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Orthotic Satisfaction Survey

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ORTHOTIC SATISFACTION SURVEY

by

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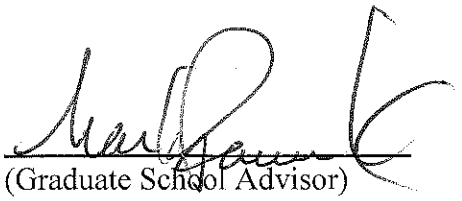
This Scholarly Project, submitted by *Jamie Bowman and Sarah Erickson* in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.



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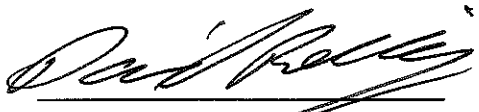

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Signature Jamie Brannan

Signature

Date 12/16/14

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I would like to thank my husband, Rob, and my three beautiful children for supporting me throughout all of my college years. Rob, you centered me when times got a little crazy. I would also, like to thank my parents and my siblings for supporting me and helping watching my children, so that I could maintain my studies. Lastly I would like to thank my friends for supporting myself and my family with your acts of kindness throughout my school years. You are all very special individuals and I hold a special place for you in my heart.

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ABSTRACT

The foot is made up of many bones, joints, and ligaments that help support the foot and body. When these structures are not properly aligned the appropriate biomechanics of the foot become compromised. Foot orthotics act as a conservative method of treatment to address some of the painful symptoms associated with these conditions. Common problems that have previously been addressed include plantar fasciitis, stress fractures, shin splints, flat feet, hallux valgus, and patellofemoral, heel and back pain.

In this study, we hope to indicate when and where orthotic use is indicated and what diagnoses benefit most when using orthotics as a conservative treatment method. This information can assist clinicians in making necessary referrals and determining patient prognoses.

Data was collected retrospectively to evaluate the effectiveness of the orthotics for increasing activity and reducing pain levels. Also evaluated were how gender, age and BMI affected these outcomes and if the patients perceived the benefits to outweigh the costs. We found that gender and age did not significantly affect outcomes. Participants who had excess weight showed greater increases in activity levels and decreases in pain than normal weight individuals. When categorized by diagnosis the majority of participants reported a decrease in pain after orthotic use. Orthotics are an effective method to reduce pain and increase activity levels, however, to what extent is still unknown.

CHAPTER I

LITERATURE REVIEW

The foot and ankle are made up a complex system of bones, joints, and ligaments that help promote or hinder efficient mobility. Joints of the foot and ankle are greatly susceptible to changes in alignment due to the forces they endure with upright activities and the stresses above and below these joints. These changes in foot alignment can affect the entire lower extremity and back negatively by producing painful symptoms. One cost effective treatment to assist in correcting these concerns is the use of foot orthotics. There are many theories as to why orthotic use can be beneficial. They can inhibit or facilitate motion, reduce or redistribute plantar pressure, improve cushioning, alter muscle activity, enhance proprioception, and prevent injuries.[1, 2] Which diagnoses or types of patient orthotics are most effective at increasing activity or decreasing pain is an ongoing topic in research.

Throughout the gait cycle the repetitive ground reaction forces can lead to overuse injuries beginning in the foot and traveling up the body as far as the back causing injuries along the way.[3] Normal ambulation begins with initial contact with the foot working as a shock absorber by managing the weight of the body and the ground reaction forces. One of the primary joints in the foot responsible for the absorption of forces is the subtalar joint.[4] These ground reaction forces imposed on the calcaneus cause the subtalar joint to move in and out of supination and pronation and the tibia to internally rotate providing

shock absorption.[3, 5] The talus rotates to compensate for the torque of the lower extremity produced by the rotational movement of the tibia.[5]

During the gait cycle the foot is required to be rigid to allow propulsion, flexible to ensure balance, and act as a shock absorber. The amount of demand placed on feet is largely in part due to the amount of body mass an individual has to support. The greater the body mass the greater the ground reaction force sustained during weight bearing. In order to keep up with the demands placed on the joints, muscles and ligaments are recruited to hold correct alignment and prevent injury. Orthotics help support the foot structures in maintaining a normal alignment therefore, influencing multiple facets of the body by promoting more efficient biomechanics above and below the ankle and foot joints.

After heel strike the foot travels into loading response, midstance, terminal stance and pre-swing accounting for 60% of the gait cycle. It then moves into the swing phase as the other leg begins its stance phases.[6] When the lower extremity progresses into midstance and terminal stance there is a torsional stress that is produced when the leg moves into extension while the tibia is internally rotated.[5] If the forces are not adequately distributed the subtalar joint is subject to changes and the entire lower extremity's alignment may need to compensate proximally and distally to the joint. These changes influence normal kinematics and musculoskeletal function negatively throughout the body.[1, 3, 4] It is during the stance phase of gait when foot orthotics attempt to modify the foot's abnormal function and restore dynamic stability.[5]

The subtalar joint is made up of the talus and the calcaneus bones with its main responsibility to control pronation and supination while assisting with dorsiflexion and

plantar flexion at the extreme end ranges.[4, 7] Supination is plantarflexion, adduction, and calcaneal inversion of the foot; while pronation is dorsiflexion, abduction, and eversion. The subtalar joint action controls the medial arch, affects the forefoot alignment, and provides shock absorption.[4] When the joint is not supported well during ambulation the foot allows over-pronation causing the supinating support structures to be put under more stress. This may lead to injuries up and down the kinetic chain causing multiple lower extremity injuries.

For most injuries pain is the biggest indicator something is wrong and plantar fasciitis is the most common cause of heel pain.[8] This condition is often seen when individuals experience excess stress on the plantar fascia ligament that supports the bones at the plantar surface of the foot. These stresses can be due to high or low arches, increased body weight, or repetitive activities such as running. Orthotics can reduce the amount of tension on this ligament by supporting the medial longitudinal arch and reducing rearfoot pronation. One study found that 159 running injuries out of 267 were plantar fasciitis and symptoms could be alleviated while increasing function through the use of orthotics. Forefoot and rearfoot postings were shown to decrease pain the most, however by the end of the 12 week study all orthotics were noted to alleviate pain to some degree. [9] According to a Cochrane data base study[1] utilizing a gold, silver, and bronze scale rating effectiveness, plantar fasciitis was given a silver level of evidence that custom orthotics were more effective than over the counter orthotics for function, but did not decrease foot pain following 3 to 12 months.

Individuals with medial tibial stress syndrome, which is more commonly known as shin splints, may benefit from the treatment of orthotics. This pathology is the most

common leg injury among athletes and occurs when the anterior leg muscles are not able to fully heal after repetitive muscle contractions and tibial strain.[10] One study reports that individuals with shin splints can often times improve their symptoms with conservative treatment; one method suggested was over the counter orthotics for flat feet and custom devices for individuals with biomechanically insufficient forefoot or rearfoot alignment.[10] Shin splints can often progress to stress fractures if an individual does not undergo any type of intervention. A commonly identified relationship between painful symptoms and diagnosing medial tibial stress syndrome is a positive navicular drop test along with foot pronation. One group identified 58% of subjects pronating in neutral stance, with either pes planus or pes cavus, which indicates an increased risk of acquiring a stress fracture.[11]

Stress fractures are commonly seen especially in athletes and military recruits. Individuals with high arches are more likely to acquire femoral and tibial stress fractures and those with low arches are more likely to acquire metatarsal fractures.[12, 3] Orthotics can act as a preventative measure against these injuries as seen in a study on cadaver bone strain during dynamic gait simulation. Custom orthotics addressing medial and lateral arches have shown to decrease shear and tension forces as well as shear and compression strain on the second metatarsal. Approximately half of all stress fractures occurring in the metatarsals are in the second metatarsal (19% to 22% of all stress fractures occur in the metatarsals).[13] So by reducing the stressful forces placed upon the foot during weight bearing, orthotics can be therapeutic as well as a useful intervention for injury prevention.

Forefoot varus is an inversion of the metatarsals in relation to the heel, causing a person to stand on the outside of the foot when uncompensated. In most instances this

deformity causes the body to make modifications which may lead to increased subtalar joint pronation and overall foot instability.[14] If the foot is over pronated (greater than 25%) it will not fully achieve the necessary rigidity for pre-swing.[15, 5] This hyper-pronation can lead to painful hallux valgus as the 1st ray becomes hyper-mobile. Patients with this condition who received medial arch support were able to effectively off load the pressure on their first ray with orthotic use, thereby reducing painful symptoms.[17]

Continuing up the body from the foot into the knee we often see patellofemoral pain syndrome affecting active individuals. This pain behind the patella could be due to a number of different reasons, one of which may be improper biomechanics of the foot. Low arches may increase the patients Q angle leading to an abnormal pull from the quadriceps muscle on the patella.[18] A study on patellofemoral knee pain showed custom orthotics to improve pain ratings significantly. The individuals that presented with forefoot varus, were noted to have even greater reduction in their pain by utilizing a forefoot posting along with their orthotic.[2,17,19,20] One group looked at soft versus rigid orthoses for runners with patellofemoral pain syndrome along with other knee injuries and reported 78% of the individuals treated showed positive results. Within these positive results, long distance runners were noted to have better tolerance to rigid orthotics while short distance runners had better tolerance with soft or flexible orthotics.[16] While other studies found that when semiflexible molded orthoses were used for treatment of knee pain, the participants showed 76% had decrease in pain.[16] One interesting study looked at 347 long distance runners and their body aches and complaints. They went on to establish that 75.5% of these individuals had a full

resolution of symptoms or felt significant improvement for all their lower extremity symptoms following the use of orthotics.[20]

Other diagnoses that resulted positively in the reduction of pain with the use of orthotics were those with reports of low back pain and fibromyalgia. Low back pain affects the majority of the North Americans at some point in their lives. When 50 individuals with low back pain were treated with orthotics over the course of 12-weeks they found their pain and disability levels decreased after 6-weeks. This improvement was maintained over a 12-week period but did not continue to improve.[21] Similarly individuals suffering from fibromyalgia were introduced to orthotic use and over 8-weeks they showed decreasing signs of disability in relation to function when compared to groups who followed normal medication use and weight bearing exercises only.[22] In a separate study by Ferrari[23] he noted when patients were prescribed orthotics as part of their intervention they used fewer analgesics and also reported lower scores on the Oswestry Disability Index over the course of 6-weeks.

Very commonly arthritis, an inflammatory condition affecting joints, develops in patients with pathologies that exist untreated for long periods of time. Patients with painful arthritic feet reported orthotics as a preferred conservative treatment to decrease pain while increasing activity levels and quality of life.[24] It has been noted custom semi-rigid orthotics were effective in increasing activity and overall patient satisfaction.[25] However, a Cochrane[1] study, given the "silver" level of evidence looking at orthotic use compared to no intervention for patients with rheumatoid arthritis showed a decrease in pain but no increase in functionality for those prescribed orthotics for a 3-month time frame. This study shows the increase in activity levels found in the previous study [25]

cannot be generalized to all patients with arthritis but perhaps that the patients had an amplified perception of increased activity because of their pain reduction.

Overall, the literature suggests orthotics can be used for a variety of painful and disabling conditions, though to what extent we do not know. This evidence supports the use of orthotics as a very reasonable way to treat patient complaints because it is cost effective and has very little risk when compared to surgery, and most importantly often reduces symptoms.

Types of Orthotics

There are many different types of orthotics that can be prescribed and have been proven to benefit various abnormal pathologies.[1, 5, 19, 26] There are custom plasters, foam molded, over the counter, and semi-custom orthotics. Flexible or semi flexible material that are not custom molded to the person's arch tend to have good shock attenuation, but do little to control rear foot or forefoot motion as the support is distorted when under weight-bearing.[16,26] Accommodative orthotics are made up of materials that are semi flexible or semi rigid that are custom molded over the position of the foot in a weight bearing position.[16, 26] The arch curve of this orthotic is more precise and its materials have a tendency to resist distortion to a greater degree. Functional or custom-made orthotics are made with semi-rigid or rigid material utilizing a plaster cast technique.[15] All the varying types of orthotics can be built with or without medial or lateral postings. These postings alter the biomechanics of gait during ambulation and running. One example of a posting can be placed beneath the medial calcaneous to address rearfoot valgus through decreased reliance on the subtalar joint.[4, 14] One main objective of custom

made orthotics is to restore the normal biomechanical relationship between the foot, ankle, and lower extremity.

There has been much debate on the different benefits between custom fit versus pre-fabricated orthotics and the comparison on specific diagnostic outcomes. Both custom made and semi-custom orthotics have been shown to decrease eversion which is one major component these devices address.[1, 27] Posting with these types of orthotics have shown even further benefits with controlling the biomechanics of the foot and lower extremity.[1, 2, 19] It has been suggested that custom made orthotics have an advantage over pre-fabricated orthotics as they have a more precise design.[28]

Another important factor to consider is the positioning of the foot when performing the impression to make sure the proper alignment is captured. D'Amico et al [28] report the gold standard and most accurate method of taking foot impressions is the subtalar neutral suspension plaster impression casting. Foam impression techniques are noted to have difficulty stabilizing the foot during a non-weight bearing position. However, this method is inexpensive and has been noted to have quick impression time.

Three diagnoses that have been shown to reduce symptoms with the use of custom made orthotics are those with plantar fasciitis, pes cavus, and rheumatoid arthritis. Individuals with plantar fasciitis report decreased complaints of pain with the use of custom fit orthotics. Fourteen of 15 patients showed positive outcomes during ambulation, however custom made products had no greater effect than over the counter devices after 36-months.[8] Individuals 18 years and older with pes cavus did see significant differences in the reduction of their pain with use of custom orthotics versus others who used over the counter inserts. [1] Those with rheumatoid arthritis have

reportedly benefited from custom rigid foot orthotics by controlling the excess movement of their foot.[26]

CHAPTER II

METHODS

The aims of this study were to gather descriptive information from individuals who consulted an out-patient prosthetic and orthotic clinic in the past two years in an effort to assess each patient's perceived indication for use, outcomes, and overall satisfaction of foot orthotic use. This was accomplished by constructing a satisfaction survey for patients who received custom foot orthotics.

The study was approved by the Institutional Review Board of Altru Health Systems and the University of North Dakota. Data was collected retrospectively to evaluate the effectiveness of the orthotics for increasing activity and reducing pain levels. Also evaluated was how gender, age and BMI affected these outcomes and if the patients perceived the benefits to outweigh the costs.

The study was conducted with a prosthetic and orthotic department within Altru Health Systems. Potential participants were identified through Altru's patient log. Inclusion criteria required participants to have received their orthotics in the last two years. Exclusion criteria included patients who were under age 18 and those with a diagnosis of diabetes. We had no knowledge of patient information when sending out information and received data back from participants ages 6 to 83 years.

A survey of 12 questions was constructed (Appendix), which identified reasons for use, outcomes and overall satisfaction. Participant's gender, age, height, weight and type of pain were to be reported along with the reason for receiving the orthotics

originally. Some individuals discontinued use and were asked the reason; others indicated they only wore them for certain activities or in specific shoes. There was a section of 6 questions that had them rate their satisfaction of their overall orthotic experience. A cover letter was written explaining the purpose of the study and asking for voluntary participation. Three hundred letters and surveys were sent out to patients who have received orthotics from Altru in the last two years. Each diagnosis was given a number, which corresponded to the diagnosis in the individual's medical record and was placed on their return envelope. This ensured our ability to preserve the data upon receiving each survey while keeping participants' personal information unknown to the research team.

Statistical Analysis

The descriptive analysis of data was performed utilizing SPSS statistical software. Four factors were analyzed. Variables that were observed were how gender, BMI, age and diagnosis affected the participant's activity level, pain level, and overall perception of benefits outweighing the cost of orthotics. Correlations were assessed by Fischer's Exact Test for nonparametric values.

CHAPTER III

RESULTS

This study presents data from a small sample of participant who received foot orthotics in the past two years. We found that the top two pathological diagnoses that were issued foot orthotics were for patients presenting with flat feet and those with plantar fascia fibromatosis (a thickening of connective tissue in the feet which causes walking to be painful). Of the individuals who chose to participate in our study, women respondents exceeded the men. It was unknown to us how many males and females were initially included in our survey population. However, with the large sample size (300 individuals) we would expect close to a 50% equal distribution between males and females. The four variables analyzed were BMI, diagnosis, gender and age with regard to increasing activity, decreasing pain and if the perceived benefits outweighed the costs. We hypothesized that there would be some significant correlation in participants variables in relation to their responses regarding their custom made foot orthotics. The null hypothesis was that no differences would be seen between groups on their outcomes.

Of the 300 individuals that received a satisfaction survey, 63 responses were received (21% response) after six weeks. Twelve of these responses were patients 18 and younger and were therefore excluded from our final results. The remaining 50 responses were recorded in SPSS and data was derived to determine correlation between variables. Of all the surveys sent out 14 (4.7%) were returned back to us because of inaccurate

addresses. After excluding the twelve minors we ended with 15 males and 35 females, ten patients ages 18-29, twenty four ages 30-59, and sixteen who were 60 or older. We also re-categorized them by diagnosis into three groups giving us 21 patients with flat feet, 11 with plantar fascia fibromatosis, and 18 into a grouping labeled other. These "other" diagnoses included back pain, cavus deformity, ensethopathy, osteoarthritis, and three people who had multiple diagnoses. There were 17 patients who reported a normal BMI, 16 who were overweight, 14 in the obese range, and 3 participants did not report their weight. We combined the individuals who were overweight and obese into a category of "excess weight".

There were five statements the participants were to report if they: strongly agreed, agreed, were neutral, disagreed, or strongly disagreed. These included: 1) My activity level has increased since receiving orthotics, 2) My orthotics have decreased my pain, 3) I would use Altru's orthotic service again, 4) The benefits of receiving orthotics were worth the cost, 5) I am overall satisfied with my orthotics.

Figures 1-8 show the results of how BMI, age, gender, and diagnosis correlated with the study's variables. Fifty-two percent of all participants reported that their orthotics increased their activity level, 75.5% reported that they noticed decrease in their pain with orthotic use, and 73.5 % felt that the benefits of orthotic were worth the cost.

When examining the cross tabulations for the BMI and how it affects each element. Seventy four percent reported a decrease in pain with the use of orthotics. Individuals of normal weight and excess weight responded similarly to "The use of orthotics decreased my pain" (Fischer's Exact Test, p=.077). However, participants who were grouped into the excess weight category showed a higher likelihood to agree that

orthotics had decreased their pain (82%) compared with respondents who were of normal weight (59%).

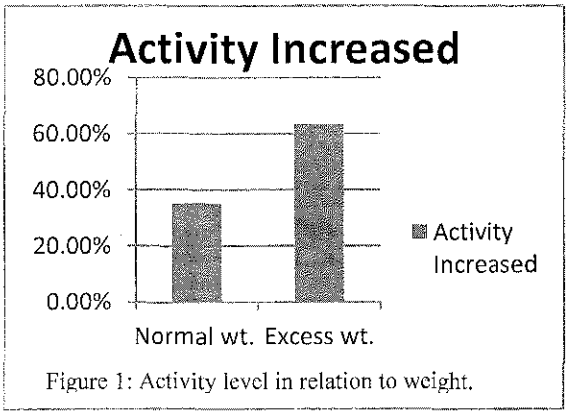

Figure 1: Activity level in relation to weight.

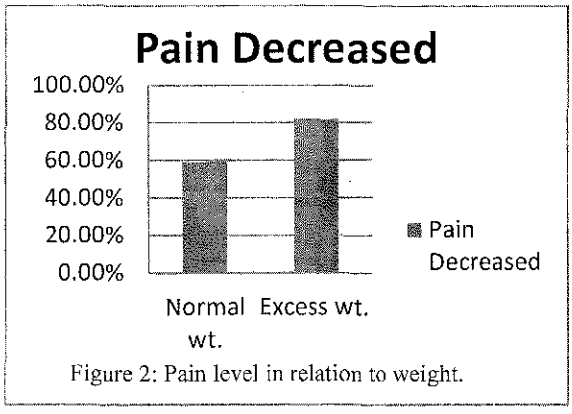

Figure 2: Pain level in relation to weight.

Fifty three percent reported an increase in activity with the use of orthotics. Individuals of normal weight and excess weight responded similarly to "My activity level increased with the use of orthotics" (Fisher's Exact Test, p=.061). However, again we saw a lower percent of individuals in the normal weight category agreeing orthotics had increased their activity. Most participants in this category felt "The benefits of receiving orthotics were worth the cost" (Fisher's Exact Test, p=.315) with no large difference between groups. When observing correlations between age groups and the variables we determined age was not a good indicator for predicting change between groups with the middle age group experiencing the highest level of activity increase.

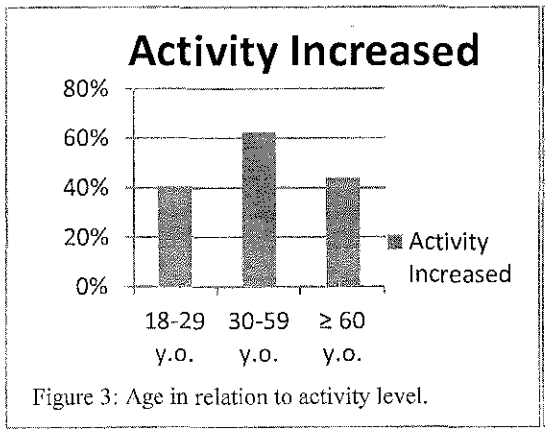

Figure 3: Age in relation to activity level.

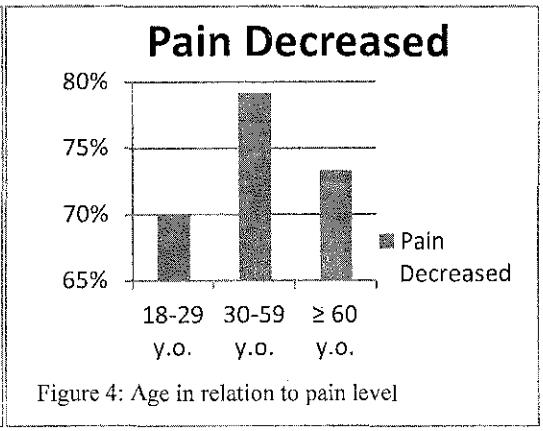

Figure 4: Age in relation to pain level

The correlations between males and females showed they felt similarly with all subcategories in that their activity increased, pain decreased and the benefits outweighed the costs.

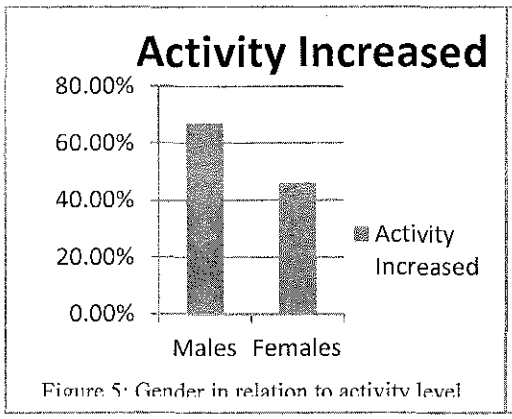

Figure 5: Gender in relation to activity level

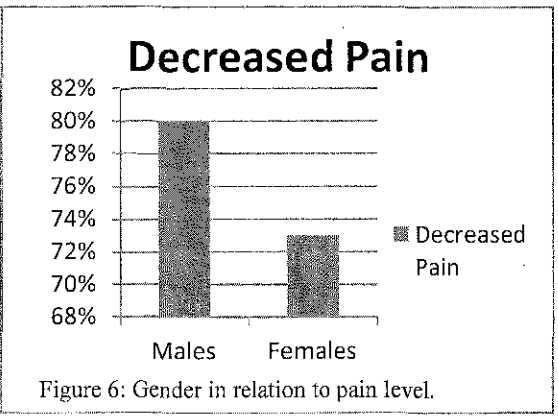

Figure 6: Gender in relation to pain level.

The diagnosis groups of flat foot, plantar fascia fibromatosis (Plantar FF), and other showed similar statistics when compared between each subgroup which is not consistent with our prediction. Roughly 70% of participants regardless of diagnosis reportedly agreed the benefits were worth the costs.

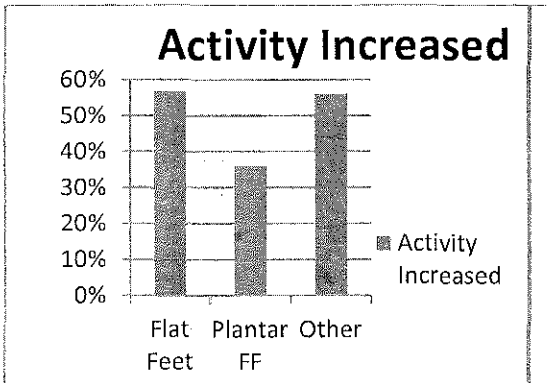

Figure 7: Diagnosis in relation to activity level.

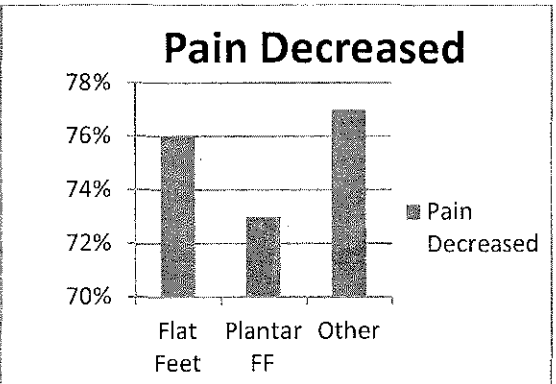

Figure 8: Diagnosis in relation to pain level.

CHAPTER IV

DISCUSSION

Overall our results emphasize the benefits custom-made orthotics can have on an individual's life. The majority of the participants felt their pain decreased, the activity level increased, and the cost was worth the benefits. While trying to subcategorize which participants showed the best results we found a small percentage of those who were overweight had greater outcomes than those in the normal weight category.

When the individuals were grouped according to their height and weight to calculate BMI, the data for these individuals showed they had the greatest differences in decreasing pain and increasing activity levels after orthotic use. This was in accordance with our hypothesis that there would be some significance in BMI on the observed variables. We believe their excess weight applies greater forces throughout their feet. The extra stress on tissues from the additional body weight may promote flat feet over time which results in pain and sometimes decreased activity. By providing support from an orthotic these individuals may experience less force and have less pain noted.

Individuals with low arches or flat feet are predisposed to injury and may need custom made orthotics for comfort issues[29]. Patients with flat feet or in the "other" category saw positive results in rising activity levels. Here again the excess stresses are decreased when the foot is brought into correct alignment. Diagnosis did not seem to play a significant role in predicting outcomes as we saw a decrease in pain greater than 70%

for all pathologies, including the "other" category which encompasses a variety of diagnoses.

Research shows orthotics can be used successfully to decrease pain and increase activity as a form of treatment for a multitude of pathologies. Age and gender are not seen as strong influences for orthotic outcomes. Specifically we did not have equal data from males and females to make conclusive connections to the possible variables. When categorized by age, we found that participant's pain levels were not influenced. The only trend we observed was that older individuals progressively felt the benefits did not outweigh the costs. We believe this may be due to the higher level expectations the older population has in regard to gratifying health care outcomes.

We feel an individual's diagnosis along with the proper orthotic seems to be the most influential. There is still much debate on whether custom made or semi-custom orthotics outweigh one another when looking at specific pathologies. Mixed outcomes have been noted on the degree of satisfaction among differing age groups. Malkin et al[30] found that individuals under the age 40 were less satisfied with their orthotics than the older age group. While Donatelli et al[14] with the mean age of 35 showed orthotics were 96% effective in relieving the participant's pain potentially leading to greater overall satisfaction.

Overall our study had a few limitations. First, we had a small sample size (N=50) which limits our ability to quantify our results or generalize them in regard to the population. Second, our participant's diagnoses were very general which made pinpointing our specific dysfunction difficult. Third, when analyzing gender relationships, there were only 15 men compared with 35 women, so our final outcomes

were restricted by this. Fourth, our participants were self-selected which may exclude data from individuals based on personality and willingness to participate. Therefore our participant population was not randomized. Also, we omitted any participant under the age of 18, which limits our data to only include the adult population. Finally, all the data received was subjective information which cannot be verified.

Conclusion

Orthotic use is a feasible noninvasive intervention that can be implemented for a variety of patients safely and efficiently. Although we saw greater increases in activity and decreases in pain with patients who were overweight in comparison to those who were not, the overall extent of effectiveness on decreasing pain and increasing activity cannot be concluded. We are not suggesting orthotics to be viewed as the most efficient or effective intervention and no one orthotic device can be prescribed for any and all symptomatic patients. However, by changing and often times stabilizing the foot into an optimal position we can not only positively affect the foot and ankle but also the knee, hip, and low back. Another benefit is the timeline to determining if improvements have been made is relatively quick. The individual's symptomatic complaints combined with the medical diagnoses, goals, and individual body characteristics should be the driving force when determining which type of orthotic would be most beneficial.

More research needs to be completed on a greater scale. Rather than work collecting data retrospectively it would be beneficial to complete current full evaluations of each patient to be able to conclude true significance. This will decrease subjective reports and standardize evaluations to determine overall effectiveness of the orthotics. Participants should use a quantifiable scale when reporting decreases in pain and

increases in activity to determine the extent of the change seen with orthotic intervention. Overall it appears our participants found their orthotics to be beneficial.

APPENDIX

Foot Orthotics Satisfaction Survey

Gender: _____ **Age:** _____ **Height:** _____ **Weight:** _____

Please circle all that apply:

Ankle pain Arthritis Heel pain Back pain Knee Pain Hip Pain

Were both feet fitted for orthotics? Yes No

Please answer the following questions based on the previous answer.

1. What was your primary reason for receiving orthotics? _____
2. When did you receive your orthotics? _____
3. Do you currently wear your orthotics daily? Yes No
   If not, briefly explain why. _____
4. If you completely discontinued use, how long did you wear them before doing so and why?
   _____
5. During which activities do you wear your orthotics? _____
6. Does changing shoes affect your orthotic use? Yes No

For the following, please rate your degree of satisfaction:
SA= Strongly agree, A=Agree, N= Neutral, D=Disagree, SD=Strongly disagree

7. My activity level has increased since receiving orthotics. SA A N D SD
8. My orthotics have decreased my pain. SA A N D SD
9. I would use Altru's orthotic service again. SA A N D SD
10. The benefits of receiving orthotics were worth the cost. SA A N D SD
11. I am overall satisfied with my orthotics. SA A N D SD
12. Could Altru improve your overall satisfaction with their orthotic services? Yes No

If so how? _____

Any other comments? (continue onto back side if needed)

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