The Effects of Patellofemoral Taping on Patellofemoral Joint Alignment and Contact Area

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THE EFFECTS OF PATELLOFEMORAL TAPING ON PATELLOFEMORAL JOINT
ALIGNMENT AND CONTACT AREA

By

Ryan M. Epstein
Ron A. Garcia
Nicole R. Riley

A doctoral project submitted in partial fulfillment
of the requirements for the

Doctor of Physical Therapy

Department of Physical Therapy
School of Allied Health Sciences
Division of Health Sciences
The Graduate College

University of Nevada, Las Vegas
May 2016
This doctoral project prepared by

Ryan M. Epstein

Ron A. Garcia

Nicole R. Riley

entitled

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is approved in partial fulfillment of the requirements for the degree of

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Department of Physical Therapy

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ABSTRACT

Purpose/Hypothesis: It is widely accepted that patellofemoral pain (PFP) is the result of excessive stress between the retro-patellar surface and the femoral trochlea. Elevated patellofemoral joint (PFJ) stress may be associated with a reduction in PFJ contact area resulting from patellar malalignment (e.g., lateral displacement, lateral tilt, or patellar alta and/or quadriceps imbalance). McConnell and Kinesio taping techniques are commonly used to address PFP and improve PFJ alignment. It has been theorized that PFJ taping can alter the PFJ alignment which may increase the patella’s contact area within the femoral trochlea, thereby resulting in a reduction in PFP. To date, the effects of these 2 taping approaches on PFJ contact area and PFJ alignment have not yet been studied thoroughly. The primary purpose of this study was to use magnetic resonance imaging (MRI) to examine the effects of patellofemoral taping techniques on PFJ alignment and contact area in persons with PFP at 3 knee joint angles (0°, 20°, and 40°).

Number of Subjects: Fourteen female subjects with retropatellar pain and PFJ malalignment participated (age: 27.86 ± 5.95 years; weight: 72.15 ± 19.27 kg; height: 1.67 ± .08 m).

Methods: Each subject underwent a pre-taping magnetic resonance imaging (MRI) scan session and 2 MRI scan sessions after the application of the 2 taping techniques aiming to correct lateral patellar displacement. Subjects were asked to report their pain using an 11-point numeric rating scale (NRS) while stepping down from a 23-cm step, before and after tape was administered. During each scan session, subjects were loaded with 25% of body weight on their involved/more symptomatic leg at 0°, 20°, and 40° of knee flexion. The outcome measures included patellar lateral displacement (bisect-offset (BSO) index),
patellar mediolateral tilt (patellar tilt angle (PTA)), patellar position (Insall-Salvati ratio (ISR)), PFJ contact area, and NRS. PFJ alignment/contact area was compared among the 3 conditions (No tape, Kinesio, and McConnell) at 3 knee angles using a two-way ANOVA with repeated measures. Pain NRS was compared among the 3 conditions using Friedman test and post-hoc Wilcoxon signed-rank tests.

**Results:** The results of the two-way ANOVAs revealed that neither McConnell nor Kinesio taping had significant effects on BSO index ($p = 0.488$), PTA ($p = 0.558$), ISR ($p = 0.778$), and contact area ($p = 0.358$) across the 3 knee flexion angles. Knee flexion angle had a significant effect on BSO index ($p = 0.001$) and contact area ($p < 0.001$). The Friedman test revealed a significant difference in pain level among the 3 conditions. The post-hoc Wilcoxon signed-rank tests further demonstrated that there was a reduction in NRS during step-down test after the application of the Kinesio Taping technique ($p=.007$).

**Conclusions:** In a weight-bearing condition, our results did not support the premise that applications of PFJ taping using a medial correction technique can alter the PFJ contact area or alignment of the patella. The reduction in pain, following the application of the Kinesio Taping technique performed in this study supports the previous literature on the use of Kinesio Taping techniques for pain management, although the underlying mechanism for the reduction of pain is unclear.

**Key words:** Patellofemoral Pain, Kinesio Taping, McConnell Taping.
ACKNOWLEDGEMENTS

A UNLV Faculty Opportunity Award and a UNLVPT Student Opportunity Research Grant made this clinical trial possible. The authors would like to thank the Kinesio Taping Association for their contribution of Kinesio Tape® and scissors for use in our clinical trial.
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INTRODUCTION

Patellofemoral pain (PFP) is one of the most common disorders of the lower extremity seen in orthopedic clinics.\textsuperscript{1-4} It has been suggested that patellofemoral pain (PFP) is the result of increased patellofemoral joint (PFJ) stress, which is defined as the PFJ reaction force per unit area of contact of the patella against the femur.\textsuperscript{5} The mechanism leading to joint overloading is thought to be multifactorial. Specifically, elevated PFJ stress may be associated with 1) an increase in PFJ reaction force,\textsuperscript{6,7} and/or 2) a reduction in PFJ contact area resulting from patellar malalignment (e.g., lateral displacement, lateral tilt, or patellar alta)\textsuperscript{8} and/or quadriceps imbalance (e.g., insufficiency of vastus medialis oblique (VMO)).\textsuperscript{9}

To correct patellar malalignment, one common clinical intervention is to apply PFJ taping on persons with PFP prior to their participation in functional activities.\textsuperscript{10}

The most frequently used and studied taping method is the McConnell taping technique.\textsuperscript{11-14} This technique utilizes a rigid and highly adhesive tape, that is structurally supportive and when applied, has been suggested to alter lateral tilt, lateral displacement, and patella alta.\textsuperscript{15,16} McConnell taping methods have been found to be effective in altering patellofemoral symptoms,\textsuperscript{10,15,17} quadriceps activation pattern,\textsuperscript{12,18} and lower extremity biomechanics.\textsuperscript{16,19,20} Existing literature however, has revealed conflicting evidence with respect to the effects of McConnell taping techniques on PFJ alignment, likely due to different loading conditions (i.e., weight-bearing or non-weight-bearing) and/or knee angles being used in previous studies.\textsuperscript{11,13,14,21} In addition, the use of McConnell taping techniques to affect PFJ contact area have not yet been studied.

The Kinesio taping method is a relative new taping technique to the therapy community, introduced to the United States in the 1990s, and it appears to be an effective
tool for managing PFP. Kinesio Tape® is an elastic tape that can stretch to 130-140% of its resting length. It has been designed to increase proprioception by either inhibiting or facilitating muscle activity. Existing literature has demonstrated that the use of the Kinesio taping technique is effective in reducing pain, swelling, and relieving symptoms of PFP.

As Kinesio taping has been found to improve the VMO activation patterns, it has been suggested that a Kinesio taping method can potentially alter patella malalignment and increase PFJ contact area. However, there is little evidence to support this claim. The purpose of this study was to use magnetic resonance imaging (MRI) to examine the effects of PFJ taping techniques on PFJ alignment (i.e., patellar lateral displacement, patellar mediolateral tilt, and patellar height) and contact area in persons with PFP at 3 weight-bearing knee joint angles (0°, 20°, and 40°).
METHODS

SUBJECTS

Fourteen females with a diagnosis of PFP were recruited for this study (TABLE 1). Due to the higher incidence of PFJ pain among females and the potential biomechanical differences between sexes (i.e. larger Q-angle), only females were included in the study.\textsuperscript{26,27} Using a two-sided paired t-test with 95% power and α value of 0.05, the analysis estimated that 10 individuals would be needed. However, due to the novelty of this research 14 female participants were recruited. Prior to participation, all subjects were informed of the nature of the study and signed a consent form approved by the Institutional Review Board of the University of Nevada, Las Vegas (IRB#1406-4848).

A physical examination that assessed the source of the subjects’ pain and PFJ alignment was performed to examine subject eligibility. To be included in the study, subjects who reported PFP were screened to rule out concomitant sources of pain. If the source of pain was localized to the quadriceps tendon, patellar tendon, patella bursa, patella fat pad, tibiofemoral joint, or the lateral and medial joint line, the subject was disqualified from the study. Persons with PFP were also excluded from participation if they reported having any of the following: history of knee surgery, history of traumatic patellar dislocation, or implanted biological devices that could interact with the magnetic field. The second step of physical examination involved the measurement of PFJ alignment and a patellar compression test. Subject eligibility was confirmed if they demonstrated a positive patellar compression test and any of the following malalignment signs: a Q-angle greater than or equal to 15°, patellar lateral hypermobility (> or =10 mm), or a positive J-sign with quadriceps activation. The Q angle was measured using a goniometer while the subjects lying in supine, defined as the
angle between the line connecting the anterior superior iliac spine (ASIS) and the center of the patella and the line connecting the center of the patella and the tibial tuberosity.28

TABLE 1. Demographic information of the 14 participants

<table>
<thead>
<tr>
<th>Subjects with PFP (N = 14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Height (m)</td>
</tr>
<tr>
<td>Weight (kg)</td>
</tr>
<tr>
<td>Q angle (&gt; or = 15°)</td>
</tr>
<tr>
<td>J Sign</td>
</tr>
<tr>
<td>Lateral hypermobility (&gt; or =10 mm)</td>
</tr>
</tbody>
</table>

PROCEDURE

Each subject underwent a pre-taping MRI scan session (Control) and 2 MRI scan sessions immediately after the application of the taping technique (Kinesio or McConnell). The order of which taping method was applied first was randomized to reduce a bias resulting from the order of testing procedure. Prior to each MRI scan session, subjects’ pain was also assessed. All testing was performed on the painful side. For subjects who had bilateral symptoms, the more painful limb was tested.

TAPING TECHNIQUES

The taping techniques (Kinesio and McConnell) used in this study were aimed to correct the frontal plane malalignment (i.e., patellar lateral displacement) due to the fact that the majority of this cohort had an excessive Q angle (TABLE1) with an average value of...
22.0° ± 6.5°. Each taping technique was applied to the symptomatic knee in subjects who had unilateral pain or the more symptomatic knee for those who had bilateral symptoms.

**KINESIO TAPING TECHNIQUE**

The “Two Overlapping” technique, incorporating two Y-cut strips, was used in the current research (FIGURE 1). The first step was a VMO activation technique with a Y-cut strip. In this step, a 1-inch anchor, with no stretch, was placed on the VMO muscle belly with the participant’s knee in extension. With the participant placed in full knee flexion, the two tails were brought distally towards the medial patella outlining the medial and lateral borders of the VMO. These tails were laid down with minimal stretch of the tape. The second step involved taping another Y-cut strip across the patella to assist with lateral tracking. The subject’s knee was placed in 20° of knee flexion. The 1-2 inch anchor was applied with no stretch and laid down just lateral to the lateral border of the patella. The two tails were stretched to maximum length and placed over the superior and inferior borders, respectively, of the patella in a medial direction. The use of the maximum elongation to the tails is theoretically designed to address malalignment by unloading the tissues, allowing the patella to sit more centrally in the trochlear groove. One trained investigator (RE) performed this technique on all participants.
MCCONNELL TAPING TECHNIQUE

The technique aiming to correct lateral displacement of the patella (i.e. medial glide technique) was used in our study (FIGURE 2). With the knee placed in extension, cover roll was placed over the skin as a protective barrier. Then, Leukotape P was anchored at the mid-lateral border of the patella, pulled medially across the patella and secured over the medial hamstring tendons, while the patella was glided medially. Using this technique, the medial soft tissues were brought across the medial femoral condyle toward the patella to create a more secure fixation. One trained investigator (RG) performed this technique on all participants.
PAIN ASSESSMENT

Prior to the pre-taping MRI assessment and immediately after each taping technique was applied, subjects were asked to report their pain using an 11-point numeric rating scale (NRS) while stepping down from a 30 cm step, with the uninvolved leg (Figure 3). The NRS was chosen because it is simple to administer, and it is equally as sensitive as the visual analogue scale (VAS).\textsuperscript{31}
FIGURE 3: Participant completing step-down test from 30 cm step after a technique was applied.

MRI ACQUISITION

MRI scanning was performed on a 3.0 Tesla scanner (Titan Model MRT 3010, Software version 2.5xR001, Toshiba America Medical Systems, Inc., Tustin, CA) along with a 16-channel flex speeder medium coil (Neocoil, Pewaukee, WI). The subjects were placed on a custom built, non-ferromagnetic loading apparatus that resembled a leg press machine to simulate a weight-bearing condition for the participants’ involved leg (FIGURE 3). Each subject was weighed upon arrival and 25% of the person’s weight was loaded onto the apparatus using non-ferromagnetic weights. For each MRI scan session, images were acquired at 0°, 20°, and 40° of flexion, using a 3-D, fast spoiled gradient recalled echo (SPGR) sequence (axial plane, TR = 14.3 ms, TE = 3.6 ms, flip angle = 10°, matrix = 320 X
160, FOV = 160 X 160 mm, slice thickness = 1 mm, scan time = 1 minutes 45 seconds). The axial plane images were required for obtaining patellar lateral displacement, patellar mediolateral tilt, and contact area. The axial images were reconstructed in the sagittal plane for the purposes of quantifying of the patellar height.

FIGURE 4: Participant in weight bearing apparatus loaded with 25% of body weight.

DATA ANALYSIS

The outcome variables included patellar lateral displacement, patellar mediolateral tilt, patellar height, and contact area. The investigators were blinded to the conditions to limit bias during analyses of images. PFJ alignment and contact area were measured using ImageJ software (National Institutes of Health, Bethesda, MD, USA). Particularly, patellar lateral displacement was quantified using bisect-offset (BSO) index, which represents the percentage of the patellar width lateral to the deepest point of the trochlear groove (FIGURE 4A). Patellar mediolateral tilt was assessed using the patellar tilt angle (PTA), which is defined as the angle formed between the line connecting the widest points of the patella and a
line joining the posterior femoral condyles (FIGURE 4B). \(^{32}\) Patellar position in the sagittal plane was determined by dividing the length of the patellar tendon by the length of the patella (i.e., Insall-Salvati ratio: ISR) (FIGURE 4C). \(^{33}\) PFJ contact was defined as areas of patella and femur approximation in which no distinct separation could be found between the cartilage borders of the two joint surfaces (FIGURE 4D). \(^{34}\) Once contact contours were determined in all images, PFJ contact area was quantified by multiplying the length of contact lines and slice thickness. \(^{34}\)
FIGURE 5. (A) Measurement of patellar lateral displacement using bisect offset (BSO) index = \([\text{length}(ab) / \text{length}(ac)] \times 100\%\); (B) Measurement of patellar mediolateral tilt using patellar tilt angle (PTA); (C) Measurement of patellar height using Insall–Salvati ratio (ISR) = \([\text{length}(ef) / \text{length}(de)]\); (D) Measurement of PFJ contact area. In this figure, a and c represent the most lateral and medial points of the patella; d and e represent the highest and the lowest points of the patella.

RELIABILITY OF OUTCOME MEASURES

To establish intra-rater reliability of each outcome measure, the data evaluator performed repeated measurement of 5 subjects at 2 days (with 7 days apart). Intraclass correlation coefficients (ICCs) and standard errors of measurement (SEM) were used to assess the reliability of the investigator between day 1 and 2. For the measurements of BSO
index and PTA, the investigator demonstrated excellent measurement reliability values (ICC = 0.995 and 0.974) with low SEMs (0.044 % and 1.343˚). Excellent intra-rater reliability was also established in the measurement of ISR with ICC of 0.983 and SEM of 0.031. Additionally, the investigator showed excellent intra-rater reliability in the measurement of contact area (ICC = 0.978 and SEM ranging from 35.270 mm²).

**STATISTICAL ANALYSIS**

A within subject two-way ANOVA with repeated measures was used to compare each MRI variable between 3 knee flexion angles (i.e. 0°, 20°, 40°) and between 3 conditions (Control, Kinesio, and McConnell). All MRI variables did not violate sphericity based on obtainment of p>0.05 in the Mauchly’s test. If a significant angle-by-condition interaction or a significant main effect was found, post-hoc testing was employed (paired t-tests with a Bonferroni correction).

As the data of pain level (NRS) was not normally distributed in this cohort (p<0.05 in the Mauchly’s test), a Friedman test with post-hoc Wilcoxon Signed Ranks test was used to compare PFP among 3 conditions (Control, Kinesio, and McConnell). All statistical analyses were performed on SPSS 22.0 statistical software (International Business Machines Corp., Armonk, NY, USA) using a significance level of 0.05.
RESULTS

The results of the two-way ANOVAs revealed that neither McConnell nor Kinesio taping had significant effects on BSO index (p = 0.488; FIGURE 5A), PTA (p = 0.558; FIGURE 5B), ISR (p = 0.062; FIGURE 5C), and contact area (p = 0.358; FIGURE 5D). Knee flexion angle had a significant effect on BSO index (p = 0.001; FIGURE 5A). Post-hoc paired t-tests with Bonferroni correction further showed that the mean BSO index was significantly different between 0° and 20° (p = 0.015) and between 0° and 40° (p = 0.036). There was not a significant difference in BSO index between 20° and 40° (p = 0.362). Knee flexion angle did not have a significant effect on PTA (p = 0.299; FIGURE 4B) or ISR (p = 0.062; FIGURE 5C). Lastly, knee flexion angle had a significant effect on contact area (p < 0.001; FIGURE 5D). Post-hoc analyses demonstrated that the contact area increased as knee flexion angle increased from 0° to 40° (p < 0.001). There was no significant angle-by-condition interaction in BSO index, PTA, ISR, and contact area (p > 0.05).

A Friedman test was performed to examine the effects of taping on pain level reported on a NRS during a step down test (Control: 1.86 ± 1.79; Kinesio 1.21 ± 1.37, McConnell: 1.35 ± 1.39). The results showed a significant difference in pain level post taping (p = 0.03). A post-hoc Wilcoxon Signed Ranks test revealed that the Kinesio taping method was the only method that showed a significant decrease in pain scale levels during the step down test verses the control (p = 0.007; Fig. 9). No difference in pain was found between the Kinesio taping technique and the McConnell taping technique (p = .559).
FIGURE 6. (A) BSO index, (B) PTA, (C) ISR, and (D) contact area of the 3 conditions (No Tape, Kinesio, and McConnell) at 0°, 20°, and 40° of knee flexion. * indicates a significant difference from 0° of knee flexion and † indicates a significant difference from 20° of knee flexion using 2-way ANOVAs and post-hoc paired t-tests with a Bonferroni correction.

FIGURE 7. Pain during step down in 3 conditions (Control, Kinesio, and McConnell).
DISCUSSION

To the authors’ knowledge this is the first research study assessing the mechanical effects of a Kinesio taping technique on PFJ alignment/contact area and those of a McConnell taping technique on PFJ contact area. The primary purpose of the current study was to quantify the effects of 2 different PFJ taping techniques (McConnell and Kinesio) on PFJ alignment and contact area in individuals with PFP and patellar malalignment. Our data did not support our hypothesis that PFJ taping would alter PFJ alignment and contact area.

Our study demonstrated that increasing knee flexion angle statistically increases PFJ contact area and decreases patellar lateral displacement (BSO index). The findings regarding contact area are consistent with the PFJ biomechanics described by Hungerford and Barry. They reported that PFJ contact area increases with increasing flexion up to 80° of knee flexion. Our findings of patellar lateral displacement are supported by Souza et al. who also demonstrated that the patella translates laterally as the knee extends from ~20° to 0° of knee flexion during weight-bearing.

We believe that the weight-bearing status and knee flexion angle play a critical role in determining the mechanical effects of McConnell taping methods. For instance, our findings agreed with Derasari et al.’s findings that the McConnell medial glide taping method had no effect on patellar mediolateral tilt and patellar lateral displacement from 0° to 40° of knee flexion during weight-bearing. In a non-weight-bearing condition, Worrell and colleagues indicated that the McConnell medial glide taping technique increased medial displacement of the patella at 0° of knee flexion. However, they reported that the same taping method did not change patellar lateral displacement from 10° to 45° of knee flexion. Although Pfeiffer et al. observed an immediate medialization effect of the patella with the application of a
McConnell medial glide technique from 0° to 36° of non-weight-bearing knee flexion, such an effect was not sustained following a bout of agility exercises. With respect to the sagittal plane alignment, Derasari et al. suggested that the McConnell medial glide taping technique altered patellar height, which did not agree with our findings regarding ISR. The disparity between our findings and Derasari et al.’s may be related to the different loading conditions utilized in the 2 studies. We examined the effects of PFJ taping at 3 static weight-bearing knee flexion angles while Derasari et al. examined subjects’ PFJ kinematics during a dynamic weight-bearing condition.

The current study did not demonstrate statistically significant differences in PFJ alignment or contact area with the application of a Kinesio taping technique. One possible explanation for the Kinesio taping technique failing to cause a mechanical effect when applied to the PFJ may be that the Kinesio taping technique utilizes a tape that has the ability to stretch 130-140% beyond its relaxed length. This property may reduce the tape’s ability to provide a mechanical effect on the PFJ. Additionally, given that we did not assess the electromyographic activity of the VMO muscle with the application of the Kinesio taping technique, the assumption that the Kinesio taping can facilitate the activation of VMO remains unclear.

In the current study, individuals with PFP reported a statistically significant reduction in self-reported pain on a NRS during a step down test immediately following the application of the tape. These findings are consistent with Wilson et al.’s results that medially directed taping produces immediate pain relief. Stradford and Spadoni determine that a 3-point change is required to meet the minimal detectable change on the NRS, which was not met in our study. This may be due to our patients having minimal to no pain on the day of testing.
with an average of 1.86 ± 1.79 reported pain prior to the application of tape. Based on our findings it is unlikely for the reduced reported pain to be the effect of a mechanical change cause by the taping technique. The reason for this occurrence may be a result of neural inhibition via Melzack and Wall’s gating mechanism\textsuperscript{39}. However, future study is required to examine this mechanism.

With respect to the findings of the current study, several limitations must be considered. First, our study only included young female subjects that could limit the generalization of our results to other populations with PFP. Another limitation is that only partial blinding of the researchers could be achieved in our approach. While all labeling was removed from the MRI slides, skin folds and soft tissue compression resulting from PFJ taping was visible. However, the evaluators were unable to distinguish the two taping methods on MRI. Additionally, we only investigated one technique of various Kinesio/McConnell techniques proposed to address PFJ malalignment. Future research may choose to expand on our research methodology and analyze the effects of different taping techniques and determine their effects on PFJ alignment and contact area.
CONCLUSION

Our data revealed that the taping techniques used in this study did not significantly change PFJ contact area or PFJ alignment during weight-bearing. Based on our findings, we cannot support the application of PFJ taping using a medial correction technique with the intent to alter the PFJ contact area or alignment of the patella.
REFERENCES

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  - Certified Strength and Conditioning Specialist (CSCS)
- Healthcare Provider CPR and AED Certification since 2014
  - American Heart Association
- APTA Member since 2013
  - Research Section

REFEREED ARTICLES:

- Epstein R, Garcia R, Riley N, Lee SP, Turner C, Ho KY. The effects of patellofemoral taping on patellofemoral joint alignment and contact area. In Preparation

PROFESSIONAL PRESENTATIONS:


- Epstein R, Garcia R, Riley N, Lee SP, Turner C, Ho KY. The effects of patellofemoral taping on patellofemoral joint alignment and contact area. 2016 APTA Combined Sections Meeting, Anaheim, CA, USA (submitted)
Objective

I believe the profession of physical therapy is strengthened through well-educated practitioners and by communication and becoming involved in community. My professional goals follow this belief and I intend to shape my career as a physical therapist around them.

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Candidate for Doctorate of Physical Therapy GPA: 3.87/4.0
University of Nevada, Las Vegas (UNLV) Las Vegas, NV
Graduation date: Spring 2016

Graduate Research Project
Research Advisor - Dr. Kai-Yu Ho, MSPT, Ph.D.
The purpose of this study is to use magnetic resonance imaging (MRI) to quantify the effects of knee angle and patellofemoral taping on PFJ alignment and contact area in PFP patients with patellar malalignment.

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- McKenzie Mechanical Diagnosis and Treatment: Part A Completed
- Functional Capacity Evaluator using Valpar's Joule System Completed
- AHA Certified BLS for Healthcare Provider (CPR and AED) 1/14-present

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- Coordinate daily operations with the physical therapy team for seamless patient care.

Refereed Articles
- Epstein R, Garcia R, Riley N, Lee SP, Turner C, Ho KY. The effects of patellofemoral taping on patellofemoral joint alignment and contact area. In Preparation

Peer Reviewed Scientific and Professional Presentations


Epstein R, Garcia R, Riley N, Lee SP, Turner C, Ho KY. The effects of patellofemoral taping on patellofemoral joint alignment and contact area. 2016 APTA Combined Sections Meeting, Anaheim, CA, USA (submitted)
EDUCATION

Bachelors of Science in Kinesiology
University of Nevada, Las Vegas (UNLV) Las Vegas, NV

Candidate for Doctorate of Physical Therapy GPA: 3.6/4.0
University of Nevada, Las Vegas (UNLV) Las Vegas, NV
Graduation date: Spring 2016

Graduate Research Project
Research Advisor - Dr. Kai-Yu Ho, MSPT, Ph.D.
The purpose of this study is to use magnetic resonance imaging (MRI) to quantify the effects of knee angle and patellofemoral taping on PFJ alignment and contact area in PFP patients with patellar malalignment.

Continuing Education
- APTA SoWH Pelvic Health Physical Therapy Level 1 Completed

PROFESSIONAL EXPERIENCE

Centennial Hills Hospital Las Vegas, NV 1/11-4/1/2016
Student Physical Therapist
- Outpatient women’s health, lymphedema therapy, and orthopedic clinical rotation

Spring Valley Hospital Las Vegas, NV 10/5-12/16/2015
Student Physical Therapist
- Acute care clinical rotation

Complex Care Hospital at Tenaya Las Vegas, NV 7/13-9/25/2015
Student Physical Therapist
- Inpatient rehabilitation clinical rotation
- Included wound care management and rounds with a physician twice a week

VA Southern Nevada Healthcare System Las Vegas, NV 06/30-8/8/2014
Student Physical Therapist
- Outpatient orthopedic and vestibular clinical rotation

Matt Smith Physical Therapy Las Vegas, NV 06/2012-5/2013
Physical Therapy Aide
- Assisted in carrying out the rehabilitation of patients with orthopedic injuries based on the supervising physical therapist’s plan of care
PROFESSIONAL MEMBERSHIPS/CERTIFICATIONS

- Certified BLS for Healthcare Provider (CPR and AED) since 2014
  - American Heart Association
- APTA Member since 2013
  - Nevada and California chapters
  - Women’s Health Section since 2016

REFFERED ARTICLES

- Epstein R, Garcia R, Riley N, Lee SP, Turner C, Ho KY. The effects of patellofemoral taping on patellofemoral joint alignment and contact area. *In Preparation*

PEER REVIEWED SCIENTIFIC & PROFESSIONAL PRESENTATIONS


Epstein R, Garcia R, Riley N, Lee SP, Turner C, Ho KY. The effects of patellofemoral taping on patellofemoral joint alignment and contact area. *2016 APTA Combined Sections Meeting*, Anaheim, CA, USA (submitted)