFOMCs, putting them way outside of the desired range. At the lower bound, both AFO F modifier combinations had desirably low stiffnesses in RPF but were not able to reach the required range of stiffness for RD or DF.

Table 4: Neutral angles for each of the Flat Blade AFOs and the AFO-Modifier combinations. The addition of the modifier consistently shifted the neutral angle of the modifier into a more plantar flexed position.

AFO	**Material**	**Neutral Angle [°]**					
		No Modifier	**L1**	**L2**	**L3**	**L4**	**L5**
A	*Gel*	0.1 ± 7.5°	-5.1 ± 6.1°	-4.7 ± 6.5°	-4.8 ± 6.7°	-4.6 ± 4.8°	-4.5 ± 4.8°
	Foam		-4.0 ± 6.3°	-3.7 ± 5.8°	-3.5 ± 5.2°	-3.5 ± 4.5°	-4.3 ± 3.8°
B	*Gel*	0.6 ± 7.8°	-	-	-	-	-
	Foam		-	-	-	-	-
C	*Gel*	0.8 ± 7.5°	-	-	-	-	-
	Foam		-	-	-	-	-
D	*Gel*	1.0 ± 8.0°	-	-	-	-	-
	Foam		-	-	-	-	-
E	*Gel*	-2.5 ± 7.1°	-	-	-	-	-6.1 ± 3.6°
	Foam		-	-	-	-	-5.6 ± 4.2°
F	*Gel*	-0.9 ± 11.3°	-2.3 ± 11.6°	-	-	-	-
	Foam		-2.7° ± 10.7°	-	-	-	-

Table 5: Energy loss due to hysteresis in mechanical testing. Energy loss appeared to decrease with the addition of the modifiers in low resistances.

Hysteresis Energy Loss													
AFO		**No Modifier**		**L1**		**L2**		**L3**		**L4**		**L5**	
		ΔE [J]	**β**	**ΔE [J]**	**β**	**ΔE [J]**	**β**	**ΔE [J]**	**β**	**ΔE [J]**	**β**	**ΔE [J]**	**β**
A	*Gel*	9.9 ± 0.6	0.23	8.1 ± 0.1	0.20	8.8 ± 0.4	0.21	10.4 ± 0.6	0.22	10.3 ± 1.2	0.19	11.4 ± 0.7	0.22
	Foam			8.6 ± 0.2	0.21	8.4 ± 0.4	0.19	9.4 ± 0.4	0.19	10.4 ± 0.3	0.19	10.2 ± 0.3	0.19
B	*Gel*	10.2 ± 0.3	0.24	-	-	-	-	-	-	-	-	-	-
	Foam			-	-	-	-	-	-	-	-	-	-
C	*Gel*	8 ± 0.2	0.22	-	-	-	-	-	-	-	-	-	-
	Foam			-	-	-	-	-	-	-	-	-	-
D	*Gel*	10.3 ± 0.3	0.25	-	-	-	-	-	-	-	-	-	-
	Foam			-	-	-	-	-	-	-	-	-	-
E	*Gel*	10.6 ± 0.5	0.20	-	-	-	-	-	-	-	-	9.9 ± 0.2	0.17
	Foam			-	-	-	-	-	-	-	-	10.8 ± 0.6	0.17
F	*Gel*	8.9 ± 0.5	0.52	5.4 ± 0.2	0.36	-	-	-	-	-	-	-	-
	Foam			4.7 ± 0.4	0.31	-	-	-	-	-	-	-	-

In addition to the stiffness of the AFOs, the addition of the modifier also affected the neutral angles. Each of the FBAFOs showed noticeable changes in the neutral angle with the addition of the modifier, each one having the neutral angle moved to a more plantar flexed position (Table 4). The neutral angles were shifted from a range of -2.5° to 1.0° at base, to -6.1° to -2.3° with the modifiers. All the base AFOs had neutral angles in the range of ± 1° from perpendicular to the ground, except for AFO E which had a neutral angle of -2.5 ± 7.1°.

The angle-moment data for each AFO showed a hysteresis loop with energy losses. Amongst AFO A and E combinations, the energy losses and β values were similar between all combinations and had small changes from base to modified AFOs (Table 5). AFO F, unlike the others, showed a large decrease in the energy loss with the addition of the modifiers, and had a corresponding drop in β values (0.52 down to 0.36 (Gel) and 0.31 (Foam)).

Table 6: Summary results of the VSAFO design requirements

	Design Requirement					
	1) Full ROM	2.a) RD range	2.b) DF range	3) ↑ RD to DF	4) - RPF	5) ≤ 300g
AFO A	✓	✗	✗	✗	—	—
AFO A - L1G	✓	✗	✗	✗	✓	✓
AFO A - L1F	✓	✗	✗	✗	✓	✓
AFO A - L2G	✓	✗	✗	✗	✓	✓
AFO A - L2F	✓	✗	✗	✗	✓	✓
AFO A - L3G	✓	✗	✗	✗	✓	✓
AFO A - L3F	✓	✓	✗	✗	✓	✓
AFO A - L4G	✓	✓	✗	✗	✓	✓
AFO A - L4F	✓	✓	✗	✗	✓	✓
AFO A - L5G	✓	✓	✗	✗	✓	✓
AFO A - L5F	✓	✓	✗	✗	✗	✓

Discussion

Currently, the design of passive AFOs optimize for either heel or forefoot rocker. AFOs designed for heel rocker tend to have a low stiffness to allow for push off in toe rocker, and to avoid a decrease in the peak plantar flexion angle, while increasing knee flexion at heel strike[15–17]. AFOs designed for forefoot rocker tend to have high stiffnesses to induce heel rise and knee flexion in the ankle rocker to forefoot rocker transition. When designing for one of these rockers, there are limitations in the others. AFOs designed for heel rocker don't have enough stiffness in forefoot rocker and cause an unstable knee flexion, while AFOs designed for forefoot rocker have a stiffness so high that little to no power can be generated at push-off[5,12]. The AFO modifier was designed to allow for a low stiffness in heel and toe rockers, avoiding knee flexion, and allowing for plantar flexion at push off. It must also have a moderate stiffness in ankle rocker to slow forward progression of the tibia and begin to store energy, followed by a high stiffness in forefoot rocker to induce heel rise and knee extension, causing further forward progression of the tibia. In theory, an AFO that can achieve these properties would be the ideal intervention for drop foot patients post stroke.

This study showed that combing the modifier with a standard polypropylene AFO (AFO A) was able to achieve some of our design requirements, but not all (Table 6). 1) The AFOMCs were all able to achieve a range of motion from 20° plantar flexed to 12° dorsiflexed. 2) Changing the modifier levels did correlate to a change in stiffness in RD and DF, meaning that this device could be tuned to match user's stiffness needs on a patient-specific basis. While the modified AFO was able to reach the required range of stiffness in RD, it peaked at 2.26 Nm/°, meaning that we would not be able to cover the full range of stiffnesses that users may need. None of the AFO A combinations were able to achieve even the minimum required stiffness of 4.2 Nm/° in DF, let alone the entire range. Typically, AFOs that are designed for a low stiffness at heel strike and push off would not achieve this range of stiffness in DF. 3) While there were some tests where the stiffness was able to double from RD to DF, none of the combinations were able to achieve the required range of 150-250% increase. There was a trend showing that this increase between the two regions was best at low-mid modifier levels but tended to decrease towards the higher modifier levels. For this design to be successful, the stiffness must be able to have a consistent increase from RD to DF at any modifier level, as this is critical for ensuring a proper ankle rocker to forefoot rocker transition. 4) The addition of the modifier to the base AFO generally did not cause the stiffness in RPF to increase. There was only one case where there was any statistically significant difference in stiffness which was AFO A-L5F. It is possible that there were unaccounted for sources of error causing this difference, and further investigation is needed. 5) The both the gel and foam modifiers were well under the required weight of 300g, making this a feasible lightweight alternative to hinged/articulating stiffness controlling AFOs.

The findings of this study are indeed limited by the assumptions made in the design and testing process. One major assumption made in this experiment is that the angle-moment curves could be independently fit in each region of motion with a linear fit. In past studies, the hysteresis loop that occurs in AFO testing has been dealt with by either including the ends in the linear fit of the data[37,39,42], or by discarding the ends of the loop and just fitting the linear regions[43]. A linear fitting method, including the ends of the loops, was chosen to make the results more practical in a clinical setting for orthotists who may be prescribing these devices to patients and would prefer the simplest way to describe their effects. Additionally, the hysteresis occurs when the AFO/testing device changes directions from dorsiflexion to plantar flexion, and from plantar flexion to dorsiflexion. Both of these events occur in the two assistive regions of motion (Assistive Plantarflexion and Assistive Dorsiflexion), which are not the main regions of focus in this study. Furthermore, similar fitting techniques have been used to determine the quasi-stiffness on the human ankle joint during walking[22,23,44–50]. The hysteresis loops caused energy losses in the system, which could be due to slop in the mechanical setup, lack of tension in the Velcro causing play when the AFO switches from plantar flexion motion to dorsiflexion motion, or loading of the AFO occurring outside of the sagittal plane. An interesting finding is that the addition of the modifier appeared to lessen the severity of the hysteresis loop for AFO F, which had a very low stiffness as the base AFO.

Another limitation in this study is the ability to accurately locate the neutral angle of the AFO. Because of the hysteresis loop, the position where the AFO moment on the ankle joint is zero differs by several degrees from dorsiflexion to plantar flexion, however, there was a general trend of the modified AFOs moving to a more plantar flexed position. This is a problem in its clinical application, as the neutral angle is important when setting the shank to vertical angle for a patient with their given AFO – footwear combination and must be carefully prescribed by the clinician[21]. This study is also limited by its small sample size. Further testing must be repeated on a larger number of samples to better investigate these trends; however, this study serves the purpose of beginning to explore a range of AFO-modifier combinations that have yet to be tested.

While the mechanical testing in this study serves as a type of verification testing of the VSAFO as a usable foot drop brace, this study was largely limited by not having performed any sort of validation testing. In the future, this AFO should be tested on foot drop patients in a clinical study to see its effects on gait. The clinical study would include 3D motion tracking of foot drop patients walking with no AFO, with a traditional homopolymer polypropylene AFO, and with the VSAFO. The purpose of the study would be to assess metabolic cost during walking, as well as other spatiotemporal parameters such as walking speed, stride length, and ankle flexion range of motion. It would also be critical to conduct patient-reported outcome measure questionnaires to get qualitative feedback from users.

Exploring the effects of the modifier on AFO A is a good indicator of its capabilities, however, a wider range of AFOMCs should be tested to assess all possible ranges of stiffness that could be used in a clinical setting. The results showed that the modifier was able to change the stiffnesses in RD and DF, which is important for the ankle to forefoot rocker transition, the modifier had no effect on the RPF stiffness, which is critical for allowing push-off in the toe rocker. Since the ideal AFO should have a small stiffness in RPF[19,20,29], an ideal modified AFO would require that the base AFO already have a low

RPF stiffness, and the RD and DF stiffnesses be able to increase enough to achieve the required ranges. Further testing of the modifier in combination with AFOs that have small RPF stiffnesses is required to better understand the effects of the combination.

The stiffnesses found for the AFO combinations in this study are within the range of values cited in literature. While, to our knowledge, there are no other studies testing the stiffness of FBAFOs, and no other studies which separates the stiffness of the AFO into the five regions of motion described in this paper, there is still a fair amount of literature evaluating the stiffnesses of various other AFOs. A recent literature review on AFO stiffnesses (Totah et. Al) found stiffness ranges of 0.06 Nm/° to 8.17 Nm/° in dorsiflexion and 0.02 Nm/° to 4.6 Nm/°in plantar flexion[29]. All the stiffness regions in this experiment fall into the ranges described in this literature review. There appears to be a general lack of synthesis in the literature surrounding AFO stiffness, including content on stiffness testing, ideal AFO stiffness, and how the stiffness in different regions of motion affect gait. It is possible that if this AFO modifier can achieve all of the design requirements, it could be used as a clinical tool to assess patient specific ideal AFO stiffnesses and their effects on gait.

While the AFO modifier combinations tested in this study were unable to achieve all of our design requirements, there were still some promising findings that should be used as motivation for future work. In the future, we should be looking to continue with this concept and expand on a few ideas: 1) Combining the modifier with a wider range of base AFOs and testing them at every modifier level. 2) Testing modifiers made of a wider range of material properties and thicknesses to learn how those factors impact stiffness. 3) Work on adjusting the modifier so that it can handle higher stiffnesses in RD and DF, as level 5 was as high as the current modifiers were designed to withstand.

This mechanical testing serves as a type of verification testing of the design requirements and once the verification is successful, we should move on to validation testing. A validation test of the AFO modifier combinations would be some form of a gait study to assess the clinical outcomes of the device on a range of stroke patients. If the verification and validation testing were to be successful, this variable stiffness ankle-foot orthosis would be worth investing in for further development to bring to market.

In summary, we tested a combination of base FBAFOs and modifiers to see if we could achieve and ideal stiffness profile. The design objective was to create an AFO which could create the ideal stiffness profile for any specific user, improving ankle kinematics at heel strike, heel off, and push off. To verify this goal, five design requirements were tested on AFO A with both modifiers at each of the modifier levels. These modified AFOs were able to achieve the required range of motion, not increase stiffness in RPF and have a modifier of less than 300 g. Half were able to achieve the required stiffness in RD, and none were able to achieve the required stiffness in DF, or undergo the required change in stiffness from RD to DF. Further work is required to improve the design to meet each of these requirements, and bring this device to a clinical study for validation. These results show some promise that the modifier concept could be a feasible solution, however, the search for a functional variable stiffness ankle foot orthosis continues.

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Appendix

Table 7: Stiffness of all AFO A, AFO E, and AFO F AFO-Modifier combinations in the five regions of motion.

AFO	Modifier Level	Modifier Material	Assistive Dorsiflexion k [Nm/°]	Resistive Dorsiflexion k [Nm/°]	Dual Flexion k [Nm/°]	Assistive Plantar Flexion k [Nm/°]	Resistive Plantar Flexion k [Nm/°]
AFO A	No Modifier		-2.24 ± 0.06	0.56 ± 0.06	0.6 ± 0.1	-1.3 ± 0.1	2.75 ± 0.03
	L1	Gel	-3.18 ± 0.06	0.46 ± 0.05	0.9 ± 0.1	-1.2 ± 0.1	2.87 ± 0.04
		Foam	-3.11 ± 0.05	0.50 ± 0.06	1.0 ± 0.1	-1.3 ± 0.1	2.87 ± 0.04
	L2	Gel	-3.10 ± 0.05	0.66 ± 0.05	1.4 ± 0.1	-1.6 ± 0.1	2.85 ± 0.04
		Foam	-3.01 ± 0.09	0.76 ± 0.06	1.6 ± 0.1	-1.6 ± 0.1	2.87 ± 0.04
	L3	Gel	-3.3 ± 0.1	1.12 ± 0.06	1.6 ± 0.1	-2.0 ± 0.1	2.86 ± 0.04
		Foam	-2.99 ± 0.06	1.44 ± 0.05	1.9 ± 0.1	-2.1 ± 0.1	2.82 ± 0.04
	L4	Gel	-3.2 ± 0.2	1.74 ± 0.06	2.0 ± 0.3	-2.3 ± 0.1	2.83 ± 0.07
		Foam	-3.19 ± 0.05	1.94 ± 0.05	1.7 ± 0.1	-2.4 ± 0.1	2.92 ± 0.05
	L5	Gel	-3.5 ± 0.1	1.90 ± 0.06	1.1 ± 0.2	-2.5 ± 0.1	2.83 ± 0.07
		Foam	-3.26 ± 0.05	2.26 ± 0.06	1.1 ± 0.2	-2.3 ± 0.1	3.08 ± 0.04
AFO E	No Modifier		-3.3 ± 0.2	0.71 ± 0.05	0.72 ± 0.14	-1.6 ± 0.1	3.89 ± 0.07
	L5	Gel	-4.70 ± 0.06	1.83 ± 0.05	1.32 ± 0.11	-2.5 ± 0.1	3.81 ± 0.04
		Foam	-4.54 ± 0.07	1.87 ± 0.07	1.61 ± 0.17	-2.7 ± 0.1	3.6 ± 0.1
AFO F	No Modifier		-1.40 ± 0.07	0.23 ± 0.06	0.34 ± 0.11	-1.4 ± 0.2	0.42 ± 0.06
	L1	Gel	-1.20 ± 0.05	0.10 ± 0.05	0.34 ± 0.14	-0.5 ± 0.1	0.86 ± 0.04
		Foam	-1.16 ± 0.07	0.16 ± 0.06	0.38 ± 0.14	-0.5 ± 0.1	0.85 ± 0.04

Table 8: Summary Table for base AFO two-way analysis of variance (ANOVA) across the 6 base AFOs and the 5 regions of motion

Compare cell means regardless of rows and columns					
Number of families	1				
Number of comparisons per family	435				
Alpha	0.05				
Sidak's multiple comparisons test	Mean Diff.	95.00% CI of diff.	Significant?	Summary	Adjusted P Value
AD:AFO A vs. AD:AFO B	-0.116	-0.632 to 0.400	No	ns	>0.9999
AD:AFO A vs. AD:AFO C	-0.197	-0.713 to 0.319	No	ns	>0.9999
AD:AFO A vs. AD:AFO D	-0.0998	-0.616 to 0.416	No	ns	>0.9999
AD:AFO A vs. AD:AFO E	1	0.485 to 1.52	Yes	****	<0.0001
AD:AFO A vs. AD:AFO F	-0.857	-1.37 to -0.341	Yes	****	<0.0001
AD:AFO A vs. RD:AFO A	-2.79	-3.31 to -2.28	Yes	****	<0.0001
AD:AFO A vs. RD:AFO B	-2.71	-3.22 to -2.19	Yes	****	<0.0001
AD:AFO A vs. RD:AFO C	-2.78	-3.29 to -2.26	Yes	****	<0.0001
AD:AFO A vs. RD:AFO D	-2.93	-3.44 to -2.41	Yes	****	<0.0001
AD:AFO A vs. RD:AFO E	-2.96	-3.48 to -2.44	Yes	****	<0.0001
AD:AFO A vs. RD:AFO F	-2.44	-2.96 to -1.92	Yes	****	<0.0001
AD:AFO A vs. DF:AFO A	-2.79	-3.31 to -2.27	Yes	****	<0.0001
AD:AFO A vs. DF:AFO B	-2.77	-3.29 to -2.25	Yes	****	<0.0001
AD:AFO A vs. DF:AFO C	-2.75	-3.26 to -2.23	Yes	****	<0.0001
AD:AFO A vs. DF:AFO D	-2.83	-3.34 to -2.31	Yes	****	<0.0001
AD:AFO A vs. DF:AFO E	-2.84	-3.35 to -2.32	Yes	****	<0.0001
AD:AFO A vs. DF:AFO F	-2.51	-3.03 to -2.00	Yes	****	<0.0001
AD:AFO A vs. APF:AFO A	-1.02	-1.53 to -0.501	Yes	****	<0.0001
AD:AFO A vs. APF:AFO B	-0.963	-1.48 to -0.447	Yes	****	<0.0001
AD:AFO A vs. APF:AFO C	-1.01	-1.52 to -0.491	Yes	****	<0.0001
AD:AFO A vs. APF:AFO D	-0.857	-1.37 to -0.340	Yes	****	<0.0001
AD:AFO A vs. APF:AFO E	-0.67	-1.19 to -0.153	Yes	***	0.
AD:AFO A vs. APF:AFO F	-0.914	-1.43 to -0.398	Yes	****	<0.0001
AD:AFO A vs. RPF:AFO A	-5.01	-5.52 to -4.49	Yes	****	<0.0001
AD:AFO A vs. RPF:AFO B	-4.96	-5.48 to -4.45	Yes	****	<0.0001
AD:AFO A vs. RPF:AFO C	-4.63	-5.14 to -4.11	Yes	****	<0.0001
AD:AFO A vs. RPF:AFO D	-4.84	-5.36 to -4.33	Yes	****	<0.0001
AD:AFO A vs. RPF:AFO E	-6.13	-6.64 to -5.61	Yes	****	<0.0001
AD:AFO A vs. RPF:AFO F	-2.68	-3.20 to -2.17	Yes	****	<0.0001
AD:AFO B vs. AD:AFO C	-0.0811	-0.597 to 0.435	No	ns	>0.9999

AD:AFO B vs. AD:AFO D	0.0161	-0.500 to 0.532	No	ns	>0.9999
AD:AFO B vs. AD:AFO E	1.12	0.601 to 1.63	Yes	****	<0.0001
AD:AFO B vs. AD:AFO F	-0.741	-1.26 to -0.225	Yes	****	<0.0001
AD:AFO B vs. RD:AFO A	-2.68	-3.19 to -2.16	Yes	****	<0.0001
AD:AFO B vs. RD:AFO B	-2.59	-3.11 to -2.08	Yes	****	<0.0001
AD:AFO B vs. RD:AFO C	-2.66	-3.18 to -2.14	Yes	****	<0.0001
AD:AFO B vs. RD:AFO D	-2.81	-3.33 to -2.29	Yes	****	<0.0001
AD:AFO B vs. RD:AFO E	-2.84	-3.36 to -2.33	Yes	****	<0.0001
AD:AFO B vs. RD:AFO F	-2.32	-2.84 to -1.81	Yes	****	<0.0001
AD:AFO B vs. DF:AFO A	-2.67	-3.19 to -2.16	Yes	****	<0.0001
AD:AFO B vs. DF:AFO B	-2.65	-3.17 to -2.14	Yes	****	<0.0001
AD:AFO B vs. DF:AFO C	-2.63	-3.15 to -2.11	Yes	****	<0.0001
AD:AFO B vs. DF:AFO D	-2.71	-3.23 to -2.20	Yes	****	<0.0001
AD:AFO B vs. DF:AFO E	-2.72	-3.24 to -2.20	Yes	****	<0.0001
AD:AFO B vs. DF:AFO F	-2.4	-2.91 to -1.88	Yes	****	<0.0001
AD:AFO B vs. APF:AFO A	-0.902	-1.42 to -0.386	Yes	****	<0.0001
AD:AFO B vs. APF:AFO B	-0.848	-1.36 to -0.331	Yes	****	<0.0001
AD:AFO B vs. APF:AFO C	-0.891	-1.41 to -0.375	Yes	****	<0.0001
AD:AFO B vs. APF:AFO D	-0.741	-1.26 to -0.225	Yes	****	<0.0001
AD:AFO B vs. APF:AFO E	-0.554	-1.07 to -0.0375	Yes	*	0.
AD:AFO B vs. APF:AFO F	-0.798	-1.31 to -0.282	Yes	****	<0.0001
AD:AFO B vs. RPF:AFO A	-4.89	-5.41 to -4.38	Yes	****	<0.0001
AD:AFO B vs. RPF:AFO B	-4.85	-5.36 to -4.33	Yes	****	<0.0001
AD:AFO B vs. RPF:AFO C	-4.51	-5.03 to -3.99	Yes	****	<0.0001
AD:AFO B vs. RPF:AFO D	-4.73	-5.25 to -4.21	Yes	****	<0.0001
AD:AFO B vs. RPF:AFO E	-6.01	-6.53 to -5.49	Yes	****	<0.0001
AD:AFO B vs. RPF:AFO F	-2.57	-3.08 to -2.05	Yes	****	<0.0001
AD:AFO C vs. AD:AFO D	0.0972	-0.419 to 0.613	No	ns	>0.9999
AD:AFO C vs. AD:AFO E	1.2	0.682 to 1.71	Yes	****	<0.0001
AD:AFO C vs. AD:AFO F	-0.66	-1.18 to -0.144	Yes	***	0.
AD:AFO C vs. RD:AFO A	-2.6	-3.11 to -2.08	Yes	****	<0.0001
AD:AFO C vs. RD:AFO B	-2.51	-3.03 to -1.99	Yes	****	<0.0001
AD:AFO C vs. RD:AFO C	-2.58	-3.09 to -2.06	Yes	****	<0.0001
AD:AFO C vs. RD:AFO D	-2.73	-3.25 to -2.21	Yes	****	<0.0001
AD:AFO C vs. RD:AFO E	-2.76	-3.28 to -2.25	Yes	****	<0.0001
AD:AFO C vs. RD:AFO F	-2.24	-2.76 to -1.73	Yes	****	<0.0001
AD:AFO C vs. DF:AFO A	-2.59	-3.11 to -2.08	Yes	****	<0.0001
AD:AFO C vs. DF:AFO B	-2.57	-3.09 to -2.06	Yes	****	<0.0001
AD:AFO C vs. DF:AFO C	-2.55	-3.07 to -2.03	Yes	****	<0.0001
AD:AFO C vs. DF:AFO D	-2.63	-3.15 to -2.11	Yes	****	<0.0001
AD:AFO C vs. DF:AFO E	-2.64	-3.16 to -2.12	Yes	****	<0.0001
AD:AFO C vs. DF:AFO F	-2.31	-2.83 to -1.80	Yes	****	<0.0001
AD:AFO C vs. APF:AFO A	-0.821	-1.34 to -0.304	Yes	****	<0.0001

AD:AFO C vs. APF:AFO B	-0.766	-1.28 to -0.250	Yes	****	<0.0001
AD:AFO C vs. APF:AFO C	-0.81	-1.33 to -0.294	Yes	****	<0.0001
AD:AFO C vs. APF:AFO D	-0.66	-1.18 to -0.143	Yes	***	0.
AD:AFO C vs. APF:AFO E	-0.473	-0.989 to 0.0436	No	ns	0.
AD:AFO C vs. APF:AFO F	-0.717	-1.23 to -0.201	Yes	***	0.
AD:AFO C vs. RPF:AFO A	-4.81	-5.33 to -4.30	Yes	****	<0.0001
AD:AFO C vs. RPF:AFO B	-4.76	-5.28 to -4.25	Yes	****	<0.0001
AD:AFO C vs. RPF:AFO C	-4.43	-4.95 to -3.91	Yes	****	<0.0001
AD:AFO C vs. RPF:AFO D	-4.65	-5.16 to -4.13	Yes	****	<0.0001
AD:AFO C vs. RPF:AFO E	-5.93	-6.44 to -5.41	Yes	****	<0.0001
AD:AFO C vs. RPF:AFO F	-2.49	-3.00 to -1.97	Yes	****	<0.0001
AD:AFO D vs. AD:AFO E	1.1	0.585 to 1.62	Yes	****	<0.0001
AD:AFO D vs. AD:AFO F	-0.757	-1.27 to -0.241	Yes	****	<0.0001
AD:AFO D vs. RD:AFO A	-2.69	-3.21 to -2.18	Yes	****	<0.0001
AD:AFO D vs. RD:AFO B	-2.61	-3.12 to -2.09	Yes	****	<0.0001
AD:AFO D vs. RD:AFO C	-2.68	-3.19 to -2.16	Yes	****	<0.0001
AD:AFO D vs. RD:AFO D	-2.83	-3.34 to -2.31	Yes	****	<0.0001
AD:AFO D vs. RD:AFO E	-2.86	-3.38 to -2.34	Yes	****	<0.0001
AD:AFO D vs. RD:AFO F	-2.34	-2.86 to -1.82	Yes	****	<0.0001
AD:AFO D vs. DF:AFO A	-2.69	-3.21 to -2.17	Yes	****	<0.0001
AD:AFO D vs. DF:AFO B	-2.67	-3.19 to -2.15	Yes	****	<0.0001
AD:AFO D vs. DF:AFO C	-2.65	-3.16 to -2.13	Yes	****	<0.0001
AD:AFO D vs. DF:AFO D	-2.73	-3.24 to -2.21	Yes	****	<0.0001
AD:AFO D vs. DF:AFO E	-2.74	-3.25 to -2.22	Yes	****	<0.0001
AD:AFO D vs. DF:AFO F	-2.41	-2.93 to -1.90	Yes	****	<0.0001
AD:AFO D vs. APF:AFO A	-0.918	-1.43 to -0.402	Yes	****	<0.0001
AD:AFO D vs. APF:AFO B	-0.864	-1.38 to -0.347	Yes	****	<0.0001
AD:AFO D vs. APF:AFO C	-0.907	-1.42 to -0.391	Yes	****	<0.0001
AD:AFO D vs. APF:AFO D	-0.757	-1.27 to -0.241	Yes	****	<0.0001
AD:AFO D vs. APF:AFO E	-0.57	-1.09 to -0.0536	Yes	*	0.
AD:AFO D vs. APF:AFO F	-0.814	-1.33 to -0.298	Yes	****	<0.0001
AD:AFO D vs. RPF:AFO A	-4.91	-5.42 to -4.39	Yes	****	<0.0001
AD:AFO D vs. RPF:AFO B	-4.86	-5.38 to -4.35	Yes	****	<0.0001
AD:AFO D vs. RPF:AFO C	-4.53	-5.04 to -4.01	Yes	****	<0.0001
AD:AFO D vs. RPF:AFO D	-4.74	-5.26 to -4.23	Yes	****	<0.0001
AD:AFO D vs. RPF:AFO E	-6.03	-6.54 to -5.51	Yes	****	<0.0001
AD:AFO D vs. RPF:AFO F	-2.58	-3.10 to -2.07	Yes	****	<0.0001
AD:AFO E vs. AD:AFO F	-1.86	-2.38 to -1.34	Yes	****	<0.0001
AD:AFO E vs. RD:AFO A	-3.8	-4.31 to -3.28	Yes	****	<0.0001
AD:AFO E vs. RD:AFO B	-3.71	-4.23 to -3.19	Yes	****	<0.0001
AD:AFO E vs. RD:AFO C	-3.78	-4.29 to -3.26	Yes	****	<0.0001
AD:AFO E vs. RD:AFO D	-3.93	-4.44 to -3.41	Yes	****	<0.0001
AD:AFO E vs. RD:AFO E	-3.96	-4.48 to -3.44	Yes	****	<0.0001

AD:AFO E vs. RD:AFO F	-3.44	-3.96 to -2.93	Yes	****	<0.0001
AD:AFO E vs. DF:AFO A	-3.79	-4.31 to -3.28	Yes	****	<0.0001
AD:AFO E vs. DF:AFO B	-3.77	-4.29 to -3.26	Yes	****	<0.0001
AD:AFO E vs. DF:AFO C	-3.75	-4.26 to -3.23	Yes	****	<0.0001
AD:AFO E vs. DF:AFO D	-3.83	-4.35 to -3.31	Yes	****	<0.0001
AD:AFO E vs. DF:AFO E	-3.84	-4.35 to -3.32	Yes	****	<0.0001
AD:AFO E vs. DF:AFO F	-3.51	-4.03 to -3.00	Yes	****	<0.0001
AD:AFO E vs. APF:AFO A	-2.02	-2.54 to -1.50	Yes	****	<0.0001
AD:AFO E vs. APF:AFO B	-1.97	-2.48 to -1.45	Yes	****	<0.0001
AD:AFO E vs. APF:AFO C	-2.01	-2.52 to -1.49	Yes	****	<0.0001
AD:AFO E vs. APF:AFO D	-1.86	-2.37 to -1.34	Yes	****	<0.0001
AD:AFO E vs. APF:AFO E	-1.67	-2.19 to -1.16	Yes	****	<0.0001
AD:AFO E vs. APF:AFO F	-1.92	-2.43 to -1.40	Yes	****	<0.0001
AD:AFO E vs. RPF:AFO A	-6.01	-6.53 to -5.49	Yes	****	<0.0001
AD:AFO E vs. RPF:AFO B	-5.96	-6.48 to -5.45	Yes	****	<0.0001
AD:AFO E vs. RPF:AFO C	-5.63	-6.14 to -5.11	Yes	****	<0.0001
AD:AFO E vs. RPF:AFO D	-5.85	-6.36 to -5.33	Yes	****	<0.0001
AD:AFO E vs. RPF:AFO E	-7.13	-7.64 to -6.61	Yes	****	<0.0001
AD:AFO E vs. RPF:AFO F	-3.68	-4.20 to -3.17	Yes	****	<0.0001
AD:AFO F vs. RD:AFO A	-1.94	-2.45 to -1.42	Yes	****	<0.0001
AD:AFO F vs. RD:AFO B	-1.85	-2.37 to -1.33	Yes	****	<0.0001
AD:AFO F vs. RD:AFO C	-1.92	-2.43 to -1.40	Yes	****	<0.0001
AD:AFO F vs. RD:AFO D	-2.07	-2.59 to -1.55	Yes	****	<0.0001
AD:AFO F vs. RD:AFO E	-2.1	-2.62 to -1.59	Yes	****	<0.0001
AD:AFO F vs. RD:AFO F	-1.58	-2.10 to -1.07	Yes	****	<0.0001
AD:AFO F vs. DF:AFO A	-1.93	-2.45 to -1.42	Yes	****	<0.0001
AD:AFO F vs. DF:AFO B	-1.91	-2.43 to -1.40	Yes	****	<0.0001
AD:AFO F vs. DF:AFO C	-1.89	-2.41 to -1.37	Yes	****	<0.0001
AD:AFO F vs. DF:AFO D	-1.97	-2.49 to -1.45	Yes	****	<0.0001
AD:AFO F vs. DF:AFO E	-1.98	-2.50 to -1.46	Yes	****	<0.0001
AD:AFO F vs. DF:AFO F	-1.65	-2.17 to -1.14	Yes	****	<0.0001
AD:AFO F vs. APF:AFO A	-0.16	-0.677 to 0.356	No	ns	>0.9999
AD:AFO F vs. APF:AFO B	-0.106	-0.622 to 0.410	No	ns	>0.9999
AD:AFO F vs. APF:AFO C	-0.15	-0.666 to 0.366	No	ns	>0.9999
AD:AFO F vs. APF:AFO D	0.00056	-0.516 to 0.517	No	ns	>0.9999
AD:AFO F vs. APF:AFO E	0.188	-0.329 to 0.704	No	ns	>0.9999
AD:AFO F vs. APF:AFO F	-0.0568	-0.573 to 0.460	No	ns	>0.9999
AD:AFO F vs. RPF:AFO A	-4.15	-4.67 to -3.63	Yes	****	<0.0001
AD:AFO F vs. RPF:AFO B	-4.1	-4.62 to -3.59	Yes	****	<0.0001
AD:AFO F vs. RPF:AFO C	-3.77	-4.29 to -3.25	Yes	****	<0.0001
AD:AFO F vs. RPF:AFO D	-3.99	-4.50 to -3.47	Yes	****	<0.0001
AD:AFO F vs. RPF:AFO E	-5.27	-5.78 to -4.75	Yes	****	<0.0001
AD:AFO F vs. RPF:AFO F	-1.83	-2.34 to -1.31	Yes	****	<0.0001

RD:AFO A vs. RD:AFO B	0.0853	-0.431 to 0.602	No	ns	>0.9999
RD:AFO A vs. RD:AFO C	0.0179	-0.498 to 0.534	No	ns	>0.9999
RD:AFO A vs. RD:AFO D	-0.133	-0.649 to 0.383	No	ns	>0.9999
RD:AFO A vs. RD:AFO E	-0.166	-0.682 to 0.351	No	ns	>0.9999
RD:AFO A vs. RD:AFO F	0.353	-0.163 to 0.870	No	ns	0.
RD:AFO A vs. DF:AFO A	0.00331	-0.513 to 0.520	No	ns	>0.9999
RD:AFO A vs. DF:AFO B	0.0225	-0.494 to 0.539	No	ns	>0.9999
RD:AFO A vs. DF:AFO C	0.0464	-0.470 to 0.563	No	ns	>0.9999
RD:AFO A vs. DF:AFO D	-0.0345	-0.551 to 0.482	No	ns	>0.9999
RD:AFO A vs. DF:AFO E	-0.0432	-0.559 to 0.473	No	ns	>0.9999
RD:AFO A vs. DF:AFO F	0.282	-0.234 to 0.798	No	ns	>0.9999
RD:AFO A vs. APF:AFO A	1.78	1.26 to 2.29	Yes	****	<0.0001
RD:AFO A vs. APF:AFO B	1.83	1.31 to 2.35	Yes	****	<0.0001
RD:AFO A vs. APF:AFO C	1.79	1.27 to 2.30	Yes	****	<0.0001
RD:AFO A vs. APF:AFO D	1.94	1.42 to 2.45	Yes	****	<0.0001
RD:AFO A vs. APF:AFO E	2.12	1.61 to 2.64	Yes	****	<0.0001
RD:AFO A vs. APF:AFO F	1.88	1.36 to 2.40	Yes	****	<0.0001
RD:AFO A vs. RPF:AFO A	-2.21	-2.73 to -1.70	Yes	****	<0.0001
RD:AFO A vs. RPF:AFO B	-2.17	-2.68 to -1.65	Yes	****	<0.0001
RD:AFO A vs. RPF:AFO C	-1.83	-2.35 to -1.32	Yes	****	<0.0001
RD:AFO A vs. RPF:AFO D	-2.05	-2.57 to -1.53	Yes	****	<0.0001
RD:AFO A vs. RPF:AFO E	-3.33	-3.85 to -2.82	Yes	****	<0.0001
RD:AFO A vs. RPF:AFO F	0.111	-0.406 to 0.627	No	ns	>0.9999
RD:AFO B vs. RD:AFO C	-0.0674	-0.584 to 0.449	No	ns	>0.9999
RD:AFO B vs. RD:AFO D	-0.218	-0.735 to 0.298	No	ns	>0.9999
RD:AFO B vs. RD:AFO E	-0.251	-0.767 to 0.265	No	ns	>0.9999
RD:AFO B vs. RD:AFO F	0.268	-0.248 to 0.784	No	ns	>0.9999
RD:AFO B vs. DF:AFO A	-0.082	-0.598 to 0.434	No	ns	>0.9999
RD:AFO B vs. DF:AFO B	-0.0628	-0.579 to 0.453	No	ns	>0.9999
RD:AFO B vs. DF:AFO C	-0.039	-0.555 to 0.477	No	ns	>0.9999
RD:AFO B vs. DF:AFO D	-0.12	-0.636 to 0.396	No	ns	>0.9999
RD:AFO B vs. DF:AFO E	-0.129	-0.645 to 0.388	No	ns	>0.9999
RD:AFO B vs. DF:AFO F	0.197	-0.320 to 0.713	No	ns	>0.9999
RD:AFO B vs. APF:AFO A	1.69	1.17 to 2.21	Yes	****	<0.0001
RD:AFO B vs. APF:AFO B	1.74	1.23 to 2.26	Yes	****	<0.0001
RD:AFO B vs. APF:AFO C	1.7	1.18 to 2.22	Yes	****	<0.0001
RD:AFO B vs. APF:AFO D	1.85	1.34 to 2.37	Yes	****	<0.0001
RD:AFO B vs. APF:AFO E	2.04	1.52 to 2.55	Yes	****	<0.0001
RD:AFO B vs. APF:AFO F	1.79	1.28 to 2.31	Yes	****	<0.0001
RD:AFO B vs. RPF:AFO A	-2.3	-2.82 to -1.78	Yes	****	<0.0001
RD:AFO B vs. RPF:AFO B	-2.25	-2.77 to -1.74	Yes	****	<0.0001
RD:AFO B vs. RPF:AFO C	-1.92	-2.43 to -1.40	Yes	****	<0.0001
RD:AFO B vs. RPF:AFO D	-2.14	-2.65 to -1.62	Yes	****	<0.0001

RD:AFO B vs. RPF:AFO E	-3.42	-3.93 to -2.90	Yes	****	<0.0001
RD:AFO B vs. RPF:AFO F	0.0253	-0.491 to 0.542	No	ns	>0.9999
RD:AFO C vs. RD:AFO D	-0.151	-0.667 to 0.365	No	ns	>0.9999
RD:AFO C vs. RD:AFO E	-0.184	-0.700 to 0.333	No	ns	>0.9999
RD:AFO C vs. RD:AFO F	0.335	-0.181 to 0.852	No	ns	0.
RD:AFO C vs. DF:AFO A	-0.0146	-0.531 to 0.502	No	ns	>0.9999
RD:AFO C vs. DF:AFO B	0.00462	-0.512 to 0.521	No	ns	>0.9999
RD:AFO C vs. DF:AFO C	0.0284	-0.488 to 0.545	No	ns	>0.9999
RD:AFO C vs. DF:AFO D	-0.0525	-0.569 to 0.464	No	ns	>0.9999
RD:AFO C vs. DF:AFO E	-0.0611	-0.577 to 0.455	No	ns	>0.9999
RD:AFO C vs. DF:AFO F	0.264	-0.252 to 0.780	No	ns	>0.9999
RD:AFO C vs. APF:AFO A	1.76	1.24 to 2.27	Yes	****	<0.0001
RD:AFO C vs. APF:AFO B	1.81	1.30 to 2.33	Yes	****	<0.0001
RD:AFO C vs. APF:AFO C	1.77	1.25 to 2.28	Yes	****	<0.0001
RD:AFO C vs. APF:AFO D	1.92	1.40 to 2.44	Yes	****	<0.0001
RD:AFO C vs. APF:AFO E	2.11	1.59 to 2.62	Yes	****	<0.0001
RD:AFO C vs. APF:AFO F	1.86	1.35 to 2.38	Yes	****	<0.0001
RD:AFO C vs. RPF:AFO A	-2.23	-2.75 to -1.72	Yes	****	<0.0001
RD:AFO C vs. RPF:AFO B	-2.19	-2.70 to -1.67	Yes	****	<0.0001
RD:AFO C vs. RPF:AFO C	-1.85	-2.37 to -1.33	Yes	****	<0.0001
RD:AFO C vs. RPF:AFO D	-2.07	-2.59 to -1.55	Yes	****	<0.0001
RD:AFO C vs. RPF:AFO E	-3.35	-3.87 to -2.83	Yes	****	<0.0001
RD:AFO C vs. RPF:AFO F	0.0928	-0.423 to 0.609	No	ns	>0.9999
RD:AFO D vs. RD:AFO E	-0.0325	-0.549 to 0.484	No	ns	>0.9999
RD:AFO D vs. RD:AFO F	0.486	-0.0298 to 1.00	No	ns	0
RD:AFO D vs. DF:AFO A	0.136	-0.380 to 0.653	No	ns	>0.9999
RD:AFO D vs. DF:AFO B	0.156	-0.361 to 0.672	No	ns	>0.9999
RD:AFO D vs. DF:AFO C	0.179	-0.337 to 0.696	No	ns	>0.9999
RD:AFO D vs. DF:AFO D	0.0986	-0.418 to 0.615	No	ns	>0.9999
RD:AFO D vs. DF:AFO E	0.0899	-0.426 to 0.606	No	ns	>0.9999
RD:AFO D vs. DF:AFO F	0.415	-0.101 to 0.931	No	ns	0.
RD:AFO D vs. APF:AFO A	1.91	1.39 to 2.43	Yes	****	<0.0001
RD:AFO D vs. APF:AFO B	1.96	1.45 to 2.48	Yes	****	<0.0001
RD:AFO D vs. APF:AFO C	1.92	1.40 to 2.44	Yes	****	<0.0001
RD:AFO D vs. APF:AFO D	2.07	1.55 to 2.59	Yes	****	<0.0001
RD:AFO D vs. APF:AFO E	2.26	1.74 to 2.77	Yes	****	<0.0001
RD:AFO D vs. APF:AFO F	2.01	1.50 to 2.53	Yes	****	<0.0001
RD:AFO D vs. RPF:AFO A	-2.08	-2.60 to -1.57	Yes	****	<0.0001
RD:AFO D vs. RPF:AFO B	-2.04	-2.55 to -1.52	Yes	****	<0.0001
RD:AFO D vs. RPF:AFO C	-1.7	-2.22 to -1.18	Yes	****	<0.0001
RD:AFO D vs. RPF:AFO D	-1.92	-2.43 to -1.40	Yes	****	<0.0001
RD:AFO D vs. RPF:AFO E	-3.2	-3.72 to -2.68	Yes	****	<0.0001
RD:AFO D vs. RPF:AFO F	0.244	-0.272 to 0.760	No	ns	>0.9999

RD:AFO E vs. RD:AFO F	0.519	0.00276 to 1.04	Yes	*	0.
RD:AFO E vs. DF:AFO A	0.169	-0.347 to 0.685	No	ns	>0.9999
RD:AFO E vs. DF:AFO B	0.188	-0.328 to 0.704	No	ns	>0.9999
RD:AFO E vs. DF:AFO C	0.212	-0.304 to 0.728	No	ns	>0.9999
RD:AFO E vs. DF:AFO D	0.131	-0.385 to 0.647	No	ns	>0.9999
RD:AFO E vs. DF:AFO E	0.122	-0.394 to 0.639	No	ns	>0.9999
RD:AFO E vs. DF:AFO F	0.447	-0.0688 to 0.964	No	ns	0.
RD:AFO E vs. APF:AFO A	1.94	1.43 to 2.46	Yes	****	<0.0001
RD:AFO E vs. APF:AFO B	2	1.48 to 2.51	Yes	****	<0.0001
RD:AFO E vs. APF:AFO C	1.95	1.44 to 2.47	Yes	****	<0.0001
RD:AFO E vs. APF:AFO D	2.1	1.59 to 2.62	Yes	****	<0.0001
RD:AFO E vs. APF:AFO E	2.29	1.77 to 2.81	Yes	****	<0.0001
RD:AFO E vs. APF:AFO F	2.05	1.53 to 2.56	Yes	****	<0.0001
RD:AFO E vs. RPF:AFO A	-2.05	-2.57 to -1.53	Yes	****	<0.0001
RD:AFO E vs. RPF:AFO B	-2	-2.52 to -1.49	Yes	****	<0.0001
RD:AFO E vs. RPF:AFO C	-1.67	-2.18 to -1.15	Yes	****	<0.0001
RD:AFO E vs. RPF:AFO D	-1.89	-2.40 to -1.37	Yes	****	<0.0001
RD:AFO E vs. RPF:AFO E	-3.17	-3.68 to -2.65	Yes	****	<0.0001
RD:AFO E vs. RPF:AFO F	0.276	-0.240 to 0.793	No	ns	>0.9999
RD:AFO F vs. DF:AFO A	-0.35	-0.866 to 0.166	No	ns	0.
RD:AFO F vs. DF:AFO B	-0.331	-0.847 to 0.185	No	ns	
RD:AFO F vs. DF:AFO C	-0.307	-0.823 to 0.209	No	ns	0.
RD:AFO F vs. DF:AFO D	-0.388	-0.904 to 0.128	No	ns	0.
RD:AFO F vs. DF:AFO E	-0.397	-0.913 to 0.120	No	ns	0.
RD:AFO F vs. DF:AFO F	-0.0716	-0.588 to 0.445	No	ns	>0.9999
RD:AFO F vs. APF:AFO A	1.42	0.906 to 1.94	Yes	****	<0.0001
RD:AFO F vs. APF:AFO B	1.48	0.960 to 1.99	Yes	****	<0.0001
RD:AFO F vs. APF:AFO C	1.43	0.917 to 1.95	Yes	****	<0.0001
RD:AFO F vs. APF:AFO D	1.58	1.07 to 2.10	Yes	****	<0.0001
RD:AFO F vs. APF:AFO E	1.77	1.25 to 2.29	Yes	****	<0.0001
RD:AFO F vs. APF:AFO F	1.53	1.01 to 2.04	Yes	****	<0.0001
RD:AFO F vs. RPF:AFO A	-2.57	-3.08 to -2.05	Yes	****	<0.0001
RD:AFO F vs. RPF:AFO B	-2.52	-3.04 to -2.01	Yes	****	<0.0001
RD:AFO F vs. RPF:AFO C	-2.19	-2.70 to -1.67	Yes	****	<0.0001
RD:AFO F vs. RPF:AFO D	-2.4	-2.92 to -1.89	Yes	****	<0.0001
RD:AFO F vs. RPF:AFO E	-3.69	-4.20 to -3.17	Yes	****	<0.0001
RD:AFO F vs. RPF:AFO F	-0.243	-0.759 to 0.274	No	ns	>0.9999
DF:AFO A vs. DF:AFO B	0.0192	-0.497 to 0.535	No	ns	>0.9999
DF:AFO A vs. DF:AFO C	0.043	-0.473 to 0.559	No	ns	>0.9999
DF:AFO A vs. DF:AFO D	-0.0379	-0.554 to 0.478	No	ns	>0.9999
DF:AFO A vs. DF:AFO E	-0.0465	-0.563 to 0.470	No	ns	>0.9999
DF:AFO A vs. DF:AFO F	0.279	-0.238 to 0.795	No	ns	>0.9999
DF:AFO A vs. APF:AFO A	1.77	1.26 to 2.29	Yes	****	<0.0001

DF:AFO A vs. APF:AFO B	1.83	1.31 to 2.34	Yes	****	<0.0001
DF:AFO A vs. APF:AFO C	1.78	1.27 to 2.30	Yes	****	<0.0001
DF:AFO A vs. APF:AFO D	1.93	1.42 to 2.45	Yes	****	<0.0001
DF:AFO A vs. APF:AFO E	2.12	1.60 to 2.64	Yes	****	<0.0001
DF:AFO A vs. APF:AFO F	1.88	1.36 to 2.39	Yes	****	<0.0001
DF:AFO A vs. RPF:AFO A	-2.22	-2.73 to -1.70	Yes	****	<0.0001
DF:AFO A vs. RPF:AFO B	-2.17	-2.69 to -1.66	Yes	****	<0.0001
DF:AFO A vs. RPF:AFO C	-1.84	-2.35 to -1.32	Yes	****	<0.0001
DF:AFO A vs. RPF:AFO D	-2.05	-2.57 to -1.54	Yes	****	<0.0001
DF:AFO A vs. RPF:AFO E	-3.34	-3.85 to -2.82	Yes	****	<0.0001
DF:AFO A vs. RPF:AFO F	0.107	-0.409 to 0.624	No	ns	>0.9999
DF:AFO B vs. DF:AFO C	0.0238	-0.492 to 0.540	No	ns	>0.9999
DF:AFO B vs. DF:AFO D	-0.0571	-0.573 to 0.459	No	ns	>0.9999
DF:AFO B vs. DF:AFO E	-0.0657	-0.582 to 0.451	No	ns	>0.9999
DF:AFO B vs. DF:AFO F	0.259	-0.257 to 0.776	No	ns	>0.9999
DF:AFO B vs. APF:AFO A	1.75	1.24 to 2.27	Yes	****	<0.0001
DF:AFO B vs. APF:AFO B	1.81	1.29 to 2.32	Yes	****	<0.0001
DF:AFO B vs. APF:AFO C	1.76	1.25 to 2.28	Yes	****	<0.0001
DF:AFO B vs. APF:AFO D	1.91	1.40 to 2.43	Yes	****	<0.0001
DF:AFO B vs. APF:AFO E	2.1	1.58 to 2.62	Yes	****	<0.0001
DF:AFO B vs. APF:AFO F	1.86	1.34 to 2.37	Yes	****	<0.0001
DF:AFO B vs. RPF:AFO A	-2.24	-2.75 to -1.72	Yes	****	<0.0001
DF:AFO B vs. RPF:AFO B	-2.19	-2.71 to -1.67	Yes	****	<0.0001
DF:AFO B vs. RPF:AFO C	-1.86	-2.37 to -1.34	Yes	****	<0.0001
DF:AFO B vs. RPF:AFO D	-2.07	-2.59 to -1.56	Yes	****	<0.0001
DF:AFO B vs. RPF:AFO E	-3.35	-3.87 to -2.84	Yes	****	<0.0001
DF:AFO B vs. RPF:AFO F	0.0881	-0.428 to 0.604	No	ns	>0.9999
DF:AFO C vs. DF:AFO D	-0.0809	-0.597 to 0.435	No	ns	>0.9999
DF:AFO C vs. DF:AFO E	-0.0895	-0.606 to 0.427	No	ns	>0.9999
DF:AFO C vs. DF:AFO F	0.235	-0.281 to 0.752	No	ns	>0.9999
DF:AFO C vs. APF:AFO A	1.73	1.21 to 2.25	Yes	****	<0.0001
DF:AFO C vs. APF:AFO B	1.78	1.27 to 2.30	Yes	****	<0.0001
DF:AFO C vs. APF:AFO C	1.74	1.22 to 2.26	Yes	****	<0.0001
DF:AFO C vs. APF:AFO D	1.89	1.37 to 2.41	Yes	****	<0.0001
DF:AFO C vs. APF:AFO E	2.08	1.56 to 2.59	Yes	****	<0.0001
DF:AFO C vs. APF:AFO F	1.83	1.32 to 2.35	Yes	****	<0.0001
DF:AFO C vs. RPF:AFO A	-2.26	-2.78 to -1.75	Yes	****	<0.0001
DF:AFO C vs. RPF:AFO B	-2.21	-2.73 to -1.70	Yes	****	<0.0001
DF:AFO C vs. RPF:AFO C	-1.88	-2.40 to -1.36	Yes	****	<0.0001
DF:AFO C vs. RPF:AFO D	-2.1	-2.61 to -1.58	Yes	****	<0.0001
DF:AFO C vs. RPF:AFO E	-3.38	-3.89 to -2.86	Yes	****	<0.0001
DF:AFO C vs. RPF:AFO F	0.0643	-0.452 to 0.581	No	ns	>0.9999
DF:AFO D vs. DF:AFO E	-0.00865	-0.525 to 0.508	No	ns	>0.9999

DF:AFO D vs. DF:AFO F	0.316	-0.200 to 0.833	No	ns	0
DF:AFO D vs. APF:AFO A	1.81	1.29 to 2.33	Yes	****	<0.0001
DF:AFO D vs. APF:AFO B	1.86	1.35 to 2.38	Yes	****	<0.0001
DF:AFO D vs. APF:AFO C	1.82	1.30 to 2.34	Yes	****	<0.0001
DF:AFO D vs. APF:AFO D	1.97	1.45 to 2.49	Yes	****	<0.0001
DF:AFO D vs. APF:AFO E	2.16	1.64 to 2.67	Yes	****	<0.0001
DF:AFO D vs. APF:AFO F	1.91	1.40 to 2.43	Yes	****	<0.0001
DF:AFO D vs. RPF:AFO A	-2.18	-2.70 to -1.66	Yes	****	<0.0001
DF:AFO D vs. RPF:AFO B	-2.13	-2.65 to -1.62	Yes	****	<0.0001
DF:AFO D vs. RPF:AFO C	-1.8	-2.31 to -1.28	Yes	****	<0.0001
DF:AFO D vs. RPF:AFO D	-2.02	-2.53 to -1.50	Yes	****	<0.0001
DF:AFO D vs. RPF:AFO E	-3.3	-3.81 to -2.78	Yes	****	<0.0001
DF:AFO D vs. RPF:AFO F	0.145	-0.371 to 0.661	No	ns	>0.9999
DF:AFO E vs. DF:AFO F	0.325	-0.191 to 0.841	No	ns	0.
DF:AFO E vs. APF:AFO A	1.82	1.30 to 2.34	Yes	****	<0.0001
DF:AFO E vs. APF:AFO B	1.87	1.36 to 2.39	Yes	****	<0.0001
DF:AFO E vs. APF:AFO C	1.83	1.31 to 2.35	Yes	****	<0.0001
DF:AFO E vs. APF:AFO D	1.98	1.46 to 2.50	Yes	****	<0.0001
DF:AFO E vs. APF:AFO E	2.17	1.65 to 2.68	Yes	****	<0.0001
DF:AFO E vs. APF:AFO F	1.92	1.41 to 2.44	Yes	****	<0.0001
DF:AFO E vs. RPF:AFO A	-2.17	-2.69 to -1.66	Yes	****	<0.0001
DF:AFO E vs. RPF:AFO B	-2.13	-2.64 to -1.61	Yes	****	<0.0001
DF:AFO E vs. RPF:AFO C	-1.79	-2.31 to -1.27	Yes	****	<0.0001
DF:AFO E vs. RPF:AFO D	-2.01	-2.52 to -1.49	Yes	****	<0.0001
DF:AFO E vs. RPF:AFO E	-3.29	-3.81 to -2.77	Yes	****	<0.0001
DF:AFO E vs. RPF:AFO F	0.154	-0.362 to 0.670	No	ns	>0.9999
DF:AFO F vs. APF:AFO A	1.49	0.978 to 2.01	Yes	****	<0.0001
DF:AFO F vs. APF:AFO B	1.55	1.03 to 2.06	Yes	****	<0.0001
DF:AFO F vs. APF:AFO C	1.5	0.988 to 2.02	Yes	****	<0.0001
DF:AFO F vs. APF:AFO D	1.65	1.14 to 2.17	Yes	****	<0.0001
DF:AFO F vs. APF:AFO E	1.84	1.33 to 2.36	Yes	****	<0.0001
DF:AFO F vs. APF:AFO F	1.6	1.08 to 2.11	Yes	****	<0.0001
DF:AFO F vs. RPF:AFO A	-2.5	-3.01 to -1.98	Yes	****	<0.0001
DF:AFO F vs. RPF:AFO B	-2.45	-2.97 to -1.93	Yes	****	<0.0001
DF:AFO F vs. RPF:AFO C	-2.11	-2.63 to -1.60	Yes	****	<0.0001
DF:AFO F vs. RPF:AFO D	-2.33	-2.85 to -1.82	Yes	****	<0.0001
DF:AFO F vs. RPF:AFO E	-3.61	-4.13 to -3.10	Yes	****	<0.0001
DF:AFO F vs. RPF:AFO F	-0.171	-0.687 to 0.345	No	ns	>0.9999
APF:AFO A vs. APF:AFO B	0.0543	-0.462 to 0.571	No	ns	>0.9999
APF:AFO A vs. APF:AFO C	0.0107	-0.506 to 0.527	No	ns	>0.9999
APF:AFO A vs. APF:AFO D	0.161	-0.355 to 0.677	No	ns	>0.9999
APF:AFO A vs. APF:AFO E	0.348	-0.168 to 0.864	No	ns	0.
APF:AFO A vs. APF:AFO F	0.104	-0.413 to 0.620	No	ns	>0.9999

APF:AFO A vs. RPF:AFO A	-3.99	-4.51 to -3.47	Yes	****	<0.0001
APF:AFO A vs. RPF:AFO B	-3.94	-4.46 to -3.43	Yes	****	<0.0001
APF:AFO A vs. RPF:AFO C	-3.61	-4.12 to -3.09	Yes	****	<0.0001
APF:AFO A vs. RPF:AFO D	-3.83	-4.34 to -3.31	Yes	****	<0.0001
APF:AFO A vs. RPF:AFO E	-5.11	-5.62 to -4.59	Yes	****	<0.0001
APF:AFO A vs. RPF:AFO F	-1.67	-2.18 to -1.15	Yes	****	<0.0001
APF:AFO B vs. APF:AFO C	-0.0436	-0.560 to 0.473	No	ns	>0.9999
APF:AFO B vs. APF:AFO D	0.107	-0.410 to 0.623	No	ns	>0.9999
APF:AFO B vs. APF:AFO E	0.294	-0.223 to 0.810	No	ns	>0.9999
APF:AFO B vs. APF:AFO F	0.0494	-0.467 to 0.566	No	ns	>0.9999
APF:AFO B vs. RPF:AFO A	-4.04	-4.56 to -3.53	Yes	****	<0.0001
APF:AFO B vs. RPF:AFO B	-4	-4.51 to -3.48	Yes	****	<0.0001
APF:AFO B vs. RPF:AFO C	-3.66	-4.18 to -3.15	Yes	****	<0.0001
APF:AFO B vs. RPF:AFO D	-3.88	-4.40 to -3.36	Yes	****	<0.0001
APF:AFO B vs. RPF:AFO E	-5.16	-5.68 to -4.65	Yes	****	<0.0001
APF:AFO B vs. RPF:AFO F	-1.72	-2.24 to -1.20	Yes	****	<0.0001
APF:AFO C vs. APF:AFO D	0.15	-0.366 to 0.667	No	ns	>0.9999
APF:AFO C vs. APF:AFO E	0.337	-0.179 to 0.854	No	ns	0.
APF:AFO C vs. APF:AFO F	0.093	-0.423 to 0.609	No	ns	>0.9999
APF:AFO C vs. RPF:AFO A	-4	-4.52 to -3.49	Yes	****	<0.0001
APF:AFO C vs. RPF:AFO B	-3.95	-4.47 to -3.44	Yes	****	<0.0001
APF:AFO C vs. RPF:AFO C	-3.62	-4.14 to -3.10	Yes	****	<0.0001
APF:AFO C vs. RPF:AFO D	-3.84	-4.35 to -3.32	Yes	****	<0.0001
APF:AFO C vs. RPF:AFO E	-5.12	-5.63 to -4.60	Yes	****	<0.0001
APF:AFO C vs. RPF:AFO F	-1.68	-2.19 to -1.16	Yes	****	<0.0001
APF:AFO D vs. APF:AFO E	0.187	-0.329 to 0.703	No	ns	>0.9999
APF:AFO D vs. APF:AFO F	-0.0573	-0.574 to 0.459	No	ns	>0.9999
APF:AFO D vs. RPF:AFO A	-4.15	-4.67 to -3.64	Yes	****	<0.0001
APF:AFO D vs. RPF:AFO B	-4.11	-4.62 to -3.59	Yes	****	<0.0001
APF:AFO D vs. RPF:AFO C	-3.77	-4.29 to -3.25	Yes	****	<0.0001
APF:AFO D vs. RPF:AFO D	-3.99	-4.50 to -3.47	Yes	****	<0.0001
APF:AFO D vs. RPF:AFO E	-5.27	-5.78 to -4.75	Yes	****	<0.0001
APF:AFO D vs. RPF:AFO F	-1.83	-2.34 to -1.31	Yes	****	<0.0001
APF:AFO E vs. APF:AFO F	-0.244	-0.761 to 0.272	No	ns	>0.9999
APF:AFO E vs. RPF:AFO A	-4.34	-4.85 to -3.82	Yes	****	<0.0001
APF:AFO E vs. RPF:AFO B	-4.29	-4.81 to -3.78	Yes	****	<0.0001
APF:AFO E vs. RPF:AFO C	-3.96	-4.47 to -3.44	Yes	****	<0.0001
APF:AFO E vs. RPF:AFO D	-4.17	-4.69 to -3.66	Yes	****	<0.0001
APF:AFO E vs. RPF:AFO E	-5.46	-5.97 to -4.94	Yes	****	<0.0001
APF:AFO E vs. RPF:AFO F	-2.01	-2.53 to -1.50	Yes	****	<0.0001
APF:AFO F vs. RPF:AFO A	-4.09	-4.61 to -3.58	Yes	****	<0.0001
APF:AFO F vs. RPF:AFO B	-4.05	-4.56 to -3.53	Yes	****	<0.0001
APF:AFO F vs. RPF:AFO C	-3.71	-4.23 to -3.20	Yes	****	<0.0001

APF:AFO F vs. RPF:AFO D	-3.93	-4.45 to -3.41	Yes	****	<0.0001
APF:AFO F vs. RPF:AFO E	-5.21	-5.73 to -4.70	Yes	****	<0.0001
APF:AFO F vs. RPF:AFO F	-1.77	-2.28 to -1.25	Yes	****	<0.0001
RPF:AFO A vs. RPF:AFO B	0.0465	-0.470 to 0.563	No	ns	>0.9999
RPF:AFO A vs. RPF:AFO C	0.382	-0.134 to 0.899	No	ns	0.
RPF:AFO A vs. RPF:AFO D	0.164	-0.353 to 0.680	No	ns	>0.9999
RPF:AFO A vs. RPF:AFO E	-1.12	-1.63 to -0.601	Yes	****	<0.0001
RPF:AFO A vs. RPF:AFO F	2.33	1.81 to 2.84	Yes	****	<0.0001
RPF:AFO B vs. RPF:AFO C	0.336	-0.180 to 0.852	No	ns	0.
RPF:AFO B vs. RPF:AFO D	0.117	-0.399 to 0.633	No	ns	>0.9999
RPF:AFO B vs. RPF:AFO E	-1.16	-1.68 to -0.647	Yes	****	<0.0001
RPF:AFO B vs. RPF:AFO F	2.28	1.76 to 2.80	Yes	****	<0.0001
RPF:AFO C vs. RPF:AFO D	-0.219	-0.735 to 0.298	No	ns	>0.9999
RPF:AFO C vs. RPF:AFO E	-1.5	-2.02 to -0.983	Yes	****	<0.0001
RPF:AFO C vs. RPF:AFO F	1.94	1.43 to 2.46	Yes	****	<0.0001
RPF:AFO D vs. RPF:AFO E	-1.28	-1.80 to -0.765	Yes	****	<0.0001
RPF:AFO D vs. RPF:AFO F	2.16	1.65 to 2.68	Yes	****	<0.0001
RPF:AFO E vs. RPF:AFO F	3.44	2.93 to 3.96	Yes	****	<0.0001

Table 9: Summary Table for Assistive Dorsiflexion two-way analysis of variance (ANOVA) across the 6 Modifier levels (5 Modifier levels + base AFO) and the two Modifier materials (Gel & Foam)

Assistive Dorsiflexion					
Source of Variation	% of total variation	P value	P value summary	Significant?	
Interaction	1.93	0.2002	ns	No	
Modifier Resistance	90.2	<0.0001	****	Yes	
Materials	2.04	0.0078	**	Yes	
Compare cell means regardless of rows and columns					
Number of families	1				
Number of comparisons per family	66				
Alpha	0.05				
Sidak's multiple comparisons test	Mean Diff.	95.00% CI of diff.	Significant?	Summary	Adjusted P Value
No Modifier:Gel vs. No Modifier:Foam	0	-0.436 to 0.436	No	Ns	>0.9999
No Modifier:Gel vs. L1:Gel	0.92	0.484 to 1.36	Yes	****	<0.0001
No Modifier:Gel vs. L1:Foam	0.857	0.421 to 1.29	Yes	****	<0.0001
No Modifier:Gel vs. L2:Gel	0.85	0.414 to 1.29	Yes	****	<0.0001
No Modifier:Gel vs. L2:Foam	0.776	0.340 to 1.21	Yes	****	<0.0001
No Modifier:Gel vs. L3:Gel	0.991	0.555 to 1.43	Yes	****	<0.0001
No Modifier:Gel vs. L3:Foam	0.746	0.310 to 1.18	Yes	****	<0.0001
No Modifier:Gel vs. L4:Gel	0.952	0.516 to 1.39	Yes	****	<0.0001
No Modifier:Gel vs. L4:Foam	0.942	0.506 to 1.38	Yes	****	<0.0001
No Modifier:Gel vs. L5:Gel	1.27	0.838 to 1.71	Yes	****	<0.0001
No Modifier:Gel vs. L5:Foam	1.01	0.575 to 1.45	Yes	****	<0.0001
No Modifier:Foam vs. L1:Gel	0.92	0.484 to 1.36	Yes	****	<0.0001
No Modifier:Foam vs. L1:Foam	0.857	0.421 to 1.29	Yes	****	<0.0001
No Modifier:Foam vs. L2:Gel	0.85	0.414 to 1.29	Yes	****	<0.0001
No Modifier:Foam vs. L2:Foam	0.776	0.340 to 1.21	Yes	****	<0.0001
No Modifier:Foam vs. L3:Gel	0.991	0.555 to 1.43	Yes	****	<0.0001

No Modifier:Foam vs. L3:Foam	0.746	0.310 to 1.18	Yes	****	<0.0001
No Modifier:Foam vs. L4:Gel	0.952	0.516 to 1.39	Yes	****	<0.0001
No Modifier:Foam vs. L4:Foam	0.942	0.506 to 1.38	Yes	****	<0.0001
No Modifier:Foam vs. L5:Gel	1.27	0.838 to 1.71	Yes	****	<0.0001
No Modifier:Foam vs. L5:Foam	1.01	0.575 to 1.45	Yes	****	<0.0001
L1:Gel vs. L1:Foam	-0.0629	-0.499 to 0.373	No	Ns	>0.9999
L1:Gel vs. L2:Gel	-0.0703	-0.506 to 0.366	No	Ns	>0.9999
L1:Gel vs. L2:Foam	-0.144	-0.579 to 0.292	No	Ns	>0.9999
L1:Gel vs. L3:Gel	0.0707	-0.365 to 0.507	No	Ns	>0.9999
L1:Gel vs. L3:Foam	-0.174	-0.610 to 0.262	No	Ns	>0.9999
L1:Gel vs. L4:Gel	0.0321	-0.404 to 0.468	No	Ns	>0.9999
L1:Gel vs. L4:Foam	0.0224	-0.413 to 0.458	No	Ns	>0.9999
L1:Gel vs. L5:Gel	0.354	-0.0815 to 0.790	No	Ns	0.2614
L1:Gel vs. L5:Foam	0.091	-0.345 to 0.527	No	Ns	>0.9999
L1:Foam vs. L2:Gel	-0.0074	-0.443 to 0.428	No	Ns	>0.9999
L1:Foam vs. L2:Foam	-0.0807	-0.517 to 0.355	No	Ns	>0.9999
L1:Foam vs. L3:Gel	0.134	-0.302 to 0.569	No	Ns	>0.9999
L1:Foam vs. L3:Foam	-0.111	-0.547 to 0.325	No	Ns	>0.9999
L1:Foam vs. L4:Gel	0.095	-0.341 to 0.531	No	Ns	>0.9999
L1:Foam vs. L4:Foam	0.0853	-0.351 to 0.521	No	Ns	>0.9999
L1:Foam vs. L5:Gel	0.417	-0.0186 to 0.853	No	Ns	0.0745
L1:Foam vs. L5:Foam	0.154	-0.282 to 0.590	No	Ns	>0.9999
L2:Gel vs. L2:Foam	-0.0733	-0.509 to 0.363	No	Ns	>0.9999
L2:Gel vs. L3:Gel	0.141	-0.295 to 0.577	No	Ns	>0.9999
L2:Gel vs. L3:Foam	-0.104	-0.539 to 0.332	No	Ns	>0.9999
L2:Gel vs. L4:Gel	0.102	-0.333 to 0.538	No	Ns	>0.9999
L2:Gel vs. L4:Foam	0.0927	-0.343 to 0.529	No	Ns	>0.9999

L2:Gel vs. L5:Gel	0.425	-0.0112 to 0.861	No	Ns	0.0636
L2:Gel vs. L5:Foam	0.161	-0.275 to 0.597	No	Ns	>0.9999
L2:Foam vs. L3:Gel	0.214	-0.222 to 0.650	No	Ns	0.9921
L2:Foam vs. L3:Foam	-0.0303	-0.466 to 0.406	No	Ns	>0.9999
L2:Foam vs. L4:Gel	0.176	-0.260 to 0.612	No	Ns	>0.9999
L2:Foam vs. L4:Foam	0.166	-0.270 to 0.602	No	Ns	>0.9999
L2:Foam vs. L5:Gel	0.498	0.0621 to 0.934	Yes	*	0.0127
L2:Foam vs. L5:Foam	0.235	-0.201 to 0.670	No	Ns	0.9646
L3:Gel vs. L3:Foam	-0.245	-0.680 to 0.191	No	Ns	0.9375
L3:Gel vs. L4:Gel	-0.0386	-0.474 to 0.397	No	Ns	>0.9999
L3:Gel vs. L4:Foam	-0.0483	-0.484 to 0.388	No	Ns	>0.9999
L3:Gel vs. L5:Gel	0.284	-0.152 to 0.720	No	Ns	0.7276
L3:Gel vs. L5:Foam	0.0203	-0.416 to 0.456	No	Ns	>0.9999
L3:Foam vs. L4:Gel	0.206	-0.230 to 0.642	No	Ns	0.9964
L3:Foam vs. L4:Foam	0.196	-0.240 to 0.632	No	Ns	0.9987
L3:Foam vs. L5:Gel	0.528	0.0924 to 0.964	Yes	**	0.0065
L3:Foam vs. L5:Foam	0.265	-0.171 to 0.701	No	Ns	0.8475
L4:Gel vs. L4:Foam	-0.0097	-0.446 to 0.426	No	Ns	>0.9999
L4:Gel vs. L5:Gel	0.322	-0.114 to 0.758	No	Ns	0.4481
L4:Gel vs. L5:Foam	0.0589	-0.377 to 0.495	No	Ns	>0.9999
L4:Foam vs. L5:Gel	0.332	-0.104 to 0.768	No	Ns	0.3848
L4:Foam vs. L5:Foam	0.0686	-0.367 to 0.504	No	Ns	>0.9999
L5:Gel vs. L5:Foam	-0.263	-0.699 to 0.172	No	Ns	0.8557

Table 10: Summary Table for Resistive Dorsiflexion two-way analysis of variance (ANOVA) across the 6 Modifier levels (5 Modifier levels + base AFO) and the two Modifier materials (Gel & Foam)

Resistive Dorsiflexion					
Source of Variation	% of total variation	P value	P value summary	Significant?	

Interaction	1.08	<0.0001	****	Yes	
Modifier Resistance	97	<0.0001	****	Yes	
Materials	1.76	<0.0001	****	Yes	
Compare cell means regardless of rows and columns					
Number of families	1				
Number of comparisons per family	66				
Alpha	0.05				
Sidak's multiple comparisons test	Mean Diff.	95.00% CI of diff.	Significant ?	Summary	Adjusted P Value
No Modifier:Gel vs. No Modifier:Foam	0	-0.303 to 0.303	No	Ns	>0.9999
No Modifier:Gel vs. L1:Gel	0.0836	-0.220 to 0.387	No	Ns	>0.9999
No Modifier:Gel vs. L1:Foam	0.0495	-0.254 to 0.353	No	Ns	>0.9999
No Modifier:Gel vs. L2:Gel	-0.106	-0.410 to 0.197	No	Ns	>0.9999
No Modifier:Gel vs. L2:Foam	-0.225	-0.529 to 0.0780	No	Ns	0.4384
No Modifier:Gel vs. L3:Gel	-0.58	-0.883 to -0.277	Yes	****	<0.0001
No Modifier:Gel vs. L3:Foam	-0.9	-1.20 to -0.596	Yes	****	<0.0001
No Modifier:Gel vs. L4:Gel	-1.2	-1.51 to -0.902	Yes	****	<0.0001
No Modifier:Gel vs. L4:Foam	-1.39	-1.70 to -1.09	Yes	****	<0.0001
No Modifier:Gel vs. L5:Gel	-1.35	-1.65 to -1.05	Yes	****	<0.0001
No Modifier:Gel vs. L5:Foam	-1.7	-2.00 to -1.40	Yes	****	<0.0001
No Modifier:Foam vs. L1:Gel	0.0836	-0.220 to 0.387	No	Ns	>0.9999
No Modifier:Foam vs. L1:Foam	0.0495	-0.254 to 0.353	No	Ns	>0.9999
No Modifier:Foam vs. L2:Gel	-0.106	-0.410 to 0.197	No	Ns	>0.9999
No Modifier:Foam vs. L2:Foam	-0.225	-0.529 to 0.0780	No	Ns	0.4384
No Modifier:Foam vs. L3:Gel	-0.58	-0.883 to -0.277	Yes	****	<0.0001
No Modifier:Foam vs. L3:Foam	-0.9	-1.20 to -0.596	Yes	****	<0.0001

No Modifier:Foam vs. L4:Gel	-1.2	-1.51 to -0.902	Yes	****	<0.0001
No Modifier:Foam vs. L4:Foam	-1.39	-1.70 to -1.09	Yes	****	<0.0001
No Modifier:Foam vs. L5:Gel	-1.35	-1.65 to -1.05	Yes	****	<0.0001
No Modifier:Foam vs. L5:Foam	-1.7	-2.00 to -1.40	Yes	****	<0.0001
L1:Gel vs. L1:Foam	-0.0341	-0.337 to 0.269	No	Ns	>0.9999
L1:Gel vs. L2:Gel	-0.19	-0.493 to 0.114	No	Ns	0.8011
L1:Gel vs. L2:Foam	-0.309	-0.612 to -0.00555	Yes	*	0.042
L1:Gel vs. L3:Gel	-0.664	-0.967 to -0.360	Yes	****	<0.0001
L1:Gel vs. L3:Foam	-0.983	-1.29 to -0.680	Yes	****	<0.0001
L1:Gel vs. L4:Gel	-1.29	-1.59 to -0.985	Yes	****	<0.0001
L1:Gel vs. L4:Foam	-1.48	-1.78 to -1.17	Yes	****	<0.0001
L1:Gel vs. L5:Gel	-1.43	-1.74 to -1.13	Yes	****	<0.0001
L1:Gel vs. L5:Foam	-1.79	-2.09 to -1.48	Yes	****	<0.0001
L1:Foam vs. L2:Gel	-0.156	-0.459 to 0.148	No	Ns	0.9831
L1:Foam vs. L2:Foam	-0.275	-0.578 to 0.0285	No	Ns	0.1189
L1:Foam vs. L3:Gel	-0.63	-0.933 to -0.326	Yes	****	<0.0001
L1:Foam vs. L3:Foam	-0.949	-1.25 to -0.646	Yes	****	<0.0001
L1:Foam vs. L4:Gel	-1.25	-1.56 to -0.951	Yes	****	<0.0001
L1:Foam vs. L4:Foam	-1.44	-1.75 to -1.14	Yes	****	<0.0001
L1:Foam vs. L5:Gel	-1.4	-1.70 to -1.10	Yes	****	<0.0001
L1:Foam vs. L5:Foam	-1.75	-2.05 to -1.45	Yes	****	<0.0001
L2:Gel vs. L2:Foam	-0.119	-0.422 to 0.184	No	Ns	>0.9999
L2:Gel vs. L3:Gel	-0.474	-0.777 to -0.170	Yes	***	0.0002
L2:Gel vs. L3:Foam	-0.793	-1.10 to -0.490	Yes	****	<0.0001
L2:Gel vs. L4:Gel	-1.1	-1.40 to -0.795	Yes	****	<0.0001
L2:Gel vs. L4:Foam	-1.29	-1.59 to -0.985	Yes	****	<0.0001
L2:Gel vs. L5:Gel	-1.25	-1.55 to -0.942	Yes	****	<0.0001
L2:Gel vs. L5:Foam	-1.6	-1.90 to -1.29	Yes	****	<0.0001
L2:Foam vs. L3:Gel	-0.355	-0.658 to -0.0514	Yes	**	0.0098
L2:Foam vs. L3:Foam	-0.674	-0.978 to -0.371	Yes	****	<0.0001
L2:Foam vs. L4:Gel	-0.98	-1.28 to -0.676	Yes	****	<0.0001
L2:Foam vs. L4:Foam	-1.17	-1.47 to -0.866	Yes	****	<0.0001
L2:Foam vs. L5:Gel	-1.13	-1.43 to -0.823	Yes	****	<0.0001
L2:Foam vs. L5:Foam	-1.48	-1.78 to -1.17	Yes	****	<0.0001
L3:Gel vs. L3:Foam	-0.32	-0.623 to -0.0163	Yes	*	0.03
L3:Gel vs. L4:Gel	-0.625	-0.928 to -0.322	Yes	****	<0.0001
L3:Gel vs. L4:Foam	-0.815	-1.12 to -0.511	Yes	****	<0.0001
L3:Gel vs. L5:Gel	-0.771	-1.07 to -0.468	Yes	****	<0.0001
L3:Gel vs. L5:Foam	-1.12	-1.42 to -0.818	Yes	****	<0.0001

L3:Foam vs. L4:Gel	-0.305	-0.609 to - 0.00195	Yes	*	0.047
L3:Foam vs. L4:Foam	-0.495	-0.798 to -0.192	Yes	***	0.0001
L3:Foam vs. L5:Gel	-0.452	-0.755 to -0.148	Yes	***	0.0004
L3:Foam vs. L5:Foam	-0.802	-1.11 to -0.499	Yes	****	<0.0001
L4:Gel vs. L4:Foam	-0.19	-0.493 to 0.114	No	Ns	0.8029
L4:Gel vs. L5:Gel	-0.146	-0.450 to 0.157	No	Ns	0.9946
L4:Gel vs. L5:Foam	-0.497	-0.800 to -0.193	Yes	***	0.0001
L4:Foam vs. L5:Gel	0.0433	-0.260 to 0.347	No	Ns	>0.9999
L4:Foam vs. L5:Foam	-0.307	-0.610 to - 0.00375	Yes	*	0.0445
L5:Gel vs. L5:Foam	-0.35	-0.654 to -0.0471	Yes	*	0.0112

Table 11: Summary Table for Dual Flexion two-way analysis of variance (ANOVA) across the 6 Modifier levels (5 Modifier levels + base AFO) and the two Modifier materials (Gel & Foam)

Dual Flexion					
Source of Variation	% of total variation	P value	P value summary	Significant?	
Interaction	1.37	0.0854	ns	No	
Modifier Resistance	94.1	<0.0001	****	Yes	
Materials	1.54	0.0017	**	Yes	
Compare cell means regardless of rows and columns					
Number of families	1				
Number of comparisons per family	66				
Alpha	0.05				
Sidak's multiple comparisons test	Mean Diff.	95.00% CI of diff.	Significant?	Summary	Adjusted P Value
No Modifier:Gel vs. No Modifier:Foam	0	-0.626 to 0.626	No	Ns	>0.9999
No Modifier:Gel vs. L1:Gel	-0.38	-1.01 to 0.246	No	Ns	0.8491
No Modifier:Gel vs. L1:Foam	-0.466	-1.09 to 0.160	No	Ns	0.4337
No Modifier:Gel vs. L2:Gel	-0.807	-1.43 to -0.181	Yes	**	0.003
No Modifier:Gel vs. L2:Foam	-1.03	-1.65 to -0.402	Yes	***	0.0001
No Modifier:Gel vs. L3:Gel	-1.05	-1.67 to -0.421	Yes	****	<0.0001
No Modifier:Gel vs. L3:Foam	-1.27	-1.90 to -0.647	Yes	****	<0.0001
No Modifier:Gel vs. L4:Gel	-1.13	-1.75 to -0.502	Yes	****	<0.0001
No Modifier:Gel vs. L4:Foam	-1.09	-1.72 to -0.464	Yes	****	<0.0001
No Modifier:Gel vs. L5:Gel	-0.339	-0.964 to 0.287	No	Ns	0.962
No Modifier:Gel vs. L5:Foam	-0.491	-1.12 to 0.135	No	Ns	0.3264
No Modifier:Foam vs. L1:Gel	-0.38	-1.01 to 0.246	No	Ns	0.8491
No Modifier:Foam vs. L1:Foam	-0.466	-1.09 to 0.160	No	Ns	0.4337
No Modifier:Foam vs. L2:Gel	-0.807	-1.43 to -0.181	Yes	**	0.003

No Modifier:Foam vs. L2:Foam	-1.03	-1.65 to -0.402	Yes	***	0.0001
No Modifier:Foam vs. L3:Gel	-1.05	-1.67 to -0.421	Yes	****	<0.0001
No Modifier:Foam vs. L3:Foam	-1.27	-1.90 to -0.647	Yes	****	<0.0001
No Modifier:Foam vs. L4:Gel	-1.13	-1.75 to -0.502	Yes	****	<0.0001
No Modifier:Foam vs. L4:Foam	-1.09	-1.72 to -0.464	Yes	****	<0.0001
No Modifier:Foam vs. L5:Gel	-0.339	-0.964 to 0.287	No	Ns	0.962
No Modifier:Foam vs. L5:Foam	-0.491	-1.12 to 0.135	No	Ns	0.3264
L1:Gel vs. L1:Foam	-0.0859	-0.712 to 0.540	No	Ns	>0.9999
L1:Gel vs. L2:Gel	-0.427	-1.05 to 0.199	No	Ns	0.6289
L1:Gel vs. L2:Foam	-0.648	-1.27 to -0.0223	Yes	*	0.0357
L1:Gel vs. L3:Gel	-0.667	-1.29 to -0.0410	Yes	*	0.0268
L1:Gel vs. L3:Foam	-0.893	-1.52 to -0.268	Yes	***	0.0008
L1:Gel vs. L4:Gel	-0.748	-1.37 to -0.122	Yes	**	0.0076
L1:Gel vs. L4:Foam	-0.71	-1.34 to -0.0844	Yes	*	0.0137
L1:Gel vs. L5:Gel	0.0414	-0.584 to 0.667	No	Ns	>0.9999
L1:Gel vs. L5:Foam	-0.111	-0.737 to 0.515	No	Ns	>0.9999
L1:Foam vs. L2:Gel	-0.341	-0.967 to 0.285	No	Ns	0.958
L1:Foam vs. L2:Foam	-0.562	-1.19 to 0.0636	No	Ns	0.1271
L1:Foam vs. L3:Gel	-0.581	-1.21 to 0.0449	No	Ns	0.0972
L1:Foam vs. L3:Foam	-0.807	-1.43 to -0.182	Yes	**	0.003
L1:Foam vs. L4:Gel	-0.662	-1.29 to -0.0365	Yes	*	0.0287
L1:Foam vs. L4:Foam	-0.624	-1.25 to 0.00149	No	Ns	0.0511
L1:Foam vs. L5:Gel	0.127	-0.498 to 0.753	No	Ns	>0.9999
L1:Foam vs. L5:Foam	-0.025	-0.651 to 0.601	No	Ns	>0.9999
L2:Gel vs. L2:Foam	-0.221	-0.847 to 0.404	No	Ns	>0.9999
L2:Gel vs. L3:Gel	-0.24	-0.866 to 0.386	No	Ns	>0.9999
L2:Gel vs. L3:Foam	-0.467	-1.09 to 0.159	No	Ns	0.4304
L2:Gel vs. L4:Gel	-0.321	-0.947 to 0.304	No	Ns	0.983
L2:Gel vs. L4:Foam	-0.283	-0.909 to 0.342	No	ns	0.9986
L2:Gel vs. L5:Gel	0.468	-0.158 to 1.09	No	ns	0.4226
L2:Gel vs. L5:Foam	0.316	-0.310 to 0.942	No	ns	0.9873
L2:Foam vs. L3:Gel	-0.0187	-0.644 to 0.607	No	ns	>0.9999
L2:Foam vs. L3:Foam	-0.245	-0.871 to 0.381	No	ns	>0.9999
L2:Foam vs. L4:Gel	-0.1	-0.726 to 0.526	No	ns	>0.9999

L2:Foam vs. L4:Foam	-0.0621	-0.688 to 0.564	No	ns	>0.9999
L2:Foam vs. L5:Gel	0.69	0.0637 to 1.32	Yes	*	0.0189
L2:Foam vs. L5:Foam	0.537	-0.0886 to 1.16	No	ns	0.1799
L3:Gel vs. L3:Foam	-0.227	-0.852 to 0.399	No	ns	>0.9999
L3:Gel vs. L4:Gel	-0.0814	-0.707 to 0.544	No	ns	>0.9999
L3:Gel vs. L4:Foam	-0.0434	-0.669 to 0.582	No	ns	>0.9999
L3:Gel vs. L5:Gel	0.708	0.0824 to 1.33	Yes	*	0.0141
L3:Gel vs. L5:Foam	0.556	-0.0699 to 1.18	No	ns	0.1389
L3:Foam vs. L4:Gel	0.145	-0.481 to 0.771	No	ns	>0.9999
L3:Foam vs. L4:Foam	0.183	-0.443 to 0.809	No	ns	>0.9999
L3:Foam vs. L5:Gel	0.935	0.309 to 1.56	Yes	***	0.0004
L3:Foam vs. L5:Foam	0.782	0.157 to 1.41	Yes	**	0.0045
L4:Gel vs. L4:Foam	0.038	-0.588 to 0.664	No	ns	>0.9999
L4:Gel vs. L5:Gel	0.79	0.164 to 1.42	Yes	**	0.004
L4:Gel vs. L5:Foam	0.637	0.0115 to 1.26	Yes	*	0.042
L4:Foam vs. L5:Gel	0.752	0.126 to 1.38	Yes	**	0.0072
L4:Foam vs. L5:Foam	0.599	-0.0265 to 1.23	No	ns	0.0743
L5:Gel vs. L5:Foam	-0.152	-0.778 to 0.473	No	ns	>0.9999

Table 12: Summary Table for Assistive Plantar Flexion two-way analysis of variance (ANOVA) across the 6 Modifier levels (5 Modifier levels + base AFO) and the two Modifier materials (Gel & Foam)

Assistive Plantar Flexion					
Source of Variation	% of total variation	P value	P value summary	Significant?	
Interaction	0.965	0.1208	ns	No	
Modifier Resistance	96.7	<0.0001	****	Yes	
Materials	0.0105	0.7467	ns	No	
Compare cell means regardless of rows and columns					
Number of families	1				
Number of comparisons per family	66				
Alpha	0.05				
Sidak's multiple comparisons test	Mean Diff.	95.00% CI of diff.	Significant?	Summary	Adjusted P Value
No Modifier:Gel vs. No Modifier:Foam	0	-0.595 to 0.595	No	ns	>0.9999
No Modifier:Gel vs. L1:Gel	0.0135	-0.582 to 0.609	No	ns	>0.9999
No Modifier:Gel vs. L1:Foam	0.0511	-0.544 to 0.646	No	ns	>0.9999
No Modifier:Gel vs. L2:Gel	0.318	-0.277 to 0.913	No	ns	0.9675
No Modifier:Gel vs. L2:Foam	0.353	-0.242 to 0.948	No	ns	0.8808
No Modifier:Gel vs. L3:Gel	0.756	0.161 to 1.35	Yes	**	0.0036
No Modifier:Gel vs. L3:Foam	0.836	0.240 to 1.43	Yes	***	0.001
No Modifier:Gel vs. L4:Gel	1.05	0.451 to 1.64	Yes	****	<0.0001
No Modifier:Gel vs. L4:Foam	1.14	0.545 to 1.74	Yes	****	<0.0001
No Modifier:Gel vs. L5:Gel	1.23	0.632 to 1.82	Yes	****	<0.0001
No Modifier:Gel vs. L5:Foam	1.04	0.445 to 1.63	Yes	****	<0.0001
No Modifier:Foam vs. L1:Gel	0.0135	-0.582 to 0.609	No	ns	>0.9999
No Modifier:Foam vs. L1:Foam	0.0511	-0.544 to 0.646	No	ns	>0.9999
No Modifier:Foam vs. L2:Gel	0.318	-0.277 to 0.913	No	ns	0.9675

No Modifier:Foam vs. L2:Foam	0.353	-0.242 to 0.948	No	ns	0.8808
No Modifier:Foam vs. L3:Gel	0.756	0.161 to 1.35	Yes	**	0.0036
No Modifier:Foam vs. L3:Foam	0.836	0.240 to 1.43	Yes	***	0.001
No Modifier:Foam vs. L4:Gel	1.05	0.451 to 1.64	Yes	****	<0.0001
No Modifier:Foam vs. L4:Foam	1.14	0.545 to 1.74	Yes	****	<0.0001
No Modifier:Foam vs. L5:Gel	1.23	0.632 to 1.82	Yes	****	<0.0001
No Modifier:Foam vs. L5:Foam	1.04	0.445 to 1.63	Yes	****	<0.0001
L1:Gel vs. L1:Foam	0.0376	-0.557 to 0.633	No	ns	>0.9999
L1:Gel vs. L2:Gel	0.305	-0.290 to 0.900	No	ns	0.9836
L1:Gel vs. L2:Foam	0.339	-0.256 to 0.934	No	ns	0.9234
L1:Gel vs. L3:Gel	0.743	0.148 to 1.34	Yes	**	0.0045
L1:Gel vs. L3:Foam	0.822	0.227 to 1.42	Yes	**	0.0012
L1:Gel vs. L4:Gel	1.03	0.437 to 1.63	Yes	****	<0.0001
L1:Gel vs. L4:Foam	1.13	0.531 to 1.72	Yes	****	<0.0001
L1:Gel vs. L5:Gel	1.21	0.619 to 1.81	Yes	****	<0.0001
L1:Gel vs. L5:Foam	1.03	0.431 to 1.62	Yes	****	<0.0001
L1:Foam vs. L2:Gel	0.267	-0.328 to 0.862	No	ns	0.9988
L1:Foam vs. L2:Foam	0.302	-0.293 to 0.897	No	ns	0.9862
L1:Foam vs. L3:Gel	0.705	0.110 to 1.30	Yes	**	0.0084
L1:Foam vs. L3:Foam	0.784	0.189 to 1.38	Yes	**	0.0023
L1:Foam vs. L4:Gel	0.995	0.399 to 1.59	Yes	****	<0.0001
L1:Foam vs. L4:Foam	1.09	0.494 to 1.68	Yes	****	<0.0001
L1:Foam vs. L5:Gel	1.18	0.581 to 1.77	Yes	****	<0.0001
L1:Foam vs. L5:Foam	0.989	0.394 to 1.58	Yes	****	<0.0001
L2:Gel vs. L2:Foam	0.0345	-0.561 to 0.630	No	ns	>0.9999
L2:Gel vs. L3:Gel	0.438	-0.157 to 1.03	No	ns	0.459
L2:Gel vs. L3:Foam	0.517	-0.0779 to 1.11	No	ns	0.1643
L2:Gel vs. L4:Gel	0.727	0.132 to 1.32	Yes	**	0.0059
L2:Gel vs. L4:Foam	0.822	0.227 to 1.42	Yes	**	0.0013
L2:Gel vs. L5:Gel	0.909	0.314 to 1.50	Yes	***	0.0003
L2:Gel vs. L5:Foam	0.721	0.126 to 1.32	Yes	**	0.0064
L2:Foam vs. L3:Gel	0.403	-0.192 to 0.998	No	ns	0.6425
L2:Foam vs. L3:Foam	0.483	-0.112 to 1.08	No	ns	0.2656
L2:Foam vs. L4:Gel	0.693	0.0977 to 1.29	Yes	*	0.0103
L2:Foam vs. L4:Foam	0.787	0.192 to 1.38	Yes	**	0.0022
L2:Foam vs. L5:Gel	0.874	0.279 to 1.47	Yes	***	0.0005
L2:Foam vs. L5:Foam	0.687	0.0919 to 1.28	Yes	*	0.0113
L3:Gel vs. L3:Foam	0.0793	-0.516 to 0.674	No	ns	>0.9999

L3:Gel vs. L4:Gel	0.289	-0.306 to 0.884	No	ns	0.9936
L3:Gel vs. L4:Foam	0.384	-0.211 to 0.979	No	ns	0.7454
L3:Gel vs. L5:Gel	0.471	-0.124 to 1.07	No	ns	0.3089
L3:Gel vs. L5:Foam	0.284	-0.311 to 0.879	No	ns	0.9957
L3:Foam vs. L4:Gel	0.21	-0.385 to 0.805	No	ns	>0.9999
L3:Foam vs. L4:Foam	0.305	-0.291 to 0.900	No	ns	0.984
L3:Foam vs. L5:Gel	0.392	-0.203 to 0.987	No	ns	0.7046
L3:Foam vs. L5:Foam	0.204	-0.391 to 0.799	No	ns	>0.9999
L4:Gel vs. L4:Foam	0.0944	-0.501 to 0.689	No	ns	>0.9999
L4:Gel vs. L5:Gel	0.182	-0.413 to 0.777	No	ns	>0.9999
L4:Gel vs. L5:Foam	-0.0058	-0.601 to 0.589	No	ns	>0.9999
L4:Foam vs. L5:Gel	0.0872	-0.508 to 0.682	No	ns	>0.9999
L4:Foam vs. L5:Foam	-0.1	-0.695 to 0.495	No	ns	>0.9999
L5:Gel vs. L5:Foam	-0.187	-0.782 to 0.408	No	ns	>0.9999

Table 13: Summary Table for Resistive Plantar Flexion two-way analysis of variance (ANOVA) across the 6 Modifier levels (5 Modifier levels + base AFO) and the two Modifier materials (Gel & Foam)

Resistive Plantar Flexion					
Source of Variation	% of total variation	P value	P value summary	Significant?	
Interaction	38.1	<0.0001	****	Yes	
Modifier Resistance	30.5	<0.0001	****	Yes	
Materials	16.1	<0.0001	****	Yes	
Compare cell means regardless of rows and columns					
Number of families	1				
Number of comparisons per family	66				
Alpha	0.05				
Sidak's multiple comparisons test	Mean Diff.	95.00% CI of diff.	Significant?	Summary	Adjusted P Value
No Modifier:Gel vs. No Modifier:Foam	0	-0.246 to 0.246	No	ns	>0.9999
No Modifier:Gel vs. L1:Gel	-0.102	-0.348 to 0.144	No	ns	0.9999
No Modifier:Gel vs. L1:Foam	-0.11	-0.356 to 0.136	No	ns	0.9989
No Modifier:Gel vs. L2:Gel	-0.0803	-0.326 to 0.166	No	ns	>0.9999
No Modifier:Gel vs. L2:Foam	-0.105	-0.351 to 0.141	No	ns	0.9997
No Modifier:Gel vs. L3:Gel	-0.0858	-0.332 to 0.160	No	ns	>0.9999
No Modifier:Gel vs. L3:Foam	-0.0574	-0.304 to 0.189	No	ns	>0.9999
No Modifier:Gel vs. L4:Gel	-0.0261	-0.272 to 0.220	No	ns	>0.9999
No Modifier:Gel vs. L4:Foam	-0.164	-0.410 to 0.0819	No	ns	0.6766
No Modifier:Gel vs. L5:Gel	-0.0224	-0.269 to 0.224	No	ns	>0.9999
No Modifier:Gel vs. L5:Foam	-0.316	-0.562 to -0.0698	Yes	**	0.0032
No Modifier:Foam vs. L1:Gel	-0.102	-0.348 to 0.144	No	ns	0.9999
No Modifier:Foam vs. L1:Foam	-0.11	-0.356 to 0.136	No	ns	0.9989
No Modifier:Foam vs. L2:Gel	-0.0803	-0.326 to 0.166	No	ns	>0.9999

No Modifier:Foam vs. L2:Foam	-0.105	-0.351 to 0.141	No	ns	0.9997
No Modifier:Foam vs. L3:Gel	-0.0858	-0.332 to 0.160	No	ns	>0.9999
No Modifier:Foam vs. L3:Foam	-0.0574	-0.304 to 0.189	No	ns	>0.9999
No Modifier:Foam vs. L4:Gel	-0.0261	-0.272 to 0.220	No	ns	>0.9999
No Modifier:Foam vs. L4:Foam	-0.164	-0.410 to 0.0819	No	ns	0.6766
No Modifier:Foam vs. L5:Gel	-0.0224	-0.269 to 0.224	No	ns	>0.9999
No Modifier:Foam vs. L5:Foam	-0.316	-0.562 to -0.0698	Yes	**	0.0032
L1:Gel vs. L1:Foam	-0.0084	-0.255 to 0.238	No	ns	>0.9999
L1:Gel vs. L2:Gel	0.0214	-0.225 to 0.268	No	ns	>0.9999
L1:Gel vs. L2:Foam	-0.0031	-0.249 to 0.243	No	ns	>0.9999
L1:Gel vs. L3:Gel	0.0159	-0.230 to 0.262	No	ns	>0.9999
L1:Gel vs. L3:Foam	0.0443	-0.202 to 0.290	No	ns	>0.9999
L1:Gel vs. L4:Gel	0.0756	-0.171 to 0.322	No	ns	>0.9999
L1:Gel vs. L4:Foam	-0.0625	-0.309 to 0.184	No	ns	>0.9999
L1:Gel vs. L5:Gel	0.0793	-0.167 to 0.325	No	ns	>0.9999
L1:Gel vs. L5:Foam	-0.214	-0.460 to 0.0319	No	ns	0.1625
L1:Foam vs. L2:Gel	0.0298	-0.216 to 0.276	No	ns	>0.9999
L1:Foam vs. L2:Foam	0.0053	-0.241 to 0.251	No	ns	>0.9999
L1:Foam vs. L3:Gel	0.0243	-0.222 to 0.270	No	ns	>0.9999
L1:Foam vs. L3:Foam	0.0527	-0.193 to 0.299	No	ns	>0.9999
L1:Foam vs. L4:Gel	0.084	-0.162 to 0.330	No	ns	>0.9999
L1:Foam vs. L4:Foam	-0.0541	-0.300 to 0.192	No	ns	>0.9999
L1:Foam vs. L5:Gel	0.0877	-0.158 to 0.334	No	ns	>0.9999
L1:Foam vs. L5:Foam	-0.206	-0.452 to 0.0403	No	ns	0.2167
L2:Gel vs. L2:Foam	-0.0245	-0.271 to 0.222	No	ns	>0.9999
L2:Gel vs. L3:Gel	-0.0055	-0.252 to 0.241	No	ns	>0.9999
L2:Gel vs. L3:Foam	0.0229	-0.223 to 0.269	No	ns	>0.9999
L2:Gel vs. L4:Gel	0.0542	-0.192 to 0.300	No	ns	>0.9999
L2:Gel vs. L4:Foam	-0.0839	-0.330 to 0.162	No	ns	>0.9999
L2:Gel vs. L5:Gel	0.0579	-0.188 to 0.304	No	ns	>0.9999
L2:Gel vs. L5:Foam	-0.236	-0.482 to 0.0105	No	ns	0.0745
L2:Foam vs. L3:Gel	0.019	-0.227 to 0.265	No	ns	>0.9999
L2:Foam vs. L3:Foam	0.0474	-0.199 to 0.294	No	ns	>0.9999
L2:Foam vs. L4:Gel	0.0787	-0.167 to 0.325	No	ns	>0.9999
L2:Foam vs. L4:Foam	-0.0594	-0.306 to 0.187	No	ns	>0.9999
L2:Foam vs. L5:Gel	0.0824	-0.164 to 0.329	No	ns	>0.9999
L2:Foam vs. L5:Foam	-0.211	-0.457 to 0.0350	No	ns	0.181
L3:Gel vs. L3:Foam	0.0284	-0.218 to 0.275	No	ns	>0.9999

L3:Gel vs. L4:Gel	0.0597	-0.186 to 0.306	No	ns	>0.9999
L3:Gel vs. L4:Foam	-0.0784	-0.325 to 0.168	No	ns	>0.9999
L3:Gel vs. L5:Gel	0.0634	-0.183 to 0.310	No	ns	>0.9999
L3:Gel vs. L5:Foam	-0.23	-0.476 to 0.0160	No	ns	0.0915
L3:Foam vs. L4:Gel	0.0313	-0.215 to 0.277	No	ns	>0.9999
L3:Foam vs. L4:Foam	-0.107	-0.353 to 0.139	No	ns	0.9995
L3:Foam vs. L5:Gel	0.035	-0.211 to 0.281	No	ns	>0.9999
L3:Foam vs. L5:Foam	-0.259	-0.505 to -0.0124	Yes	*	0.031
L4:Gel vs. L4:Foam	-0.138	-0.384 to 0.108	No	ns	0.9375
L4:Gel vs. L5:Gel	0.0037	-0.242 to 0.250	No	ns	>0.9999
L4:Gel vs. L5:Foam	-0.29	-0.536 to -0.0437	Yes	**	0.009
L4:Foam vs. L5:Gel	0.142	-0.104 to 0.388	No	ns	0.9137
L4:Foam vs. L5:Foam	-0.152	-0.398 to 0.0944	No	ns	0.8259
L5:Gel vs. L5:Foam	-0.294	-0.540 to -0.0474	Yes	**	0.0078