ARCH SUPPORT USE FOR IMPROVING BALANCE AND COMFORT IN OLDER ADULTS

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IN OLDER ADULTS

BY

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A Thesis submitted to the Faculty Of the School of Graduate Studies

At Armstrong Atlantic State University

In Partial Fulfillment of the Requirements of the Degree

Master of Science in Nursing

Savannah, Georgia

2004

Abstract

Arch Support Use for Improving Balance and Comfort in Older Adults

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Falls are a serious health problem among the older adult in the United States and are the most frequent cause of injury-related morbidity, mortality, and health care spending among the older population (CDC, 2003). Advanced Practice Nurses (APNs),

physicians, and other health care providers are in a good position to reduce the risk of falls of the older adult by conducting a fall risk assessment annually. They can provide support to the older adult through a supportive-educative role by including education, self-care recommendations, and health promotion regarding risks for falls. The purpose of this study was to evaluate if (a) a significant change in balance (Berg Balance Test; BBS) and functional mobility (Timed Up & Go Test; TUG) measures in pre-intervention to immediate post-intervention (arch support use) to 6 week post-intervention (arch support use), (b) a significant change in the report of feet, ankle, knee, hip, and back pain from immediate post-intervention to 6 week post-intervention; and (c) self-reported benefits using arch supports for 6 weeks. The BBS and TUG tools were used to measure each participant's balance (BBS) and functional mobility (TUG). The pain intensity assessment scale tool was used to measure perceived pain of feet, ankle, knee, hip, and/or back pain.

Sixty-seven participants completed the study, aged 60 to 87 (mean = 69.9). The first measurement, each participant completed tests for balance, functional mobility, and pain intensity scale assessment, fitted for arch supports, and while wearing the arch supports, instructed and given printed instructions on how to wear arch supports. After 6 weeks the participants returned and repeated the balance and functional mobility tests (with arch supports), and completed a 6 week post-intervention pain intensity scale assessment and post survey. One way repeated measures ANOVA and paired-samples test were used for analysis. The results indicated statistically significant changes in scores for balance, functional mobility, pain, and self-reported benefits use of arch supports ($p < .05$). There was no statistically significant change in ankle pain. ($p > .05$).

Orem's Self-Care Deficit Nursing Theory (Orem, 2001) was used as the theoretical framework for the study to promote self-care in the older adult using a supportive-educative nursing intervention. The supportive-educative role enabled the participants to integrate new self-care measures enhancing his/her self-care health promotion with the use of arch supports to improve balance and/or discomfort of fee, ankle, knee, hip, and back pain.

Acknowledgments

I would like to give my sincere gratitude and appreciation to everyone that has helped

me along my journey at AASU. First, I'd like to give special thanks to my committee chair, Dr. Helen Taggart, who has enthusiastically guided, supported and inspired me and always had faith in me, which I will always be grateful. Dr. Camille Stern and Dr. Anita Nivens, thank you so much for your guidance and leadership as committee members.

Special thanks to Foot Efx owners, Carol Kirchner and Carol Romig, thank you for your dedication and continuous involvement in the study. Thank you for all the hard work that went into recruiting the participants. Thank you to Bio Orthotics, International, Plano, TX for the arch supports donated for the study.

Thank you doesn't begin to express the appreciation and love that I have for my husband, Michael. You have always stood by my side with so much support and patience, giving me support and encouragement and for that I am so grateful. My daughter and son; Megan and James it seems like your whole childhood I have been in school, thank you for understanding when I couldn't do things with you because I had to study or had a paper to write. Thank you so much for your patience and love.

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Chapter 1: Introduction to the Problem

Falls are a serious health problem among older adults in the United States (CDC, 2003). After a fall, an older adult can experience psychological, physical, social, economical and sometimes fatal effects (Brown, 1995). Approximately 20% to 30% of older adults who fall will suffer moderate to severe injuries such as hip fractures, wrist fractures or head trauma. These injuries can reduce an older adult's mobility and independence, and increase the risk of premature death (Sterling, O'Connor, & Bonadies 2001).

The impact of falling creates a psychological consequence where the older adult may develop a fear of falling (Hatch, Gill-Body, & Portney, 2003). This fear of falling can lead to activity restrictions, inactivity, and diminished mobility. Also, a history of previous falls in older adults can increase their risk for future falls (Zwick, Rochelle, Choksi, & Domowicz, 2000). Further, decreased mobility, impaired balance and gait, disabilities of the lower extremities, decline in vision, hearing, smell, foot problems and a fear of falling have a high correlation with falls in the older adult (Bogle-Thorbahn, & Newton, 1996; Newton, 2003).

Age-related changes of the older adult can affect balance. These changes specifically affect the sensory system and motor system that are responsible for good balance (Newton, 2003; Lord & Menz, 2000). Vision plays an important role in posture and balance in the older adult.

Vision provides the Central Nervous System (CNS) with information in relation to position and movement of the body and the environment. For example, older adults with visual provlems are three times more likely to fall than older adults without visual problems (Newton, 2003, Lord & Menz, 2000).

Diseases such as: Parkinson desease, cardiovascular disease, musculoskeletal disease (osteoarthritis, arthritis, limitations of joints, joint pain, weakness of lower limb

extremities, and foot problems) fear of falling, falls in the past 6 months, and use of ambulatory aides can affect balance and increase the older adults' risk for falls (Burke & Laramie, 2000). Risk of falls is also greater when lower limb muscle strength decreases physical function (Rekeneire et al., 2003) and gait changes affect balance (Cromwell & Newton, 2004). Medications such as psychoactive medications and taking 4 or more prescriptions can increase the older adults risk of falls (Cumming, 1998; Liu, Topper, Reeves, Gryfe & Maki, 1995).

In addition to age related changes, diseases, and medications, improper foot care and footwear can increase an older adults risk for falls. Many older adults have difficulties walking due to improper care of their feet and improper footwear. (Ebersole & Hess, 2001). Limited research on footwear in the older adult suggests that wearing no shoes and wearing shoes that are low-heeled (Lord & Bashford, 1996), or slip-resistant shoes (Menz, Lord & McIntosh, 2001), and improperly fitted shoes contribute to abnormal foot mechanics that causes areas of excessive pressure and pain (Bedinghaus & Niedfeldt, 2001).

Significance to Nursing

Falls are the most frequent cause of injury-related mordibity, mortality, and health care spending among the older adult populations (CDC, 2003). The number of people aged 65 or older is projected to increase to approximately 70 million by 2030 (NCHS, 2004). By the year 2040, the number of hip fractures is expected to exceed 500,000. Hip fractures alone account for $3 billion in direct medical costs (Cummings, Rubin, & Black, 1990; Newton, 2003). Falls are prevalent and costly and can impact the older adults' quality of life (Burke & Laramie, 2000). The Advanced Practice Nurse (APN) can help decrease the risk of falls in the older population by conducting a fall risk assessment annually, including educational and self-care recommendations (Newton, 2003; Ness, Gurney, & Ice, 2003). Further, education and intervention planning should include family and/or carefiver and the use of other disciplines, such as physical therapy (Burke & Laramie, 2000).

While several researchers examined the effects of footwear on balance in the older adult (Lord & Bashford, 1996; Menz, Lord et al., 2001), there is limited research using arch supports (Charette, 2002) as an intervention which may improve an older adult's balance and comfort from any joint pain of the lower extremities and/or back.

Purpose

The purpose of this study was to examine the effect of arch supports on balance, functional mobility and back and lower extremity joint pain in older adults. Orem's Self Care Nursing Theory (SCDNT) was used as a theoretical framework. The Berg Balance Scale (BBS) (Berg, Wood-Dauphinee, Williams, & Maki, 1992) and timed up and Go (TUG) (Podsiadlo & Richardson, 1991) were used to measure balance and functional mobility. The pain intensity assessment scale was used to measure pain pre and post-intervention.

Theoretical Framework

The current focus of healthcare delivery system is shifting from the healthcare provider to the healthcare consumer. This shift has influenced the nursing profession to place an emphasis on promoting self-care and health in clients. Due to this shift of responsibility and the increase in the older population, the APN must empower the older adult in meeting the goals of health promotion, and self-care to promote health and wellness (King, 1994; Callaghan, 2003; Leenerts, Teel & Pendleton, 2002). Trends indicate that the numbers of older adult population will continue to increase, reaching approximately 70 million by the year 2030 (NCHS, 2004). This study has placed an emphasis on promoting self-care and health in the older population by using Orem's SCDNT as the theoretical framework to promote self-care and health among the older adult. The self-care deficit nursing theory is Orem's (1985, 1991, 2001) general theory of nursing that is applicable across all practice situations.

Orem's (1985, 1991, 2001) general theory consists of three theories: (1) self-care, (2) self-care deficit, and (3) nursing system. Derived from these theories, Orem developed a conceptual framework nursing model and basic nursing model, most commonly referred to as SCDNT. In order to have a better understanding of the SCDNT the concepts of

these theories will be described. Orem (1985, 1991, 2001) describes self-care as the practice of activities or actions by individuals to participate and initiate on their own behalf in maintaining well-being, life and health. The self-care agency is the ability of individuals to engage in self-care and the following factors can influence this ability: age, developmental stage of life, socio-culture beliefs, health and available resources. Orem classifies these requisites into three categories: universal -life processes and

maintenance of health, ability to perform activities of daily life; developmental – the changes in an individual's life and the ability of the individual to deal with these life changes; and health deviation – an individual requires intervention by a health care provider due to any illness or injury (Orem, 2001). The nursing system is based on the nurse's assessment of the individual's self care needs and what activities the individual is able to perform for self. If a deficit exists between what the individual is able to do fro self (self-care agency) and what needs to be done to maintain essential functioning (therapeutic self-care demand_ then there is a need for nursing. Based on the individual's needs the three nursing systems are implemented by the nurse: wholly compensatory, party compensatory, and supportive-educative (Foster & Bennett, 2002, Hartweg, 1991.)

Orem's (2001) theory of self-care deficit specifies when nursing is needed; the individual's demands or requisites are greater than the individual's ability for his/her own self-care. This theory is the core of Orem's general theory of nursing. When an individual seeks healthcare, the individual must learn to incorporate newly prescribed self-care measures into his/her own self-care system (Hartwek, 1991). The APN placed

an emphasis on health promotion and self-care in a supportive-educative role with the

participants of this study. The supportive-educative role will enable participants to

integrate new self-care measures to enhance his/her present self-care promotion

through the use of arch supports to improve balance and/or discomfort of back, hip,

knee, ankle, and foot pain.

Research Questions

In this study, three research questions will be evaluated.

1. Is there a difference in BBS and TUG scores from pre-intervention to immediate

post-intervention to 6 week post intervention use of arch supports?

2. Is there a difference in the report of fee, ankle, knee, hip, and back pain from pre-intervention to 6 week post intervention use of arch supports?

3. What are the self-reported benefits of the older adult in using arch supports?

Assumptions

1. Participants will benefit from the use of arch supports as evidenced by improved balance and comfort of back, hips, knees, ankles, and feet.

2. Participants will answer the demographics, pre and post pain, and post survey questions honestly.

3. Research results will advance nursing knowledge to care for the older client.

4 Participants will develop an awareness of the importance of health promotion and self-care.

Limitations

1. Participants may drop out of the study prior to 6-week follow-up.

2 Limited control over study, missing data that affects the results.

3. Possible variations of administering balance tests among 4 different raters.

Definition of Terms

1. Arch Supports: rigid or soft “shim” placed in between the foot and shoe to position the foot near its neutral position so it can function more

efficiently. The purpose of the arch support is to prevent or reduce compensatory pronation which places additional stresses on the different foot structures (James, Bates, & Osternig, 1978).

2. Falls: to come down suddenly from a standing or sitting position (Agnes & Guralnik, 2001).

3. Self-Care: the practice of activities or actions by individuals to participate and initiate on their own behalf in maintaining well being, life, and health (Orem, 1985, 1991, 2001).

4. Older Adult: In this study the older adult is 60 years of age and older.

5. Berg Balance Test: a balance test that evaluates an older adults' risk for falls as measured by the BBS (Berg, et al., 1992).

6. Timed Up & Go Test: a test that evaluates functional mobility (gait and balance) as measured by the TUG (Podsiadlo & Richardson, 1991) test.

7. Pain: a sensation of hurting, or strong discomfort, in any part of the body caused by an injury, disease, or functional disorder which is transmitted through the central nervous system. Pain is highly subjective and individual; therefore, it is whatever the person experiencing it, says it is (Kozier, Erb, Blais, & Wilkinson, 1995).

Chapter 2: Review of Literature

An extensive review of the literature, including Medline, and CINAHL) revealed no studies conducted to examine the effects of arch supports on balance and comfort (joint pain) in the older adult. Numerous studies investigated balance and falls in the older population, using balance tests to assess an older adult's dynamic and static balance, to determine the risk for falls and functional mobility.

The review of literature will focus on two areas. First, a review of Orem's (1985, 1991, 2001) self-care deficit that is the framework for this study, will focus on studies specifically related to self-care in the older adult. Second, a review of research examining the use of arch supports as an intervention to help improve balance and/or comfort (joint pain) in healthy adults, diabetic adults, and athletes.

Orem's Self Care Deficit Theory

Orem's self-care model focuses on an individual's responsibility for health or self-care needed to live independent and active lives to maintain maximum functioning and well being. Optimally, self care contributes to an individual's human structural integrity, human functioning, and human development. Orem's self care model provided a useful framework for the older adult using arch supports to help improve balance and/or comfort (joint pain). APNs are in key positions to promote self-care in the older adult through a supportive-educative role in the community.

Leenerts et al. (2002) used Orem's self care deficit theory in developing a model of self-care for health promotion in aging. The purpose of the study was toe xamine and understand literature-based knowledge about self-care in the older adult population in the community by applying findings from current theoretical and empirical theory. With these findings the authors developed a self-care model for health promotions in aging. Dimensions of self-care include: internal and external environment (relationship with self and others), self-care abilty (readiness to care), education (connecting self-care ability and activity), self-care activity (repertoire in caring), and outcomes (promotion of health while aging). The most important foundation and concept devised from this model is an individual's experience that influences self-care (Leenarts et al., 2002). For example an APn would work in a supportive-educative role by exploring self-care beliefs

and practices through communication and partnering with the older adult to develop an education plan to promote health.

Ward-Griffin and Bramwell (1990) conducted a descriptive, correlational study to explore the relationship between nurse and older adult perceptions of their self-care agency. Orem's (1985) self-care model was used as a framework for this study because the model focused on an individual's responsibility for health. According to Orem (1985) self care-agency is the human ability to look after oneself. Agency refers to taking action and the action that is taken by the individual is the self-care agent. Orem's (1985) theory of Nursing Systems proposes that an individual and nurse collaborate to determine and achieve self-care goals. The study included 40 older adult participants and registered nurses' ($n = 40$) selected from two different community settings. Three questionnaires were completed (a) demographic sheet, (b) Self-Care Agency Scale, and (c) Perceived Health Status. Pearson product moment correlation coefficients were significant for the relationships between (a) individual and nurse perceptions of individuals' self-care agency ($r = .42$, $p < .001$), (b) individual and nurse perceptions of individuals' health status ($r = .38$, $p < .001$), and (c) nurse perceptions of individuals' self-care agency and nurse perceptions of individuals' health status ($re = 0.44$, $p < .001$). the major finding of this study was that older adults and nurses perceived the older adults health status differently.

Backman and Hentinen (1999) conducted a study integrating Orem's self care model for home-dwelling elderly. The study focused on developing a model for self-care of elderly adults in Oulu, Finland. A grounded theory model was used and the study included 40 home-dwelling elderly people aged 75 or more. The model for the self-care of the home-dwelling elderly adult consists of four categories of self-care: responsible for care, formally guided self-care, independent self-care and abandoned self-care. Responsible self-care is an individual's activity of daily living, caring for their health and any illness. These individuals are responsible for their own self-care activities such as medical treatments, self-administration of medication, healthy lifestyles including diet and exercise and awareness of any medical conditions. Formally guided self-care individuals do what they are told but are not sure of the reasons. Independent self-care individuals are suspicious of doctors' and nurses' opinions and education, this individual listens to their own internal voice and does things their own creative way, living day by day. Abandoned self-care individuals are helpless and are lacking of responsibility, these individuals do not care about themselves and they are no longer able to manage their

daily life. The results showed that self-care activities reflect an individual's attitude towards health care, illnesses and life. (Backman & Hentinen, 1999). In a similar study Backman and Hentinen (2001) examined how functional capacity, activities of daily living (ADL), instrumental activities of daily living (IADL), life satisfaction and self-esteem are related to self-care behavior styles of home-dwelling elder persons (n=40). The research findings suggest, self-care behavior style is related to self-esteem, which originates from all life experiences and life satisfaction. Also, functional capacity impacts self-care, so if any individual is able to function and perform ADL and IADL their self-care behaviors will be independent.

Orem's (1985, 1991, 2001) self-care model has been used in several studies that focused on developing self-care models for health promotion of the older adult. Self-care is an individual's responsibility for self needed to live an independent life in order to caer for self and to perform activities of everyday life. The supportive-educative role enabled the participants of this study to integrate new self-care measures enhancing his/her self-care health promotion with the use of arch supports to improve balance and/or discomfort of feet, ankle, knee, hip and back pain.

The use of Arch Supports as an Intervention

In this section the arch supports review will be divided under three headings: regular arch supports, magnetic insoles, and vibrating insoles. Each section will be discussed examining the literature related to regular arch support use, magnetic insoles, and vibrating insole use.

Regular Arch Supports

Several studies in the literature examine the use of arch supports as an intervention in athletes with overuse injuries and pain. Arch supports are recommended or prescribed in sports and physical activities to prevent injury or to avoid a certain movement-related injury (Nigg, Nurse, Stefanyshyn, 1999). Razeghi and Batt (2000) conducted a literature review to gain a better understanding of knowledge with the relationship between foot shape and arch supports use. The focus of the literature research examined was on the use of arch supports and their effects in the treatment and prevention on overuse injuries. Razeghi and Batt reviewed numerous research articles and proposed that further research is needed to establish the casual effect of foot type and functions on the

risk of overuse injury, and document the specific effect of arch support therapy on injury treatment and prevention and the long-term effect of arch support intervention.

Gross, Davlin, & Evanski (1991) conducted a study using arch supports as an intervention in long-distance runners (n = 500). The study found that the use of arch supports was very effective in providing symptomatic relief from hip, knee, feet, and ankle problems. In this retrospective study by Gross et al, the authors concluded that 90% of the runners continued to use arch supports even after the resolution of their symptoms. For example, Gross et al. reported that 24.5% of study participants made slight or no improvement, and 13.5% experienced new complaints or their symptoms worsened. These findings were due to poorly fitted arch supports or incorrect diagnosis. Overall, positive findings of symptom relief from the use of arch supports for overuse injuries have been reported (James et al., 1987 Gross, et al., 1991). However, despite the above positive findings, arch support use provided little symptomatic relief in other athletes. (Razeghi & Batt, 2000).

Sutlive et al. (2004) used arch supports with modified activity to reduce patellofemoral pain (PFPS) in the knee. Forty-five participants were given arch supports with instructions, as well as modified activity for 21 days. A visual analog scale (VAS) to characterize their baseline level of knee pain was administered on day one and then another VAS was completed on their return visit between 20 and 23 days. The results indicate that the best predictor for improvement was the participants with PFPS who have forefoot valgus alignment of greater than or equal to 2 degrees, passive great toe extension of less than or equal to 78 degrees, or navicular drop of less than or greater to 3 mm are most likely to respond to the interventions. The study results showed that the participants responded favorably to the use of off-the-shelf arch supports and modified activity.

Several studies examined the use of arch supports as an interventional therapy in diabetes to improve foot ulcers. Lord and Hosein (1994) conducted a pilot study to evaluate the redistribution of plantar pressure with the use of a custom-molded insert versus simple flat insert in orthopedic shoes of diabetes (n =6) who are at risk for plantar ulceration. The study showed that the custom-molded insert was more effective in reducing the pressure level under the metatarsal heads of the foot. In another study, Davies, Gibby, Phillips, Price, and Tyrrell (2000) compared self-reported health status of four groups of diabetic patients using arch supports as an intervention compared to

other groups that did not receive the arch support intervention. The groups consisted of an intervention group (n = 150), a comparison group (n = 100), and an amputation group (n = 10), and an ulceration group (n = 20). The intervention resulted in statistically significant improvements in health status ($p < .05$) both physically and mentally, for people with at-risk feet. Furthermore, the researchers reported a 65% post-intervention improvement in the mean score of limited role activities due to physical problems (i.e. ulcerations of feet.) This result indicates that using arch supports, as an intervention for diabetics with at-risk feet should be considered an important treatment intervention.

Stude and Brink (1997) investigated the effects of arch support intervention on balance and proprioception in 12 experienced golfers. The researchers measured balance and proprioception before and after nine holes of simulated golf using sensor platforms. The participants wore custom-made, flexible arch supports daily for 6 weeks and t hen were retested using the same measures. The data from this study suggests that wearing the custom-made, flexible arch supports did have a positive influence on balance, and proprioception in experienced golfers.

Magnetic Insoles

Winemiller, Billow, Laskowski, and Harmsen (2003) conducted a study on the effectiveness of magnetic insoles on the pain relief of plantar fasciitis (plantar heel pain). This study was a randomized, double-blind, placebo controlled trial with 101 volunteers. The volunteers were assigned to two groups; one group used magnetic insoles (n = 116) and the second group used nonmagnetized insoles (n = 117), for 8 weeks. Each volunteer maintained a daily pain diary. At the end of 8 weeks there was no statistically significant between group differences except that both groups reported significant improvement in morning foot pain. At the end of the study, 35% of the magnetic insole group and 33% of the nonmagnetic insole group reported being all or mostly better.

Suomi and Koceja (2001) conducted a study using magnetic insoles to measure postural sway in men and women using a static balance test. The study included twenty-eight adults, divided into two age groups; 7 men and 7 women between ages of 20 and 31, and 7 men and 7 women between the ages of 58 and 77 years old. All balance tests were conducted in a university motor control laboratory using a Kistler force platform with the use of nonmagnetic insoles and magnetic insoles. There was significant

improvement in postural and lateral sway in the older group ($p < .05$). The researchers note that the older adults had a greater postural sway than the y ounger group because of the older adult's age-related changes in balance, therefore the older group is more likely to benefit from magnetic therapy.

In a more recent study using magnetic versus nonmagnetic insoles, a repeated measures design was used on 56 community-dwelling older adults with a mean age of 76 years. This study was conducted to determine whether magnetic insoles influenced the standing balance of older adults with a history of reported falls or balance deficits (Balz, Bock & Olson, 2002). Each subject performed a series of balance tests in varying sequence while wearing three different types of insoles; two insoles with magnets with varying magnetic strengths and one pair of insoles without magnets. There were no significance changes in balance measures when wearing the three types of insoles ($p = .605$). The researchers recommend additional studies involving a longer timeframe to determine whethere magnetic insoles could directly or indirectly affect balance.

Weintraub et al. (2003) conducted a study to determine if wearing magnetic insoles could reduce neuropathic pain and improve quality of life scores in symptomatic diabetic peripheral neuropathy (DPN) in diabetic patients. The researchers used a randomized, placebo-control, and parallel study in 48 centers in 27 states with 375 participants with DPN stage II and III. The participants were randomly assigned to wear constantly magnetized insoles for 4 months; the placebo group wore similar unmagnetized insoles. Results were statistically significant during the third and fourth months in burning ($p < .05$), numbness and tingling ($p < .05$), and exercise-induced foot pain ($p < .05$). For a particular subset of patients with baseline severe pain, there were significant reductions from baseline through the fourth month in numbness and tingling ($p<.01$), and foot pain ($p < .01$). In conclusion, the results from the data analysis indicate that analgesic benefits were achieved from the use of magnetic insoles.

Vibrating Insoles

Vibrating insoles were used as an intervention for balance control in older adults. The premise for using vibrating insoles is to enhance an older persons sensory and motor function through vibration. Priplata, Niemi, Harry, Lipsitz and Collins (2003) applied vibrating insoles as an intervention to improve balance control in the older adult. The study included 27 participants; 10 young men and 5 women, mean age 23, and 12 elderly

participants; 8 women and 4 men, mean age 73. The study found that vibrating insoles improved 7 of 8 postural sway parameters in the younger group and improved all 8 postural sway parameters in the older group. The older adults showed greater improvement than the younger adults in two variables, mediolateral range ($p = .008$), and critical mean square displacement ($p = .012$). The researchers of this study conclude that vibrating insoles could be an effective intervention in an older persons dynamic balance activities (walking), and could improve an older adults postural sway caused by age-related sensory loss.

The literature review examined arch support interventions that included the use of regular arch supports, magnetic insoles, and vibrating insoles in various populations. These studies have yielded positive changes in balance and pain relief of the older population, diabetic population, and athlete population with the use of arch supports as an intervention.

As discussed earlier, falls are a serious health care problem causing injury, death, and absorbent health care costs of the older adult and their family. Future research is needed using Orem's self-care model to promote self care activities and use of arch supports as an intervention to improve balance and decrease the risk of falls in the older adult.

Chapter 3: Methodology

This chapter describes the methodology that was utilized in this research study. The chapter will provide detailed information regarding the research design, population, setting, human rights protection, instrumentation including reliability and validity, data collection and analysis of data.

Design

A pre-experimental research design was conducted to answer the following questions: (a) is there a difference in BBS (Bert et al., 1992) and TUG (Podsiadlo & Richardson, 1991) scores from pre-intervention to immediate post-intervention to 6-week post intervention arch support use; (b) is there a difference in the report of feet, ankle, knee, hip, and back pain from pre-intervention to 6 week post-intervention use of arch supports, and (c) what are the self-reported benefits of the older adult using arch supports. In this one-group pretest-posttest design, the participants were both the

experimental and control group (Grooves & Burn, 2001). Participants participated in BBS and TUG at two separate timeframes, participants were tested twice on the same day; once without arch supports and once fitted with arch supports, and after 6 weeks of using arch supports. The measurement of variables is illustrated in Table 1. Data collection instruments were (a) the BBS (Berg et al, 1992), (b) TUG (Posiadlo & Richardson, 1991) and (c) pre and post pain assessment scale. A convenience sample was chosen for the purpose of accessibility with the inclusion criteria of adults aged 60 and older.

Selection of the participants was based on their age and their willingness to participate in the 6 week study.

Table 1: Variables

Pretest	Post-immediate with arch supports	6 week post-test with arch supports
BBS	BBS	BBS
TUG	TUG	TUG
Pain intensity scale		Pain intensity scale
Pre-demographics		Post-survey

Population

A purposive sample population of 111 older adults (male and female; 60 years and older) was selected. The population represents the healthy adult population aged 60 and older. Participants participated in BBS and TUG at two separate timeframes. Participants were tested twice on the same day; once without arch supports and once fitted with arch supports, and after 6 weeks of using arch supports.

Setting

The study was conducted in Savannah, Georgia at a specialty shoe store, Foot Efx. The participants were scheduled appointments for testing and fitting of arch supports. The participants were recruited by the owner of Foot Efx through senior expos, “Eye on Business” and “Health Beat” on a local television station, and by word of mouth. The testing took approximately 15 to 20 minutes per subject at each testing.

Human Rights Protection

Human rights were protected per protocol of Armstrong Atlantic State University Institutional Review Board (IRB). Each subject read and signed an Informed Consent form prior to participation of the study. (Appendix A). the purpose of the study was explained to each subject, and all participants were informed of their right to participate or not participate in this study without fear of retaliation or charges of arch supports.

The participants had the right to withdraw at anytime without penality and strictest confidentiality was maintained. A copy of the signed consent form was returned to each individual participant.

Instrumentation

Instruments used for data collection were BBS (Berg, et al., 1992) (Appendix F), TUG test (Podsiadlo & Richardson, 1991) (Appendix G) and pain intensity assessment scale (Appendix D).

Berg Balance Scale (BBS)

The BBS (Berg et al., 1992) is a balance assessment test that rates the ability of a subject to maintain balance while performing 14 movements required in everyday activities. Scoring is an ordinal 5-point scale. The BBS is scored on a scale 0-4, a score of 0 is given to the subject if unable to complete the task, ans a score of 4 is given tot the subject if able to complete the task. The maximum score for the BBS is 56. The test consists of simple mobility tasks, such as; transfers, standing unsupported, and sitting-to-standing, and more difficult tasks, such as; tandem standing, turning 360 degrees, and

single-leg stance. Testing takes approximately 15 to 20 minutes and the equipment required to conduct the BBS test include a chair with arms and one without arms, a ruler, a stopwatch or watch with a second-hand, and a stool. The BBS is a valid and reliable tool that assists healthcare professionals in determining treatment goals, evaluating effectiveness of treatment and predicting the older adults' risk for falls (Berg, Wood-Dauphinee, Williams, & Gayton, 1989).

Berg et al. (1989) developed a clinical tool (BBS) to measure balance in the older adult (60 to 93 years old). The study's main goal was to address the issues of content validity and reliability. Content validity measure was established over three different phases using 32 participants and 32 healthcare professionals. Having physical therapists rate fourteen participants age 65 and older displaying varying degrees of balance impairment while performing the BBS assessed reliability measures. The intraclass correlation coefficients measuring the inter and intra rater reliability for the BBS was 0.98 and 0.99, respectively. The correlation coefficients ranged from 0.71 to 0.99. There was a high degree of internal consistency reported, a Cronbach's alpha of 0.96. The results suggest atht the BBS is a useful clinical tool to measure the older adults' balance.

Research supports the use of the BBS as a predictor for assessing a person's risk for falls (Zwick et al., 2000). In a recent study Chiu, Au-Yeung and Lo (2003) completed a comparison study of four functional tests (BBS, Tinetti Mobility Score, Elderly Mobility Scale, and TUG). The researchers concluded that the BBS was the best predictor of the

functional test in discriminating fallers from non-fallers in the older population. The BBS measures have established reliability and validity; intraclass correlation coefficient for intra- and inter-rater reliability were 0.98 and 0.99, respectively; internal consistency, alpha 0.96 (Podsiadlo, & Richardson, 1991; Ness et al., 2003; Hatch, et al., 2003).

The BBS instrument was originally examined for validity and reliability in Canada with data from 113 older adult nursing home residents and 70 stroke patients (Berg, Wood-Dauphinee & Williams, 1995;). Assessment of these participants included clinical evaluation, caregiver rating of balance, and laboratory evaluation using three clinical evaluation tools; the Barthel Index, the TUG test, and the Tinetti Balance subscale (Berg, et al., 1995).

Similarly, Berg, Maki, Williams, Holliday & Wood-Dauphinee (1992) used a cross-sectional study to compare scores of the BBS with laboratory measures of postural sway and other measures of balance and mobility. Thirty-one nursing home participants were tested on clinical and functional measures of postural sway, standing still on the pseudorandom movements of the platform. The BBS was strongly associated with functional mobility and showed high correlations between the Balance Sub-scale ($r = .91$), Barthel Mobility sub-scale ($r = .67$) and TUG ($r = -.76$). The high correlations

of these tests support the validity of the BBS in the older population. The BBS was selected for this study because of the ease of administration and it was designed to specifically test balance of the older adult.

Timed Up and Go (TUG)

The TUG test measures functional mobility or dynamic balance of an individual. The test measures the amount of time it takes for an individual to rise from a

standard arm chair (approximate seat height of 46cm), wearing their own shoes

and/or using an ambulatory aide (cane, walker), walk at distance of 10 feet. To

perform the test the individual resets with his/her back against chair and when

he/she is told "go" by the tester, the individual gets up and walked 10 feet and returns to chair with back resting against the back of the chair. The individual is timed with a stopwatch or a watch with a second hand and the time to perform the TUG is

recorded in seconds. The TUG is a good indicator in identifying an older adults' functional mobility based on the measure of time to complete the test (Wall, Bell, Campbell & Davis, 2000; Shumway-Cook & Brauer, 2000).

Reliability and validity of the TUG test suggests that the TUG test is a reliable

and valid performance test of functional mobility in participants over the age of 70 years (Podsiadlo & Richardson, 1991). In a study conducted by Podsiadlo and Richardson (1991) reliability was established by using the same raters with participants on two consecutive days. The study was conducted at a geriatric day care center with sixty participants. The intra- and inter-rater coefficients both were reported at 0.99. Validity was established by correlating TUG scores with the scores of the BBS, gait speed, and

functional capacity. The results indicate that the TUG correlates well with the log-transformed scores of the BBS (r = -.78).

The TUG was selected because it is easy to administer and the reliability and

validity has been established for the use in the older adult population. The TUG

requires no special equipment and takes a few minutes to administer.

Pain Intensity Assessment Scale

A pain intensity assessment scale was administered at the start of the study and post 6 weeks. The pain scale used is the 0-10 Numeric Distress Scale (Appendix D). The participants were asked to rate his/her pain on a scale from 0 to 10. Zero representing no pain, 2 representing mild pain, 5 representing moderate pain, 7 representing severe pain and 10 representing extremely severe. The use of a pain intensity rating scale provides consistency for healthcare providers to communicate with the client and with each other (Kozier et al., 1995; Ebersole & Hess, 2001). Participants rated pain in his/her feet, ankles, knees, hips, and back, pretest and post 6-week test. APNs must remember that pain is a very subjective experience and the healthcare provider must remember that the existence and intensity of pain is what the client reports (Kozier et al., 1995; Ebersole & Hess, 2001).

The pain intensity assessment scale was used for this study because it is easy to understand and to use. With the use of this scale, the older adult tends to do better with

identifying his/her pain and the APN can obtain a fairly accurate rating of the older adults' discomfort or pain (Ebersole & Hess, 2001).

Data Collection

Data collection consisted of informed consent (Appendix A), demographics (Appendix C & E), pain intensity assessment scale (Appendix D), BBS (Appendix F), and TUG test (Appendix G). The pre-demographic sheet assisted in identifying factors associated with falls or decreased balance in the older adult. The post-demographics sheet was a similar format and had a post survey-section (Appendix E).

The owners of a specialty shoe store, Foot Efx, recruited the participants and scheduled appointments for testing on site. The informed consent was explained to each subject by the research team (one graduate student and three faculty from Armstrong Atlantic State University); the demographics sheet and pain intensity assessment scale were

completed prior to BBS and TUG test. The completion of the demographics sheet and pain assessment scale took approximately 10 minutes to complete. The BBS and TUG test administered by 4 qualified raters (research team). The BBS and TUG took approximately 10 to 15 minutes to administer.

Data was collected on three occasions; (1) at baseline (pre-intervention),

(2) immediately after fitting with arch supports on day one (immediate post-intervention),

And (3) after 6 weeks of wearing arch supports (6 week post-intervention), participants were tested a third time. Refer to Table 2 for the data collection sequence.

Table 2

Data Collection Sequence		
Time	RN-Researchers	Foot Efx
1	Informed consent Enter Study Pre-Demographics	Fit with arch supports and provide verbal and written instructions for use.
	Pain intensity assessment scale BBS TUG	
2	Repeat BBS & TUG with arch supports	
3	After 6 weeks use of arch supports: Post-Survey Demographics	

Pain intensity assessment scale

BBS & TUG with arch supports

Data Analysis

Data analysis consisted of descriptive statistics, Repeated Measures Analysis of Variance (ANOVA), and paired-samples t test. The data collected was analyzed using Statistical Package for Social Sciences (SPSS; Green, Salkino, & Akey, 2001). Descriptive analysis included mean and standard deviation for demographic data with the use of tables to represent data. The one-way ANOVA and paired-sampled t test was used to answer the research questions pertaining to this study.

Chapter 4: Analysis

In this chapter, the statistical findings from the study will be discussed and presented. The chapter will include descriptive statistics that describe the mean and standard deviation for demographic data. The demographic data was grouped and analyzed according to categories. One-Way Repeated-Measures (ANOVA), paired-samples t test, and descriptive statistics were used for analysis to answer each research question.

Demographics

Originally, 111 participants participated in the first phase of the study. Twenty-eight participants withdrew before the 6-week follow-up. An additional 16 were dropped after the study concluded due to missing data or incomplete records.

Participants (n=28) who did not return for the 6 week arch support intervention, dropped from the study for various reasons. The reasons ranged from forgetting to wear arch supports to not being able to adjust to wearing arch supports due to discomfort. An additional sixteen participants were dropped from the study due to missing data, even though they did complete the study. The missing data affected the TUG test; there were 15 missing scores. Two participants were dropped because the TUG test was not administered by the rater, and 13 participants were dropped because the TUG test was not recorded in actual seconds to complete the test, rather it was scored <20- seconds or

>29 seconds by a rater. One subject was dropped due to outlier TUG test scores. The outlier for pre- intervention TUG score was 59 seconds, immediate post-intervention TUG score

Was 121 seconds, and 6-week post-intervention TUG score was 127 seconds. These scores represent extreme values in the data set, therefore were not used in this study.

Total number of participants remaining in study is sixty-seven.

The study consisted of 44 females (65.7%) and 23 males (34.4%) total participants

(n = 67), ranging in age from sixty to eighty-seven (mean = 69.9, SD = 6.90). Ninety-one percent of participants (n = 61) live in their own home, two participants (3%) live with family, one subject (1.5%) lives in a retirement community, two participants (3%) had other living arrangements and one subject did not answer. Sixty-one (91%) of participants live in their own home and are able to care for themselves independently. This study focused on the older healthy independent adult.

The participants evaluated their current health status as excellent, very good, or fair. Forty-seven (70.1%) reported their health as very good, ten (14%) reported their health as excellent and fair, respectively. Table 3 shows the number of chronic health problems reported by participants that range from one to six. Twenty two (32.8%) of the participants reported two chronic health problems, and sixteen (23.9%) reported three chronic health problems.

Table 3

Frequency Distribution of Chronic Health Problems

No. of chronic health problems Sequence	No. participants	%
None	11	16.4%
1	12	17.9%
2	22	32.8%
3	16	23.9%

4	2	3.0%
5	3	4.5%
6	1	1.5%

Participants also reported taking daily medications. Thirteen (19.4%) reported taking two medications on a daily basis and eleven (16.4%) reported taking three medications on a daily basis. Table 4 reports the number of medications taken on a daily by the participants.

Participants were asked to report if they had problems with balance and walking. Twenty three (34.3%) reported having problems with balance and thirty three (49.3%) reported problems with walking. Table 5 shows the frequency distribution of problems with balance and problems with walking.

Table 4

Frequency Distribution of Daily Medication

No. of medications	No. participants	%
None	2	3.0%
1	9	13.4%
2	13	19.4%
3	11	16.4%
4	6	9.0%
5	5	7.5%
6	6	9.0%
7	6	9.0%
8	1	1.5%
9	5	7.5%
12	2	3.0%

19	1	1.5%

Table 5

Frequency Distribution of Participants by Balance Problems and Problems with Walking

No. of medications	No. participants	%
Balance Problems		
No	40	59.7%
Yes	23	34.3%
Sometimes	1	1.5%
Problems walking		
No	31	46.3%
Yes	33	49.3%

Participants reported use of ambulatory aides. Fifty-eight (86.6%) reported no use of ambulatory aides, six (9.0%) reported the use of a cane while walking, and three (4.5%) did not respond to the question.

Table 6 displays the number of participants who reported falls, fear of falling, and any changes in activity due to fear of falling. Fourteen (20.9%) reported a fall in the 6 months preceding the study and change in activities (n = 13, 19.4$). An additional six subjects (9%) reported a fall in the last 6 weeks of the study. Participants rated their fear of falling as no fear, somewhat fearful, or very fearful. Twenty-two of the participants reported their fear of falling as “somewhat” (32.8%) and “very” (n=5, 7.5%).

Table 6

Frequency Distribution of Participants by Falls, Fear of Falling, and Change in Activities		
	No. participants	%
Falls in past 6 months		
No	52	77.6%
Yes	14	20.9%
Fear of falling		
No	38	56.7%
Somewhat	22	32.8%
Very afraid	5	7.5%
Activity change to avoid falls		
No	44	65.7%
Yes	13	19.4%
Post Survey: Falls in past 6 weeks		
No	58	86.6%
Yes	6	9.0%

Participants reported on the use of arch supports prior to entering the study, use of arch supports for six week during the study, frequency of arch support use, and arch support use during the six-week study. Forty-three (64.3%) reported no prior use of arch supports, sixty-five (65%) reported using arch supports for 6 weeks, and forty-eight

(71.6%) reported daily use of arch supports during the 6-week study. Table 7 represents the frequency distribution of prior use and 6-week arch support use and frequency.

Table 7

Frequency Distribution of Participants prior to use of Arch Supports, 6 weeks Arch Support Use, and Frequency of Arch Support Use		
	No. participants	%
Arch support use prior to study		

Yes	43	64.2%
No	22	32.8%
Arch support using during 6 week study		
No	2	3.0%
Yes	65	97%
Frequency of arch support use during 6 week study	5	7.5%
Daily	48	71.6%
Six times per week	1	1.5%
Five times per week	1	1.5%
Four times per week	1	1.5%
Three times per week	2	3.0%
Twice a week	1	1.5%
Did not respond to question	12	17.9%
Did not respond to question	3	4.5%

The BBS (Berg et al., 1992), balance scores ranged from 0 to 56, a higher score indicates better balance. Mean balance scores increased from pre-intervention to immediate post intervention by 0.95, and mean balance scores from immediate post intervention to 6 week post intervention decreased by 0.0.9. The means and standard deviation for balance at pre-intervention, immediate post-intervention, and 6 week post intervention, are displayed in Table 8.

Table 8

Balance Scores in Means and Standard Deviations for Berg Balance Test (BBS)		
Time	Mean	SD
Pre-intervention	52.87	3.88
Immediate post-intervention	53.82	3.15
6 Week post intervention	53.73	3.70

Note: Possible range 0 to 56 with 9 (less balance) and 56 (best balance).

The TUG (Podsiadlo & Richardson, 1991) test measures functional mobility. The test is measured in seconds and the lower score indicates better functional mobility. The mean score for functional mobility decreased from pre-intervention to immediate post-intervention by 0.58 seconds and from immediate post-intervention to 6 week post-intervention by 1.11 seconds. The means and standard deviations of functional mobility scores at pre-intervention, immediate post-intervention, and 6 week post-intervention are represented in Table 9.

Table 9

Functional Mobility in Means and Standard Deviations for Timed Up & Go (TUG)

Time	Mean	SD
Pre-intervention	11.51	4.24
Immediate post-intervention	10.52	3.05
6 Week post intervention	9.41	2.60

Note: Test recorded in seconds, lower score (better functional mobility) and highest score (less functional mobility).

Research Questions

In this section, the research questions are identified and data analysis is discussed. Within-participants, one way repeated analysis (ANOVA) is used to answer the research question 1, a paired-sample t test will answer research question 2, and descriptive statistics will answer research question 3. Level of significance entered at $p < .05$.

Question 1

Is there a difference in BBS and TUG scores from pre-intervention to immediate post-intervention to 6 week post-intervention arch support use? The BBS variables were measured within subject factors utilizing multivariate test results. The results indicate a significant change for pre-intervention to immediate post-intervention to 6 week post-intervention. Table 10 represents the ANOVA results for balance (BBS).

Table 10

One-Way Within-Subjects ANOVA: Balance (BBS)					
	df	within-subjects error	F	η	p
Pre-intervention to immediate post intervention to 6 week post-intervention	2	65	9.04	.22	.000*

Note: * p <.05.

The TUG results had a positive change in pre-intervention to immediate post-intervention to 6 week post-intervention. Table 11 represents the ANOVA results for functional mobility.

Table 11

One-Way Within-Subjects ANOVA: Functional Mobility (TUG)					
	df	within-subjects error	F	η	p
Pre-intervention to immediate post intervention to 6 week post-intervention	2	65	17.73	.22	.000*

Note: * p <.05.

Question 2

Is there a difference in the report of feet, ankle, knee, hip, and back pain from pre-intervention to 6 week post-intervention use of arch supports? The Pain Assessment

intensity scale measured reported pain of the feet, ankle, knee, hip, and/or back. The scale measures pain intensity on a scale 0 to 10, with 0 = no pain, 2 = mild pain,

5 = moderate pain, 7 = severe pain, and 10 = extreme pain. The mean and standard deviation score for feet pain, ankle pain, knee pain, hip pain, and back pain are represented in Table 12.

Table 12

Pain Scores in Means and Standard Deviations for Pain Assessment

Time	N	Mean	SD
Pre-intervention Feet Pain		4.33	2.71
6 week Post Feet Pain		2.88	2.15
	64		
Pre-intervention Ankle Pain		2.32	2.25
6 week Post Ankle pain		1.92	1.76
	62		
Pre-intervention Knee Pain		3.31	2.49
6 week Post Knee Pain		2.83	2.32
	59		
Pre-intervention Back Pain		4.21	2.81
6 week Post Back Pain		2.84	1.99
	58		
Pre-intervention Hip Pain		3.71	2.88
6 week Post Hip Pain		2.68	1.98
	62		

The paired-samples t test result for pain showed a significant difference from pre-intervention to 6 week post-intervention for feet, knee, hip, and back pain. There was no significant difference for ankle pain. Table 13 represents the paired-samples t test results for pain.

Table 13

Paired-samples t test: Pre-intervention to 6 week Post-intervention Pain				
	Mean	SD	df	Significance
Feet Pain	1.45	2.30	63	.000*
Ankle Pain	0.40	1.92	61	.105
Knee Pain	0.47	1.79	58	.047*
Back Pain	1.36	2.53	57	.000*
Hip Pain	1.03	2.29	61	.001*

Note: * $p < .05$, two-tailed.

Question 3

What are the self-reported benefits of the older adult using arch supports? The post survey data indicates that the majority of the participants benefited from the use of arch supports (n=57, 85.1%). Descriptions of benefits from the use of arch supports reported by participants included improved balance when walking, exercising, golfing, and bowling, can walk better and stand on my feet longer, less pain in feet, ankle, knee, hip, and back. See Table 14 for frequency distribution.

Table 14

Frequency Distribution of Participants that benefited from Arch Support Use		
	No. participants	%
No	3	4.5%
Yes	57	85.1%
Undecided	4	6.0%
Did not respond to question	3	4.5%

Chapter 5: Discussion, Conclusions, Implications, and Recommendations

The purpose of this study was to evaluate if there was (a) a difference in BBS and TUG scores from pre-intervention to immediate post-intervention to after 6 week post-intervention use of arch supports, (b) is there a difference in the report of feet, ankle, knee, hip, and back pain from pre-intervention to 6 week post-intervention; and (c) what are the self-reported benefits of the older adult using arch supports. The results indicated statistically significant changes ($p < .05$) in scores for balance, functional mobility, pain, and self-reported benefits use of arch supports. There was no statistical significant change in ankle pain ($p > .05$). In this chapter the findings are further discussed, conclusions are presented based on these findings, implications for nursing and research, and recommendations of future research are presented. Results of this study are similar to other studies using regular arch supports as an intervention. The participants benefited from the use of arch support use to improve balance, functional mobility, and pain of the lower extremities, and back.

Discussions

It is important for APNs to remember that the older adult can experience many age related changes. Change in balance puts them at risk for falls. APNs are in a good position to promote health for the older adult using a supportive-educative nursing intervention. Orem's (1985, 1991, 2001) self-care deficit theory of nursing provided the framework for this study. Self care is the ability of each individual to care for self and

perform daily life activities. The participants of this study learned to incorporate newly prescribed self-care measures by using arch supports and participating in this study. The supportive-educative role enabled the participants to integrate new self-care measures enhancing health promotion with the use of arch supports t improve balance and/or discomfort of feet, ankle, knee, hips, and back pain. The sample population consisted of 67 older men and women (mean age = 69.9, SD = 6.90) who participated in the BBS and TUG without and with arch supports at Foot Efx in Savannah, Georgia. After initial testing of balance and functional mobility, the participants wore their arch supports for 6 weeks and returned for the final balance tests. The study revealed positive changes in balance (BBS), functional mobility (TUG), pain, and self-reported benefits of arch support use for 6 weeks. Demographics, research questions, conclusions, implications, and recommendations are discussed in the following section.

Demographics

Ninety-one percent of the 67 participants maintain their own homes and 70% reported their health as very good. This study represents the independent healthy adult ranging in ages from 60 to 87. Sixty-one of the participants have 0 to 4 chronic health problems and 40 participants take 1 to 4 medications. Research studies indicate that taking 4 or more medications can increase the older adults risk of falls (Cumming, 1998; Liu et al., 1995).

Participants reported pre-intervention balance problems (34.3% with 33 having problems walking. Fourteen reported a fall in the 6 months preceeding the study and 13 changed their activities (19.4%) due to a fear of falling. At post-survey, 6 reported falling

in the 6 weeks during the study. Various studies in the literature indicate that falling creates a psychological problem with the older adult that can lead to a fear of falling (Hatch, et. Al., 2003) and lead to activity restriction (Zwick, e. al., 2000), as well as decreased physical function (Rekeneire e.al., 2003) and gait changes (Cromwell & Newton, 2004) that increases the older adults risk for falls.

This study did not collect post-survey data on balance and walking problems, or on change in activity and fear of falling after 6 week use of arch supports. This information at baseline and 6 week post-intervention would have given additional information on the effects of arch support use. However, the participants after 6 weeks of arch support use had favorable results: 48 of the participants wore their arch supports daily, 85.1% benefited from arch support use, and pain scores decreased for feet, knees, hips, and back.

Research Questions

Question 1

Is there a difference in BBS and TUG scores from pre-intervention to immediate post-intervention to 6 week post-intervention use of arch supports? Currently, there are no research studies or similar studies on the use of arch supports as an intervention using the BBS and/or TUG to assess an older adult's balance. The BBS instrument that was used in this study has been examined for validity and reliability in numerous studies. These

Studies conducted by researchers; Berg, Maki et al. (1992), and Chi et al. (2003), and Zwick et al. (2000) conclude that the BBS was the best predictor in predicting fallers from non-fallers in the older population.

The TUG measures functional or dynamic mobility of an individual. The TUG is a good indicator in identifying an older adults' functional mobility basted on the measure of time it takes to complet the test (Wall et al., 2000; Shumway-Cook & Brauer, 2000). Reliability and validity of the TUG is a valid performance test of functional mobility in the older adult (Podsiadlo & Richardson, 1991). The research findings for research question 1 are reported as follows:

Balance (BBS)

The BBS (Berg, et al., 1991) measures static balance. Balance scores ranged from 0 to 56, a higher score indicates better balance. The mean balance scores from pre-intervention (mean 52.87) to immediate post intervention (mean 53.82) increased by 0.95. The mean score from immediate post intervention (mean 53.82) to 6 week post-intervention (mean 53.73) decreased by 0.09. The greatest change in mean balance scores was from pre-intervention (no arch supports) to immediate post intervention (arch supports). The use of arch supports revealed immediate effects that improved the participants' balance by providing mechanical alignment and support to the feet. Even though there was a slight decrease (0.09) in BBS from 6 week post-intervention balance test, this may be due to the participants' scoring high on the initial testing of BBS. The

Highest possible score in the BBS is 56 and the mean at baseline (pre-intervention) was 52.87, leaving little room for improvement. Nineteen participants scored 56 on the BBS at baseline (pre-intervention). Overall, the changes in BBS balance scores are significant ($p < .05$) from pre-intervention to immediate post-intervention to 6 week post-intervention.

Functional Mobility (TUG)

The TUG (Podsiadlo & Richardson, 1991) test measured functional mobility. The test is measured in seconds and the lower score indicates better functional mobility and highest score less functional mobility. The mean score for pre-intervention (mean 11.51) to immediate post-intervention (mean 10.52) for functional mobility decreased by 0.58

seconds and from immediate post-intervention (mean 10.52) to 6 week post-intervention (mean 9.41) decreased by 1.11 seconds. The greatest change was from immediate post-0interveriont to 6 week post-intervention. The participants' wore arch supports for six weeks that improved functional mobility. The TUF scores of fictional mobility were significant from pre-intervention to immediate post-intervention to 6 week post-= intervention ($p < .05$). The TUG indicated greater improvement from immediate post-intervention to 6 week post-intervention than the BBS because the use of the arch support for 6 weeks continued to improve mobility. As mentioned before the BBS mean at baseline were 52.87 and there was not much room for improvement in balance.

Question 2

Is there a significant difference in the report of feet, ankle, knee, hip, and back pain from pre-intervention to 6 week post-intervention? The literature revealed no research studies that have been conducted using the older population using arch supports as an intervention to improve pain in the back, hips, and lower extremities. However, there are several similar studies that examine the use of arch supports as an intervention in athletes with overuse injuries and pain (Nigg et al 1999) and in long-distance runners (Gross et al., 1991) Nigg et al., recommends arch support use in sports and physical activities to prevent injury or to avoid certain movement-related injury. The Gross et al. study found that with the use of arch-supports in long-distance runners were effective in the relief of pain from hip, knee, feet, and ankle problems. Sutlive et al. (2004) used arch supports with modified activity to reduce patellofemoral pain in the knee, in which the participants responded favorably to using arch supports.

The results of this study are similar to those of Gross et al. (1991) and Sutlive et al. (2004). Gross et al. reported significant improvement in pain scores in hip, knee, feet,

and ankle of long distance runners. Sutlive et al. reported improved knee pain with the use of arch supports and modified activity. The research findings for research question 2 are reported as follows:

Pain: Immediate post-intervention to 6 week post-intervention

The pain intensity assessment scale measures pain. Pain is rated on a scale from 0-10. Zero representing no pain, 2 representing mild pain, 5 representing moderate pain, 7

representing severe pain, and 10 representing extremely severe. Pain was decreased from pre-intervention to 6 week post-intervention for feet, knee, hip, and back pain ($p < .05$) except for ankle pain ($p > .05$). Arch supports provide cushioning, support of arches and evenly distributes pressure of the feet, while maintaining alignment of the skeleton, resulting in the improvement of pain to the lower extremities and back, as well as balance and posture. The improvement of pain scores in the lower extremities and back will help reduce the risk for falls because an individual will have better balance and functional mobility.

Question 3

What are the self-reported benefits of the older adult using arch supports? The post survey data indicates that the majority of the participants benefited from the use of arch supports ($n = 57$, 85.1%). The participants comments of the self-reported benefits include improved balance when walking, exercising, golfing, and bowling, can walk better and stand on feet longer, less pain in feet, ankle, knee, hip, and back. Arch supports will help improve an individual's balance and reduce the risk for falls because they feel better, are more active, and are able to stand longer which in turn strengthens lower extremities.

The search of literature did not reveal any intervention studies of the older adults' self-reported benefit use of arch supports. Even though there are no related studies there are several important studies on improper foot care and footwear that can increase an older adults risk for falls and lead to discomfort of the feet (Ebersole & Hess, 2001). Research study on footwear in the older adult suggests that wearing no shoes and wearing shoes

that are low-heeled (Lord & Bashford, 19910, or slip-resistant shoes (Menz, Lord, & McIntosh, 2001) helps maximize balance. Neglect of the feet (Ebersole & Ness, 1991), and improperly fitted shoes contribute to abnormal foot mechanics that causes areas of excessive pressure and pain (Bedinghaus & Niedfeldt, 2001). Also decreased muscle strength in the lower extremities (Reneneire et al., 2003) and gait changes affect balance (Cromwell & Newton, 2004).

Conclusions

The conclusions are based on the findings and are listed below:

1. The older healthy independent population in this study is not representing of the older population as a whole.
2. The 67 men and women were willing to participate in the study and to integrate new self-care measures by wearing the arch supports to improve balance and comfort of lower extremities and back.
3. Arch support use for 6 weeks was associated with statistically significant improvement in scores for balance (BBS), functional mobility (TUG), and pain in lower extremities (except ankle pain) and back.
4. Self-reported benefit of arch supports for 6 weeks indicated that the majority of participants (n = 57, 85.1%) benefited from the use of arch supports.
5. Orem's (2001) self-care deficit theory of nursing can provide a framework to promote self-care and health of the older adult.

Implications for Nursing

APNs can provide care to the older adult through a supportive-educative role using Orem's (1985, 1991, 2001) self-care model. The APN is in a good position to

improve health of the older adult by promoting self-care and health to reduce the risk of falls by improving the older adults balance through the use of arch supports. The APN can help decrease the risk of falls by assessing the older adult risk for falls, by including educational and self=-care recommendation. Further, education and intervention planning should include the older adult's caregivers and referrals to the proper discipline if necessary. APNs can include the TUG test to evaluate an older adult's functional mobility. The TUG is an easy test to administer and gives valuable information in regards to a person's functional mobility that is necessary in order to perform self-care activities. This study has provided research evidence based nursing practice, and will assist in further research in decreasing the risk of falls of the older adult by recommending arch supports for the older adult to improve balance and comfort in lower extremities and/or back pain.

Recommendations

After a thorough review of the findings, conclusions, and implications, the following

recommendations are made:
1. Replicate the study and have a more diverse group of the older population (i.e., homebound individuals).

2. Schedule time slots for 30 minutes per subject instead of 15 minutes, this will

allow more time with each subject to review and complete the demographics sheet and pain assessment scales in its entirety; therefore, avoid missing data that

affects the study.

1. Follow-up with the participants by telephone after one week to see how they are progressing with the use of the arch supports. This may help reduce the drop rate of participants from the study of those that had difficulty adjusting to the arch supports.

1. Replicate the same study and add a control group. Have participants return at 6 weeks, 3 months, and at 1 year to determine a long-term effect of the arch supports in relation to balance and comfort to lower extremities and/or back.
2. Prior to the study review procedures of BBS and TUG to increase interrater reliability, thus tests will be administered with less variation and will decrease the number of participants that are eliminated from the study to due improper administration of test.
3. The TUG instrument needs to be revised to include instructions on how to score the test. The instructions should indicate the TUG scores in actual seconds. This will help decrease the number of participants eliminated from study due to improper administration of test by rater.

Recommendations for Future Research

Further research would be beneficial in reducing the older adults risk for falls by using arch supports to improve balance and comfort. The findings of this study have significant implications for nursing research. The use of arch supports for 6 weeks resulted in significant improvement in balance, functional mobility, and pain of the lower extremities and back. Since there are no similar studies in the literature, there needs to be further studies conducted to determine the long-term benefits and effects of arch supports in the older population. This study focused on the healthy independent adult, research is also needed in a more diverse older population.