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Effects of Footstrike Pattern on Low Back Posture, Shock Attenuation, and Comfort During Running

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EFFECTS OF FOOTSTRIKE PATTERN ON LOW BACK POSTURE, SHOCK ATTENUATION, AND COMFORT DURING RUNNING

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A doctoral project submitted in partial fulfillment

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Abstract:

Purpose: Barefoot running (BF) is popular in the running community. Biomechanical changes occur with BF, especially when initial contact changes from rearfoot strike (RFS) to forefoot strike (FFS). In addition, changes in lumbar spine range of motion (ROM), particularly involving lumbar lordosis, have been associated with increased low back pain (LBP). However it is not known how changing from RFS to FFS affects lumbar lordosis or LBP. Thus, the purpose of this study was to determine if a change from RFS to FFS would change lumbar lordosis, and/or decrease shock attenuation, and/or change comfort levels in healthy recreational/experienced runners.

Methods: Forty-three subjects performed a warm up on the treadmill where a self-selected footstrike pattern was determined. Instructions on running RFS/FFS were taught and two conditions were examined. Each condition consisted of 90 s of BF with RFS or FFS; order randomly assigned. A comfort questionnaire was completed after both conditions. Fifteen consecutive strides from each condition were extracted for analyses.

Results: Statistically significant differences between FFS and RFS shock attenuation ($p<0.001$), peak leg acceleration ($p<0.001$), and overall lumbar ROM ($p=0.045$) were found. There were no statistically significant differences between FFS and RFS in lumbar extension or lumbar flexion. There was a statistically significant difference between FFS and RFS for comfort/discomfort of the comfort questionnaire ($p=.007$). There were no statistically significant differences between other questions or the average of all questions.

Conclusion: Change in footstrike from RFS to FFS decreased overall ROM in the lumbar spine but did not make a difference in flexion or extension in which the lumbar spine is positioned. Shock attenuation was greater in RFS. RFS was perceived a more comfortable running pattern.

Acknowledgements:

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Introduction:

Preventing injury in the athletic population is of interest,[1] especially in the running community. As running is a popular pastime for both experienced and recreational athletes, attempts are continuously made to find ways to enhance performance and/or prevent injuries. Examples include a change in posture[2] or footwear.[3] In addition, overuse injuries from training errors occur, yet these injuries may be preventable.[4, 5] One of the techniques employed in the prevention of injuries is to modify the gait pattern,[6] with one particular trend, barefoot running, rising among athletes.[7] However, there is growing evidence to suggest that barefoot running creates kinematic and kinetic changes throughout the body,[8-10] and these should be explored.

Evidence shows that barefoot running changes the footstrike pattern from a rearfoot strike (RFS) to a forefoot strike (FFS).[1,11] This change results in a decrease in impact attenuation at the tibia[6] and in vertical ground reaction force.[12] It has also been shown to improve running performance overall.[11]

Focusing specifically on the low back while running, there is evidence to suggest that during loading response and stance phase there are positional changes in the low back and pelvis.[13] This leads to the notion that a change in initial contact as a result of utilizing a different footstrike pattern could change the position of the low back during running. Hasegawa et al[11] suggested that a change in the running pattern from RFS to FFS can create changes across the low back.[13] Relative to injury prevention, Nicola and Jewison[14] and Levine et al[15] stated that an excessive anterior pelvic tilt, which allows for a longer stride length[8,14,16] and is more directly associated with a RFS, results in increased lumbar lordosis[13,15] and can potentially lead to injury in runners.[14,15] Additionally, Hamill et al[17] concluded that low back pain can be caused by lower extremity stiffness, especially in the knee, and Bishop et al[18] concluded that lower extremity stiffness can be decreased with barefoot running.

If a runner's low back posture could be affected by a change in footstrike pattern, what other factors does this running style affect? Injuries to structures in the low back, such as joints and articular cartilage, have been linked to the propagation of shock throughout the body.[19] Shock attenuation, the dissipation of the impact that occurs during initial contact of foot with the ground, is dependent on passive structures of the body and active movement. It can be influenced by running speed, stride length, and state of fatigue.[20] If shock attenuation could change by running a different way, then perhaps injury and pain in the low back could change as well. It is known that with an increase in stride length, an increase in shock attenuation occurs[9] as with RFS.[1,21]

Thus, we questioned the relationship between the change in a runner's footstrike pattern and low back posture, with the primary purpose of the study to determine if changing the footstrike pattern from RFS to FFS would change lumbar lordosis in recreational/experienced runners. The hypothesis was that there would be a change in lumbar lordosis when changing this footstrike pattern. The secondary purpose of the study was to determine if changing the footstrike pattern from RFS to FFS would decrease shock attenuation in recreational/experienced runners. The hypothesis was that there would be an increase in shock attenuation when changing this footstrike pattern. Finally, we sought to determine if there is a difference in perceived comfort during running while using a RFS and a FFS in recreational/experienced runners. The hypothesis was that there would be a perceived change in overall comfort when changing this footstrike pattern.

Methods:

Sample:

A convenience sample in which subjects were enrolled non-consecutively was used to obtain 48 volunteer participants. These individuals were recruited using flyers posted in areas likely to be seen by runners in the local community. Subjects were included in the study based on the following criteria: ages 18 through 45 years,[22,23] in good overall health, and a recreational/expert runner with the criteria of running at least four times a month. Exclusion criteria included: history of sensory deficits in the lower extremities, unresolved lower extremity injuries,[17] unresolved lower back pain, diagnosis of scoliosis, and/or any health conditions that would prevent them from running at the time of data collection. Three volunteers were excluded and two subjects' data were omitted from analysis due to equipment malfunction, resulting in 24 male and 19 female participants (Table 1).

Instrumentation:

Lumbar lordosis was measured in the sagittal plane using an Electrogoniometer (Biometrics LTD, Ladysmith, VA; 1000 Hz; model SG150/B).[24,25] Instrument precision has been reported to be 0.8-3.6 degrees.[26] Leg and head accelerations at impact were measured using uniaxial accelerometers (PCB Piezotronics, Depew, NY; 1000 Hz; model no. 352C68). The reliability and validity for these accelerometers has been reported to be within the frequency and amplitude range of human body motion.[27]

A comfort questionnaire was selected and adapted from The Physical Activity Enjoyment Scale.[28] The questionnaire was comprised of seven questions assessing the subject's perception of stability, balance, level of frustration, comfort, likeability, and agility when running using each of the two different footstrikes. The questionnaire was based on a 7 point scale with 1 and 7 being opposite extremes and 4 being neutral (Figure 1).

Procedures:

Upon the appointment, written informed consent, approved by the affiliated institution,* was obtained, and consenting subjects completed a brief questionnaire to provide demographic and anthropometric information and determine eligibility. Eligible participants were then randomly assigned to run RFS or FFS during the data collection. Subjects were asked to warm-up on the treadmill with their shoes on, using a self-selected speed and their preferred footstrike pattern. The warm-up consisted of a 2-min jog followed by a 1-min run and finished with another 2-min jog. During the 1-min run time, the self-selected footstrike pattern was observed and recorded. At least two raters with previous training in recognition of footstrike pattern observed and agreed on the self-selected footstrike pattern.

Subjects were then instructed on how to run using two different footstrike patterns, FFS and RFS. The FFS pattern was taught with the verbal cueing consisting of 1) "try to run on your toes" and 2) "do not let your heels touch the ground." The RFS pattern was taught with the verbal cueing consisting of 1) "try to run with your heels hitting the ground" and 2) "try to run with your heel hitting the ground first." Each subject was allowed to practice the different footstrikes on the treadmill until they felt they could use these patterns correctly.[29]

* IRB Protocol Number: 1105-3831

The accelerometers were then attached to the subject, while standing barefoot upright on even ground. One was placed on the anterior medial aspect of the distal 1/3rd left tibia,[30] taped down with athletic tape, then leukotape, and reinforced lightly with an elastic strap. An open helmet with a taped accelerometer on the anterior portion was then strapped to the head. The spinous process of the second lumbar vertebrae was identified and marked with a surgical marker. The electrogoniometer was applied to the low back across the L2 segment and reinforced with leukotape across both sides of the joint line (Figure 2). Standing barefoot on the treadmill, the subject was asked to relax with arms at side while natural lumbar lordosis data were recorded.

Each subject ran barefoot on the treadmill at a self-selected pace and a self-selected pattern of footstrike while the speed and footstrike pattern were documented; this self-selected speed was used for all subsequent trials. The subject was then told to run with the first randomly assigned footstrike pattern then the other until they felt they could reproduce the patterns during data collection. At that point, the footstrike patterns were observed to ensure proper technique. The comfort scale was then explained to the subject. Next, one investigator showed a card to the subject specifying which footstrike pattern to run first while the investigator collecting data was blinded; the investigator collecting data was unaware of the subject's random assignment until the end of data collection when data were saved to the computer. Condition 1 was completed using the first randomized footstrike pattern for 90 seconds. After completing the comfort questionnaire, Condition 2 was completed using the second randomized footstrike pattern for 90 seconds followed by completion of the comfort questionnaire.

Data Extraction:

BioWare software (version 4.0.x; Kistler Instruments Corp.) was used to capture synchronous electrogoniometer and accelerometer data (Figure 3). The accelerometer data were used as a reference for stride cycles (the time between left foot initial contact to left foot initial contact). Fifteen consecutive stride cycles per condition were selected during the middle of data capture for subsequent analysis. For each stride, the peak left leg and head acceleration values were obtained and used to calculate shock attenuation using the formula: (1-(leg peak/head peak)*100.[31] Thus, a larger value was indicative of greater impact attenuation.[20] For each footstrike pattern, the average shock attenuation of the 15 strides per subject was calculated and evaluated statistically.

Electrogoniometer data were extracted for each stride cycle. Data between each footstrike were analyzed for minimum (lumbar flexion) and maximum (lumbar extension) values in degrees. For each footstrike pattern the overall ROM was defined as the difference of these two minimum and maximum average values.

Statistical Analysis:

All statistical analyses were performed using SPSS, Version 19 (IBM, Chicago, IL). The level of statistical significance was set to $\alpha<0.05$. Paired samples t-tests were used to analyze the differences between the biomechanical variables (lumbar spine ROM, amount of flexion and extension, shock attenuation, and peak leg acceleration) in FFS and RFS running pattern. A nonparametric Wilcoxon signed rank test was used to compare differences in comfort questionnaire responses between the two footstrike conditions.

Results:

Lumbar Spine Motion:

Analysis of the lumbar spine motion revealed statistically significant differences between FFS and RFS lumbar ROM, t (42) =-2.069, p=0.045 (RFS$\bar{x}$=22.1degrees, FFS$\bar{x}$=20.9 degrees). There was no statistically significant difference between the FFS and RFS lumbar extension, t (42) = 1.367, p=0.179, or flexion, t (42) = -0.327, p=0.745.

Shock Attenuation and Leg Impact:

There was a statistically significant difference between FFS and RFS for shock attenuation, t (42) = -9.026, p<0.001 (FFS $\bar{x}$=56.5% SD=17.14, RFS$\bar{x}$=73.4% SD=10.88). There was a statistically significant difference in the peak leg acceleration between FFS and RFS, t (42) =-8.301, p<0.001, with a lesser leg acceleration peak in FFS (FFS $\bar{x}$=3.8g SD=1.78, RFS$\bar{x}$=6.1g SD=2.16).

Comfort Questionnaire:

The mean and standard deviation values for the comfort questionnaire are given in Table 2. Wilcoxon signed rank test results revealed that there was a statistically significant difference between the two running conditions for comfort/discomfort (question 7), Z=2.710, p=.007, in favor of RFS (RFS$\bar{x}$=4.3, FFS$\bar{x}$= 3.0). There was no statistically significant difference between questions 1-6 or the average score of all questions.

Discussion:

The primary purpose of the study was to determine if changing the footstrike pattern from RFS to FFS would change lumbar lordosis in recreational/experienced runners. The original recruitment criteria for this study were very broad including running at least 4 times per month. Across the group, the average mileage per month was 10-15 miles and over 60% of the participants reported running more than twice per week. In addition, none of the participants classified themselves as elite runners. As well, less than 10% of the study participants reported previously using FFS during running. Thus, the study sample was much more homogenous than the study inclusion criteria specified.

Lumbar Spine Motion:

Results indicated that a change in footstrike pattern from RFS to FFS decreased the overall sagittal ROM in the lumbar spine during running in recreational/experienced runners. When running with a RFS, there was overall greater excursion in the lumbar spine. However, the change in footstrike did not make a difference in the amount of flexion or extension in which the lumbar spine is positioned. Even though the amount of overall ROM excursion increased in RFS, the position of the lumbar spine was neither more extended nor flexed when compared to running FFS. The results support the null hypothesis that there would be no change in lumbar lordosis.

Schache et al[13] showed different positional changes in the low back and pelvis during midstance and toe off in running. When initial foot contact was changed in running, the positional change of the lumbar spine was not necessarily in favor of flexion or extension, but rather in overall ROM as confirmed by the present study. This change in overall lumbar ROM may be accounted for by the shorter stride length that occurs when running FFS compared to RFS.[1] A change in stride length creates changes in the pelvis,[8] and positional changes in the pelvis correspond with lumbar lordosis changes.[32]

The most probable reason for this study not finding a difference in flexion and extension in the lumbar spine is that no true difference exists. With a change in footstrike, the lower extremities including the knee and hip joints may accommodate[8,9] sufficiently to allow the lumbar spine to remain in a relatively similar position. Another explanation for this finding may be what is occurring in the body in terms of shock. It is beneficial from an injury prevention aspect if lesser impact has to be absorbed.[33] Lumbar lordosis acts as a shock-absorbing structure in the body,[10] and with more lordosis there is a greater ability to absorb shock.[34] Because the FFS pattern resulted in lesser leg shock at contact, there is less force that needs to be absorbed by the lumbar spine and other body segments, decreasing the need to accommodate shock by exaggerating lumbar lordosis.

Shock Attenuation and Leg Impact:

This study revealed that there was lesser peak leg impact at contact when running with a FFS pattern. This is consistent with current evidence suggesting that running with a FFS would decrease shock when compared to running RFS.[1,21,35] Shock attenuation was also observed to be greater with RFS than FFS; there is more shock absorbed throughout the body when running RFS. This may be due to the overall greater foot-ground impact to be generated in RFS, thus increasing the magnitude of shock to be attenuated. This result is consistent with Mercer et al[9] indicating that a RFS would absorb more shock in the body because of a longer stride length.

Comfort Questionnaire:

In terms of comfort, the study found that RFS is perceived to be a more comfortable running pattern than FFS for recreational or experienced runners. This may be a result of a lack of familiarity with FFS for the participants who had little time to accommodate. The results could also be due to the subjects feeling uncomfortable simply because of the novel motion (RFS was the preferred footstrike for 84% of the subjects). Williams et al[29] indicated that familiarity should not have had an effect on the lower extremity mechanics so the accommodation period may have had a larger role. Also, the subjects' comments during and after data collection were largely concerning the treadmill's warmth and the feeling of running barefoot in both footstrike conditions. Studies have shown that there are changes in ground reaction forces, rate of proprioception encountered,[1] and kinematics when running barefoot versus shod,[12,18,36,37] and this may have influenced the results.

The accommodation period may be another alternative explanation for the absence of significant differences in any of the other questions on the questionnaire. The fact that the subjects in this study were not accustomed with running barefoot could also explain this result because both footstrike conditions were performed without shoes. This barefoot phenomenon could have disguised any other differences.

Clinical Relevance:

Greater overall low back excursion with a RFS pattern may suggest that this pattern creates a greater demand for stability in the lumbar spine. Therefore, this footstrike could possibly not be beneficial for individuals with stability problems, including hypermobility or atrophied lumbar spine musculature. However, the change in ROM did not exceed known error of the measuring device for lumbar ROM, suggesting that the effect may not be clinically significant even though it reached statistical significance. In terms of directional preferences for the lumbar spine, changing the footstrike pattern from RFS to FFS is unlikely to be beneficial according to the current findings.

In addition, excessive loading or shock can lead to degenerative changes and the weakening of shock absorbing structures of the body including the intervertebral discs.[33] Therefore, decreasing the amount of shock that the body encounters could potentially prevent or delay these degenerative changes. It can then be suggested that FFS running could help prevent or delay these degenerative changes over RFS.

It has been shown that LBP creates a limited ability to attenuate shock.[33] Wosk et al[38] suggested that decreasing shock that enters the body significantly reduces LBP and improves mobility of patients with LBP. It then follows that an individual with LBP may benefit from running FFS over RFS to reduce pain, because FFS was shown to introduce lesser leg impact at foot contact. Further research is needed to explore this line of inquiry.

One limitation of the study was that subjects ran on a treadmill, which may change the runners' strategies and biomechanics compared to over ground running.[39] Another potential limitation involved the lack of an accommodation period the subjects had for the novel (FFS) running pattern.

Future research investigating the effects of FFS and RFS on individuals with LBP may provide additional insight into whether a change in footstrike pattern would affect low back motion and pain in runners. While the overall lumbar ROM was found to be significant, the statistical power, computed post hoc, was only .520.

Conclusion:

Results of this study suggested that a change in footstrike pattern from RFS to FFS decreased the overall ROM in the lumbar spine during running but did not make a difference in the amount of flexion or extension in which the lumbar spine was positioned. The peak leg acceleration was greater in RFS than in FFS, and shock attenuation was greater with RFS than FFS. Results also identified that RFS was perceived to be a more comfortable running pattern than FFS for recreational or experienced runners.

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Appendix

Figure 1: Adapted Comfort Questionnaire

At the moment, please rate how you feel about the current footstrike pattern you are using while running. Below is a list of feelings with respect to the current footstrike pattern while running. For each feeling, please mark the number that best describes you

	1	2	3	4	5	6	7	
1. I enjoy it.								I hate it.
2. I feel unstable.								I feel stable.
3. I feel awkward.								I feel agile.
4. I am very frustrated by it.								I am not at all frustrated by it.
5. I feel balanced.								I feel unbalanced.
6. I dislike it.								I like it.
7. I feel discomfort.								I feel comfortable.

Figure 2: Placement of Instrumentation

Placement of an accelerometer on the anterior medial aspect of the distal $1/3^{rd}$ left tibia (top), securing the open helmet housing an accelerometer on the anterior portion of the head (middle) and placement of an electrogoniometer spanning the spinous process of the second lumbar vertebrae (bottom).

Figure 3: Exemplar accelerometer data

Exemplar accelerometer time history for the leg accelerometer (solid line) and head accelerometer (dashed line)

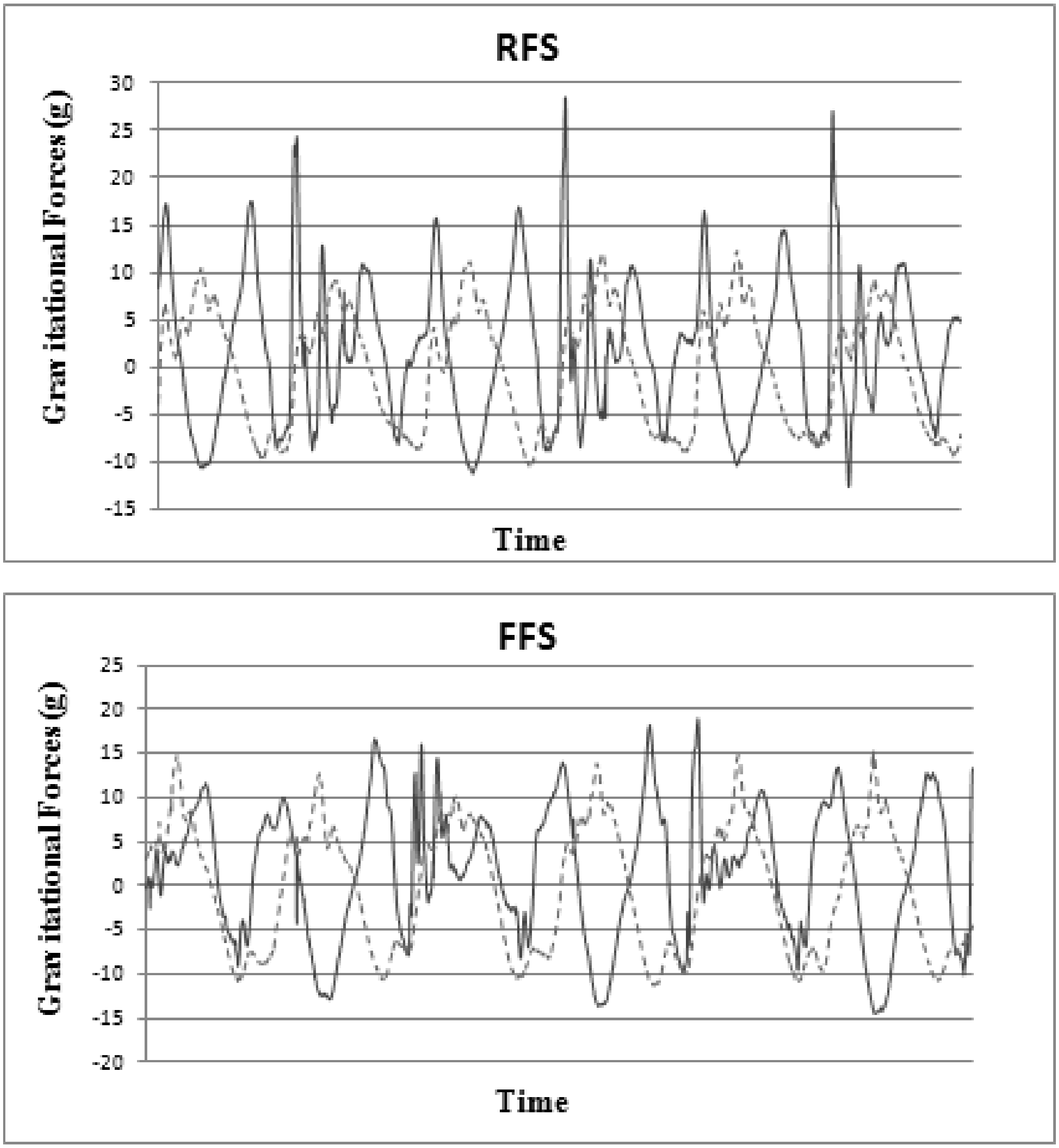

Table 1	Subject Demographics Statistics				
	Minimum	**Maximum**	**Mean**	**Mode**	**Std. Deviation**
Height (cm)	154.9	193	173.0	172.7	9.70
Mass (kg)	46.72	120.2	74.0	56.70	18.65
Age (yrs)	19	31	24.2	25	2.48
	Category	**N**	**%**		
Gender	Male	24	55.8%		
	Female	19	44.2%		
Race/Ethnicity	White	34	79.1%		
	Hispanic Latin or Spanish Origin	3	7.0%		
	Asian/Pacific Islander	4	9.3%		
	Other	2	4.7%		

Table 2		**Comfort Questionnaire Responses by Condition**							
		Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Average
Mean	FFS	4.1	4.4	3.9	5.1	4.5	3.9	3.4	4.2
	RFS	4.9	4.7	4.2	5.5	4.8	4.7	4.6	4.7
SD	FFS	1.80	1.74	1.92	1.80	1.67	1.93	1.73	1.40
	RFS	1.55	1.95	1.85	1.61	2.00	1.78	1.81	1.50
Z value		-1.876	-.742	-.408	-1.008	-.665	-1.723	-2.710	N/A
P value		.061	.458	.683	.314	-506	.085	.007	.119

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Curriculum Vitae

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- Attending UNLV, Doctorate in Physical Therapy, DPT, May 2013
- Bachelor of Science, Kinesiological Sciences Comprehensive, Cum Laude, May 2010

Relevant Experience:

Family and Sports Physical Therapy
Student PT, Las Vegas, Nevada January 2013-April 2013
Outpatient Care
Examine, evaluate, assess, and treat patients with a variety of orthopedic, balance/vestibular, and chronic health conditions. Proficient in the software Web PT.

Mesa View Physical Therapy
Student PT, Las Vegas, Nevada June 2011-July 2011
Outpatient Care ♦ Inpatient Care ♦ Acute Care
Examined, evaluated, assessed, and treated patients with a variety of orthopedic, sub-acute, and chronic health conditions in multiple settings; in acute care, handled total PT patient load and attended daily case management meetings.

Relevant Employment Experience:

Comprehensive Therapy Centers June 2004-Present
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Position: Physical Therapy Technician, Event Coordinator, Front Office/Billing

- ♦ Prepare patients and equipment for treatments, aided in carrying out treatment procedures, assist in supervision of patients, order and stock office and clinic supplies, change linens, and maintain equipment.
- ♦ Plan company events, book locations, host, and manage events.
- ♦ Cross-trained in reception and billing positions; answer phones, schedule patients, bill insurance/patients, work with the computer software programs PTOS and Turbo.
- ♦ Operate and maintain company website
- ♦ Prepare, distribute, and analyze annual patient questionnaires.

Research Experience: *Student Co-Investigator, Mentored Group Research, Las Vegas, Nevada*

"Effects of foot strike on low back posture, shock attenuation, and comfort in running." As found in the journal MSSE (Delgado et. al 2012)

Professional Memberships/ Certifications:

American Physical Therapy Association (APTA)
Member since 2010

The National Society of Collegiate Scholars (NSCS)
Member since 2006

CPR Adult and Infant Certified
American Heart Association ♦ Expires March 2013

Collaborative Institutional Training Initiative (CITI)
Human Biomedical Research

Continuing Education:

Combined Sections Meeting, APTA, San Diego, California
January 21-24, 2013 ♦ Student Assembly

Combined Sections Meeting, APTA, Chicago, Illinois
February 8-10, 2012 ♦ Student Assembly

Combined Sections Meeting, APTA, New Orleans, Louisiana
February 9-12, 2011 ♦ Student Assembly

Mobilization of the Nervous System Course
April 10, 2011♦ Presented by Dr. Louie Puentadura, PT, DPT, GDMT, OCS, FAAOMPT♦ 6 hours

Understand and Explain Pain, UNLV Department of PT, Las Vegas, Nevada
August 21-22, 2010 ♦ Presented by Dr. Lorimer Moseley, PT (Hons), Ph.D. ♦ 14.25 hours

♦ *References provided upon request* ♦

Curriculum Vitae

Emilia Kubera-Shelton, SPT

Education

Doctor of Physical Therapy – University of Las Vegas, NV – May 2013
Bachelor of Science in Kinesiology - University of Las Vegas, NV – May 2010
Physical Education – Academy of Physical Education, Poland, 2002-2005

Continuing Education

- APTA Combined Section Meeting – 2011, 2012
- NPTA Seminars (Introduction to Electrodiagnostics, Orthotic Design, Microprocessor Controlled Prosthetic Knees, Dupuytern's Disease Management, Radiographic Imaging)
- Nevada Geriatric Education Center Interdisciplinary Diabetes Education Workshop – October 2011, March 2012
- Explain Pain Seminar – July 2010, February 2012
- Mobilization of the Nervous System – April 2011
- Bioness Plus Training– August 2012

Professional Experience- Clinical Affiliations

Advance Manual Therapy Institute, Henderson, NV – Outpatient Setting Jan – April 2013

- Evaluated and treated patients with back and neck pain, muscle imbalances in lower extremities and other common orthopedic conditions
- Coordinated patient care with prosthetist and MD's to improve therapy outcomes and patient's quality of life.

St. Rose Dominican Hospital, Henderson, NV – Acute Setting October - December 2012

- Evaluated and treated 10-15 acute patients daily. Evaluated patients after THA, TKA, TSA on the day of surgery and post-operative day 1. Collaborated with OT, RN and MD's to improve patient care.
- Became efficient with electronic documentation using Cerner software

Desert Canyon Rehabilitation Hospital, Las Vegas, NV – Rehabilitation June – October 2012

- Evaluated and treated patients with neurological problems (CVA, TBI, SCI), musculoskeletal, cardiovascular and respiratory issues
- Handled 100% patient load and maintained 90% productivity at the end of affiliation

Comprehensive Therapy Centers, NV – Rural Outpatient Setting June-August 2010

- Evaluated and treated patients with orthopedic conditions with emphasis on individualized care approach.

Other Work Experience

Graduate Assistant for Director of Clinical Education at UNLVPT June 2010 – June 2011

- Directed the development of UNLVPT Newsletter
- Implemented new ways to maintain Clinical Database
- Handled and processed paperwork of 90 students

Research Experience

"The effects of footstrike pattern on shock attenuation, lumbar posture and comfort" – published in Medicine & Science in Sports & Exercise Journal in March 2013 and presented at CSM and UNLV as poster presentation

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Professional Membership/Certifications

- APTA , NPTA Member Since 2010
- APTA Orthopedic Section Member Since 2010
- CPR and AED Certification
- HIPPA Certification

Curriculum Vitae

Robert Robb

<u>Education</u>

University of Nevada, Las Vegas – Las Vegas, NV

- Doctor of Physical Therapy – May 2013

University of Nevada, Las Vegas – Las Vegas, NV

- Bachelor of Science in Kinesiological Sciences – 2009

<u>Professional Experience</u>

Pro Physical Therapy – Lake Havasu City, AZ
June-July 2011

- Clinical Internship
  - Examined and evaluated patients with musculoskeletal, neurological, and balance pathologies in an outpatient setting
  - Developed appropriate physical therapy diagnosis based on evaluation
  - Developed and applied appropriate physical therapy intervention protocols using evidence-based knowledge to meet the goals of patients
  - Observed Surgeries - Total Knee Replacement and Total Hip Replacement
  - Provided an in-service on Kleinert and other protocols for Flexor Tendon Repairs

Kindred Hospital, Sahara Campus – Las Vegas, NV
July-September 2012

- Clinical Internship
  - Examined and evaluated complex patients in a long term acute care setting
  - Developed proficiency with all transfers, including hoyer lifts
  - Developed proficiency with physical therapy interventions appropriate for this setting
  - Participated in team meetings and decisions about recommended patient setting after discharge

Family and Sports Physical Therapy – Las Vegas, NV
October-December 2012

- Clinical Internship
  - Examined and evaluated patients with musculoskeletal, neurological, and balance pathologies in an outpatient setting
  - Developed proficiency with manual techniques, mechanical traction, exercise prescriptions, modalities, and other interventions and protocols
  - Developed familiarity and proficiency with billing and charges for this setting

Summerlin Hospital – Las Vegas, NV
January-April 2013

- Clinical Internship
    - Examined and evaluated patients in an acute physical therapy setting with a wide range of pathologies
    - Participated and made decisions concerning recommended patient setting following acute care
    - Developed and applied appropriate interventions in this setting
    - Participated and performed wound care evaluations and treatments, including dressing changes, applying and managing wound vacs, and recommending dressings for RN staff
    - Developed proficiency with billing and charges for acute care and wound care

<u>Research Experience</u>

Mentored Group Research Project – University of Nevada, Las Vegas
In Progress

- Student Investigator – "The Effects of Foot Strike on Low Back Posture, Shock Attenuation, and Comfort."
    - Poster Presentation at CSM in San Diego, CA, January 2013
    - Accepted for publication in the journal *Medicine & Science in Sports & Exercise* for March 2013

<u>Professional Membership/Certifications</u>

APTA Membership since 2010

- Nevada Chapter

Healthcare Provider CPR Certified since 2011

- American Heart Association – Expires April 2013

<u>Continuing Education</u>

- **APTA Combined Sections Meeting – New Orleans, LA**
  February 2011
- **APTA Nevada Chapter Meetings – Las Vegas, NV**
  June 2010 – Present
- **APTA Combined Sections Meeting – San Diego, CA**
  January 2013