



**PASIG** **PERFORMING ARTS**  
SPECIAL INTEREST GROUP



**PASIG MONTHLY CITATION BLAST: No. 110**

**November 2015**

Dear Performing Arts SIG members:

The PASIG has been busy! We have a lot of updates, please see below:

**Fellowship Taskforce Performing Arts Physical Therapy Analysis Survey:**

An assembled team of members of the Orthopaedic Section, APTA, Performing Arts Special Interest Group (PASIG) and identified practitioners in the sub-specialty field of performing arts physical therapy, are working to revalidate the 2004 *Description of Specialized Clinical Practice (DSCP) in Physical Therapy for Performing Artists*.

**By completing this survey you will be helping to revalidate the unique attributes that need to be taken into consideration for treating the performing artist population. You will be asked to assess each competency/skill/attribute in three ways: 1.) Frequency of use, 2.) Importance of skill, and 3.) Level of Mastery required. Demographic information, such as years of practice and practice setting, will also be requested in order to assess the generalizability of the survey responses across the sub-specialty field. The survey is estimated to take *approximately 30 minutes to complete. Once you exit the survey, you will not be able to re-enter at a later time.***

**Please click here to access this survey:**

<https://www.surveymonkey.com/r/6QKMWBN>

The intent of this revalidation process is three-fold: 1.) To provide current practice guidelines for practitioners in the sub-specialty field of Performing Arts Physical Therapy, 2.) To transform the 2004 DSCP to a Description of Advanced Specialized Practice (DASP), a document of skills, attributes, and competencies appropriate for

fellowship level curriculum and expertise, and 3.) To create a Description of Fellowship Practice (DFP) in Performing Arts Physical Therapy for fellowship curriculum development.

Thank you in advance for participating in this survey. We recognize that your time is valuable.

**CSM 2016:** PASIG will offer a preconference course, “Dynamic Neuromuscular Stabilization: Assessment & Management of Performing Artists,” given by Clare Frank, PT, DPT, OCS, FAAOMPT and Annette Karim, PT, DPT, OCS, FAAOMPT, on Wednesday, February 17, 2016, 8:00 AM- 5:00 PM. We will also have our regular PASIG programming, “Life on Broadway: Care of the Professional Theatrical Performer” by Jennifer Green, PT, MS, CMT on Friday, February 19<sup>th</sup>, after our annual business meeting: time TBA.

**Call for 2016 PASIG committee chairs!** We have several positions available. We have a lot of fun, and a little effort goes a long way, as we move forward in the areas of education, research, screening, membership, PR, and scholarship. Please consider nominating yourself and a colleague in order to become more involved with the PASIG. For more information, contact Liz Chesarek: [echesarek@gmail.com](mailto:echesarek@gmail.com)

A **PASIG student scholarship** is available for performing arts poster and platform presentations at CSM 2016! Contact Anna Saunders, PASIG student scholarship chair, with your abstract: [annarosemary@gmail.com](mailto:annarosemary@gmail.com)

**Call for case reports:** If you have a brief, clinically-focused case report on a performing arts PT patient, or a clinical commentary, please contact Annette Karim to submit your writing for the next Orthopaedic Physical Therapy Practice Magazine: [neoluvsonlyme@aol.com](mailto:neoluvsonlyme@aol.com)

**Tweet Tweet! We have a Twitter page!**

<https://twitter.com/PT4Performers>

Post your articles and info on your site, let's get connected!

**Check out the Orthopaedic section Facebook page**, where you can find and post PASIG info: <https://www.facebook.com/pages/APTA-Orthopaedic-Section/121020534595362>

**Below is a list of the PASIG leadership. Please consult this list regarding contact info:**

Annette Karim, President	2014-2017	<a href="mailto:neoluvsonlyme@aol.com">neoluvsonlyme@aol.com</a>
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Andrea N. Lasner, Nominating Committee	2015-2018	<a href="mailto:alasner1@jhmi.edu">alasner1@jhmi.edu</a>

**WE NEED MORE CONTRIBUTORS TO OUR MONTHLY CITATION BLASTS!!!!**

Past Monthly citation blasts are available, with citations and EndNote file, listed on the website:  
[http://www.orthopt.org/content/special\\_interest\\_groups/performing\\_arts/citations\\_endnotes](http://www.orthopt.org/content/special_interest_groups/performing_arts/citations_endnotes)

**TOPICS THAT HAVE BEEN COVERED RECENTLY INCLUDE:**

*Stress fractures of the foot and ankle*  
*Dry needling*  
*Dynamic Warm Up and Stretching*  
*Platelet Rich Plasma Injections*

*Back Pain in Dancers*  
*Hallux Valgus in Dancers*  
*Posterior ankle impingement*  
*TMD in Musicians*  
*Concussions*

*Bone Mineral Density in Dancers*  
*Serratus Anterior Strengthening for Dancers Focal Dystonia*

**If you are interested in contributing by writing a citation blast, contact us,**

**Brooke Winder:** [BrookeRwinder@gmail.com](mailto:BrookeRwinder@gmail.com)

**Laura Reising:** [lbreising@gmail.com](mailto:lbreising@gmail.com)

Best regards,

*Laura*

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**PERFORMING ARTS CONTINUING EDUCATION, CONFERENCES, AND  
RESOURCES**

Musician Health Series, Janice Ying, PT, DPT, OCS

Glendale Adventist Therapy and Wellness Center, Los Angeles area (Eagle Rock), CA

<http://www.musicianshealthcorner.com/>

[Healthy Musician Series - Overuse](#)

Orthopaedic Section Independent Study Course. *20.3 Physical Therapy for the  
Performing Artist.*

Monographs are available for:

- Figure Skating (J. Flug, J. Schneider, E. Greenberg),
  - Artistic Gymnastics (A. Hunter-Giordano, Pongetti-Angeletti, S. Voelker, TJ Manal),
- and
- Instrumentalist Musicians (J. Dommerholt, B. Collier).

Contact: Orthopaedic Section at: [www.orthopt.org](http://www.orthopt.org)

Orthopaedic Section-American Physical Therapy Association,  
Performing Arts SIG

[http://www.orthopt.org/content/special\\_interest\\_groups/performing\\_arts](http://www.orthopt.org/content/special_interest_groups/performing_arts)

Performing Arts Citations and Endnotes

[http://www.orthopt.org/content/special\\_interest\\_groups/performing\\_arts/citations\\_endnotes](http://www.orthopt.org/content/special_interest_groups/performing_arts/citations_endnotes)

ADAM Center

<http://www.adamcenter.net/>

Publications:

<http://www.adamcenter.net/#!vstc0=publications>

Conference abstracts:

<http://www.adamcenter.net/#!vstc0=conferences>

Dance USA

<http://www.danceusa.org/>

Research resources:

<http://www.danceusa.org/researchresources>

Professional Dancer Annual Post-Hire Health Screen:

<http://www.danceusa.org/dancerhealth>

Dancer Wellness Project

<http://www.dancerwellnessproject.com/>

Becoming an affiliate:

<http://www.dancerwellnessproject.com/Information/BecomeAffiliate.aspx>

Harkness Center for Dance Injuries, Hospital for Joint Diseases

<http://hjd.med.nyu.edu/harkness/>

Continuing education:

<http://hjd.med.nyu.edu/harkness/education/healthcare-professionals/continuing-education-courses-cme-and-ceu>

Resource papers:

<http://hjd.med.nyu.edu/harkness/dance-medicine-resources/resource-papers-and-forms>

Links:

<http://hjd.med.nyu.edu/harkness/dance-medicine-resources/links>

Informative list of common dance injuries:

<http://hjd.med.nyu.edu/harkness/patients/common-dance-injuries>

Research publications:

<http://hjd.med.nyu.edu/harkness/research/research-publications>

International Association for Dance Medicine and Science (IADMS)

<http://www.iadms.org/>

Resource papers:

<http://www.iadms.org/displaycommon.cfm?an=1&subarticlenbr=186>

Links:

<http://www.iadms.org/displaycommon.cfm?an=5>

Medicine, arts medicine, and arts education organization links:

<http://www.iadms.org/displaycommon.cfm?an=1&subarticlenbr=5>

Publications:

<http://www.iadms.org/displaycommon.cfm?an=3>

Performing Arts Medicine Association (PAMA)

<http://www.artsmed.org/>

<http://www.artsmed.org/symposium.html>

Interactive bibliography site:

<http://www.artsmed.org/bibliography.html>

Related links:

<http://www.artsmed.org/relatedlinks.html>

Member publications:

<http://artsmed.org/publications.html>

***(Educators, researchers, and clinicians, please continue to email your conference and continuing education information to include in future blasts)***

## **Pilates**

The pilates exercise method has been popular with performing artists since it was brought to the US by Joseph Pilates in 1926. Performing artists commonly use pilates exercises to supplement regular training and as a part of injury rehabilitation. Pilates exercises are done on the mat and on various pieces of equipment (including the chair, ladder barrel, reformer, and trapeze table). Pilates exercises are performed with the goal of improving strength, posture, flexibility, breathing, mind-body awareness, balance, control, and efficient movement.

Although there has been an increase in the research done on pilates since the last citation e-blast on the topic in 2010, there is still very limited research specific to performing artists. The greatest amount of research to date has investigated pilates training in adult women and pilates training for chronic low back pain. Limited research is also available regarding the effects of pilates on postmenopausal women, elderly women (>60 y/o), rehabilitation of partial ACL injuries, juvenile idiopathic arthritis, women's health issues, and core muscle activity.

The following is an update of published articles between 2011 and 2015 on: 1) pilates and low back pain, 2) pilates and partial ACL injury rehabilitation, and 3) the effects of pilates on healthy adult individuals. These topics were selected from the current research on pilates as they were felt to be most relevant to the greatest percentage of performing artists.

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*Board Certified Clinical Specialist in Orthopedics and Sports*  
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## **PILATES AND LOW BACK PAIN**

**Alves de Araujo ME, Bezerra da Silva E, Bragade MD, Cader SA, Shiguemi I Salgado A, Dantas EH. The effectiveness of the Pilates method: reducing the degree of non-structural scoliosis, and improving flexibility and pain in female college students. *J Bodyw Mov Ther.* 2012 Apr;16(2):191-8.**

**OBJECTIVE:** To evaluate the effectiveness of Pilates with regard to the degree of scoliosis, flexibility and pain.

**METHOD:** The study included 31 female students divided into two groups: a control group (CG = 11), which had no therapeutic intervention, and an experimental group (EG = 20), which underwent Pilates-based therapy. We used radiological goniometry measurements to assess the degree of scoliosis, standard goniometry measurements to determine the degree of flexibility and the scale of perceived pain using the Borg CR 10 to quantify the level of pain.

**RESULTS:** The independent t test of the Cobb angle ( $t = -2.317$ ,  $p = 0.028$ ), range of motion of trunk flexion ( $t = 3.088$ ,  $p = 0.004$ ) and pain ( $t = -2.478$ ,  $p = 0.019$ ) showed significant differences between the groups, with best values in the Pilates group. The dependent t test detected a significant decrease in the Cobb angle ( $\Delta\% = 38\%$ ,  $t = 6.115$ ,  $p = 0.0001$ ), a significant increase in trunk flexion ( $\Delta\% = 80\%$ ,  $t = -7.977$ ,  $p = 0.0001$ ) and a significant reduction in pain ( $\Delta\% = 60\%$ ,  $t = 7.102$ ,  $p = 0.0001$ ) in the EG. No significant difference in Cobb angle ( $t = 0.430$ ,  $p = 0.676$ ), trunk flexion, ( $t = 0.938$ ,  $p = 0.371$ ) or pain ( $t = 0.896$ ,  $p = 0.391$ ) was found for the CG.

**CONCLUSION:** The Pilates group was better than the control group. The Pilates method showed a reduction in the degree of non-structural scoliosis, increased flexibility and decreased pain.

**da Luz MA, Costa LO, Fuhro FF, Manzoni AC, de Oliveira NT, Cabral CM. *Phys Ther.* 2014; 94(5):623-31. Effectiveness of mat Pilates or equipment-based Pilates in patients with chronic non-specific low back pain: a protocol of a randomised controlled trial.**

**BACKGROUND:** The Pilates method has been widely used to treat patients with chronic low back pain. Pilates exercises can be performed in 2 ways: by using specific equipment or without it (also known as mat Pilates). There are no studies, however, that have compared the effectiveness of mat Pilates

with that of equipment-based Pilates.

**OBJECTIVE:** The aim of this study was to compare the effectiveness of mat Pilates and equipment-based Pilates in patients with chronic nonspecific low back pain.

**DESIGN:** A 2-arm randomized controlled trial with a blinded assessor was conducted.

**SETTING:** The study was conducted at a private physical therapy clinic in Brazil.

**PATIENTS:** Eighty-six patients with chronic nonspecific low back pain participated.

**INTERVENTION:** The patients were randomly allocated to 1 of 2 groups: a mat Pilates group (n=43) and an equipment-based Pilates group (n=43). The participants in both groups attended 12 Pilates sessions over a period of 6 weeks.

**MEASUREMENTS:** The primary outcomes were pain intensity and disability. The secondary outcomes were global perceived effect, patient's specific disability, and kinesiophobia. A blinded assessor evaluated the outcomes at baseline and 6 weeks and 6 months after randomization.

**RESULTS:** After 6 months, there was a statistically significant difference for disability (mean difference=3.0 points, 95% confidence interval [CI]=0.6 to 5.4), specific disability (mean difference=-1.1 points, 95% CI=-2.0 to -0.1), and kinesiophobia (mean difference=4.9 points, 95% CI=1.6 to 8.2) in favor of equipment-based Pilates. No differences were found for the remaining outcomes.

**CONCLUSIONS:** Equipment-based Pilates was superior to mat Pilates in the 6-month follow-up for the outcomes of disability and kinesiophobia. These benefits were not observed for pain intensity and global perceived effect in patients with chronic nonspecific low back pain.

**Lee CW, Hyun J, Kim SG. Influence of pilates mat and apparatus exercises on pain and balance of businesswomen with chronic low back pain. *J Phys Ther Sci.* 2014;26(4):475-7.**

**PURPOSE:** The purpose of this study was to examine the influence of mat Pilates and apparatus Pilates on pain and static balance of businesswomen with chronic back pain.

**SUBJECTS AND METHODS:** Participants were randomly allocated to Pilates mat exercises (PME) or Pilates apparatus exercise (PAE), and performed the appropriate Pilates exercises 3 days per week for 8 weeks. In order to measure the improvement in the participants' static balance ability as a result of the exercise, the sway length and sway velocity of the subjects were measured before and after the experiment while the subjects stood on a Balance Performance Monitor (BPM) facing the front wall for 30 seconds with their eyes open. The visual analogue scale (VAS) was used to measure the degree of pain.



RESULTS: The VAS score, sway length, and sway velocity of both groups decreased significantly after the experiment, but the PME group showed a greater decrease than the PAE group.

CONCLUSION: PME showed greater improvement in pain level and balance compared with PAE in this research. Since the subjects of this study were patients with low back pain, PME is assumed to have been more suitable and effective because it uses body weight to strengthen core muscles rather than heavier apparatuses as in PAE.

**Lim EC, Poh RL, Low AY, Wong WP. Effects of Pilates-based exercises on pain and disability in individuals with persistent nonspecific low back pain: a systematic review with meta-analysis. *J Orthop Sports Phys Ther*. 2011 Feb;41(2):70-80. doi: 10.2519/jospt.2011.3393. Epub 2010 Oct 22.**

STUDY DESIGN: A systematic review with meta-analysis.

OBJECTIVES: To compare pain and disability in individuals with persistent nonspecific low back pain who were treated with Pilates exercises compared to minimal or other interventions.

METHODS: Searches of Medline, CINAHL, Embase, Cochrane library, PEDro, and ProQuest Dissertations and Thesis databases were conducted.

Randomized controlled trials (RCTs) were selected and reviewed if they compared pain and disability in individuals with persistent nonspecific low back pain who were treated with Pilates exercises compared to other treatment approaches. Quality of the trials was evaluated. Data for pain and disability scores were extracted. Narrative synthesis plus meta-analyses were performed, with either a fixed-effects or random-effects model, standardized mean differences (SMDs), and tests for heterogeneity.

RESULTS: Seven RCTs were identified and included in the meta-analyses. Data pooling was performed using RevMan 5. When compared to minimal intervention, Pilates-based exercise provided superior pain relief (pooled SMD, -2.72; 95% CI: -5.33, -0.11;  $P = .04$ ) but the pooled disability scores were not significantly different (pooled SMD, -0.74; 95% CI: -1.81, 0.33;  $P = .17$ ). No significant differences were found when comparing Pilates-based exercise to other forms of exercise for pain (pooled SMD, 0.03; 95% CI: -0.52, 0.58;  $P = .92$ ) or disability scores (pooled SMD, -0.41; 95% CI: -0.96, 0.14;  $P = .14$ ).

CONCLUSION: Pilates-based exercises are superior to minimal intervention for pain relief. Existing evidence does not establish superiority of Pilates-based exercise to other forms of exercise to reduce pain and disability for patients with persistent nonspecific low back pain. However, the relatively low quality of existing studies and the heterogeneity of pooled studies in this systematic review combine to suggest that these results should be interpreted with caution.

LEVEL OF EVIDENCE: Therapy, level 1a.

**Miyamoto GC, Costa LO, Cabral CM. Efficacy of the Pilates method for pain and disability in patients with chronic nonspecific low back pain: a systematic review with meta-analysis. *Braz J Phys Ther.* 2013; 17(6):517-32.**

**OBJECTIVE:** To systematically review the available evidence on the efficacy of the Pilates method in patients with chronic nonspecific low back pain.

**METHOD:** Searches were performed in MEDLINE, EMBASE, PEDro, SciELO, LILACS, CINAHL and CENTRAL in March 2013. Randomized controlled trials that tested the effectiveness of the Pilates method (against a nontreatment group, minimal intervention or other types of interventions) in adults with chronic low back pain were included regardless the language of publication. The outcome data were extracted from the eligible studies and were combined using a meta-analysis approach.

**RESULTS:** The searches identified a total of 1,545 articles. From these, eight trials were considered eligible, and seven trials were combined in the meta-analysis. The comparison groups were as follows: Pilates versus other types of exercises (n=2 trials), and Pilates versus no treatment group or minimal intervention (n=4 trials) for short term pain; Pilates versus minimal intervention for short-term disability (n=4). We determined that Pilates was not better than other types of exercises for reducing pain intensity. However, Pilates was better than a minimal intervention for reducing short-term pain and disability (pain: pooled mean difference=1.6 points; 95% CI 1.4 to 1.8; disability: pooled mean difference=5.2 points; 95% CI 4.3 to 6.1).

**CONCLUSIONS:** Pilates was better than a minimal intervention for reducing pain and disability in patients with chronic low back pain. Pilates was not better than other types of exercise for short-term pain reduction.

**Natour J, Cazotti LA, Ribeiro LH, Baptista AS, Jones A. Pilates improves pain, function and quality of life in patients with chronic low back pain: a randomized controlled trial. *Clin Rehabil.* 2015; 29(1):59-68.**

**OBJECTIVE:** To assess the effectiveness of pilates method on patients with chronic non-specific low back pain (LBP).

**METHOD:** A randomized controlled trial was carried out in sixty patients with a diagnosis of chronic non-specific LBP. Patients were randomly assigned to one of two groups: Experimental Group (EG) that maintained medication treatment with use of NSAID and underwent treatment with the pilates method and Control Group (CG) that continue medication treatment with use of NSAID and did not undergo any other intervention. A blinded assessor performed all evaluations at baseline (T0), after 45, 90, and 180 days (T45, T90 and T180) for: pain (VAS), function (Roland Morris questionnaire), quality of life (SF-36), satisfaction with treatment (Likert scale), flexibility (sit and reach test) and NSAID intake.

**RESULTS:** The groups were homogeneous at baseline. Statistical differences favoring the EG were found with regard to pain ( $P < 0.001$ ), function ( $P < 0.001$ ) and the quality of life domains of functional capacity ( $P < 0.046$ ), pain

( $P < 0.010$ ) and vitality ( $P < 0.029$ ). Statistical differences were also found between groups regarding the use of pain medication at T45, T90 and T180 ( $P < 0.010$ ), with the EG taking fewer NSAIDs than the CG.

**CONCLUSIONS:** The pilates method can be used by patients with LBP to improve pain, function and aspects related to quality of life (functional capacity, pain and vitality). Moreover, this method has no harmful effects on such patients.

**Patti A, Bianco A, Paoli A, Messina G, Montalto MA, Bellafiore M, Battaglia G, Iovane A, Palma A. Effects of Pilates exercise programs in people with chronic low back pain: a systematic review. *Medicine*. 2015; 94(4): e383.**

The Pilates method has recently become a fast-growing popular way of exercise recommended for healthy individuals and those engaged in rehabilitation. Several published studies have examined the effects of Pilates method in people with chronic low back pain (LBP). The objective of this study is to describe and provide an extensive overview of the scientific literature comparing the effectiveness of the Pilates method on pain and disability in patients with chronic nonspecific LBP. The study is based on the data from the following sources: MEDLINE-NLM, MEDLINE-EBSCO, Scopus Elsevier, Cochrane, DOAJ, SciELO, and PLOS ONE. Original articles and systematic reviews of adults with chronic nonspecific LBP that evaluated pain and/or disability were included in this study; studies in which the primary treatment was based on Pilates method exercises compared with no treatment, minimal intervention, other types of intervention, or other types of exercises. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were adopted. The literature search included 7 electronic databases and the reference list of relevant systematic reviews and original articles to July 2014. Two independent investigators conducted the literature search and performed the synthesis as follows: Study Design; Sample (n); Disability measure; Intervention; and Main results. The searches identified a total of 128 articles. From these, 29 were considered eligible and were included in the analysis. The items were stratified as follows: Pilates method versus other kind of exercises (n = 6 trials) and Pilates method versus no treatment group or minimal intervention for short-term pain (n = 9 trials); the therapeutic effect of the Pilates method in randomized cohorts (n = 5); and analysis of reviews (n = 9). We found that there is a dearth of studies that clearly demonstrates the efficacy of a specific Pilates exercise program over another in the treatment of chronic pain. However, the consensus in the field suggests that Pilates method is more effective than minimal physical exercise intervention in reducing pain. These conclusions need to be supported by other proper investigations.

**Pereira LM, Obara K, Dias JM, Menacho MO, Guariglia DA, Schiavoni D, Pereira HM, Cardoso JR. Comparing the Pilates method with no exercise or lumbar stabilization for pain and functionality in patients with chronic low back pain: systematic review and meta-analysis. *Clin Rehabil.* 2012 Jan;26(1):10-20.**

**OBJECTIVE:** To perform a systematic review with meta-analyses that evaluates the effectiveness of the Pilates method on the pain and functionality outcome in adults with non-specific chronic low back pain.

**DATA SOURCES:** The search was performed in the following databases: Medline, Embase, AMED, Cinahl, Lilacs, Scielo, SportDiscus, ProQuest, Web of Science, PEDro, Academic Search Premier and the Cochrane Central Register of Controlled Trials from 1950 to 2011; the following keywords were used: 'Pilates', 'Pilates-based', 'back exercises', 'exercise therapy', 'low back pain', 'back pain' and 'backache'.

**REVIEW METHODS:** The inclusion criteria were studies that assessed the effects of the Pilates method on patients with chronic low back pain.

**RESULTS:** Five studies met the inclusion criteria. The total number of patients was 71 in the Pilates group and 68 in the control group. Pilates exercise did not improve functionality (standardized mean difference (SMD) = -1.34; 95% confidence interval (CI) -2.80, 0.11; P = 0.07) or pain between Pilates and control groups (SMD = -1.99; 95% CI -4.35, 0.37; P = 0.10). Pilates and lumbar stabilization exercises presented no significant difference in functionality (mean difference (MD) = -0.31; 95% CI -1.02, 0.40; P = 0.39) or pain (MD = -0.31; 95% CI -1.02, 0.40; P = 0.39).

**CONCLUSION:** The Pilates method did not improve functionality and pain in patients who have low back pain when compared with control and lumbar stabilization exercise groups.

**Stolze LR, Allison, SC, Childs JD. Derivation of a preliminary clinical prediction rule for identifying a subgroup of patients with low back pain likely to benefit from Pilates-based exercise. *J Orthop Sports Phys Ther.* 2012; 42(5):425-36.**

**STUDY DESIGN:** Prospective cohort study.

**OBJECTIVE:** To derive a preliminary clinical prediction rule for identifying a subgroup of patients with low back pain (LBP) likely to benefit from Pilates-based exercise.

**BACKGROUND:** Pilates-based exercise has been shown to be effective for patients with LBP. However, no previous work has characterized patient attributes for those most likely to have a successful outcome from treatment.

**METHODS:** Ninety-six individuals with nonspecific LBP participated in the study. Treatment response was categorized based on changes in the Oswestry Disability Questionnaire scores after 8 weeks. An improvement of 50% or greater was categorized as achieving a successful outcome. Thirty-seven variables measured at baseline were analyzed with univariate and multivariate methods to derive a clinical prediction rule for successful outcome with Pilates exercise. Accuracy statistics, receiver-operator curves,

and regression analyses were used to determine the association between standardized examination variables and treatment response status.

**RESULTS:** Ninety-five of 96 participants completed the study, with 51 (53.7%) achieving a successful outcome. A preliminary clinical prediction rule with 5 variables was identified: total trunk flexion range of motion of 70° or less, duration of current symptoms of 6 months or less, no leg symptoms in the last week, body mass index of 25 kg/m<sup>2</sup> or greater, and left or right hip average rotation range of motion of 25° or greater. If 3 or more of the 5 attributes were present (positive likelihood ratio, 10.64), the probability of experiencing a successful outcome increased from 54% to 93%.

**CONCLUSION:** These data provide preliminary evidence to suggest that the response to Pilates-based exercise in patients with LBP can be predicted from variables collected from the clinical examination. If subsequently validated in a randomized clinical trial, this prediction rule may be useful to improve clinical decision making in determining which patients are most likely to benefit from Pilates-based exercise.

**Wells C, Kolt GS, Marshall P, Hill B, Bialocerkowski A. Effectiveness of Pilates exercise in treating people with chronic low back pain: a systematic review of systematic reviews. *BMC Med Res Methodol.* 2013; Jan 19;13:7.**

**BACKGROUND:** Systematic reviews provide clinical practice recommendations that are based on evaluation of primary evidence. When systematic reviews with the same aims have different conclusions, it is difficult to ascertain which review reported the most credible and robust findings.

**METHODS:** This study examined five systematic reviews that have investigated the effectiveness of Pilates exercise in people with chronic low back pain. A four-stage process was used to interpret findings of the reviews. This process included comparison of research questions, included primary studies, and the level and quality of evidence of systematic reviews. Two independent reviewers assessed the level of evidence and the methodological quality of systematic reviews, using the National Health and Medical Research Council hierarchy of evidence, and the Revised Assessment of Multiple Systematic Reviews respectively. Any disagreements were resolved by a third researcher.

**RESULTS:** A high level of consensus was achieved between the reviewers. Conflicting findings were reported by the five systematic reviews regarding the effectiveness of Pilates in reducing pain and disability in people with chronic low back pain. Authors of the systematic reviews included primary studies that did not match their questions in relation to treatment or population characteristics. A total of ten primary studies were identified across five systematic reviews. Only two of the primary studies were included in all of the reviews due to different inclusion criteria relating to publication date and status, definition of Pilates, and methodological quality. The level of evidence of reviews was low due to the methodological design of

the primary studies. The methodological quality of reviews varied. Those which conducted a meta-analysis obtained higher scores.

**CONCLUSION:** There is inconclusive evidence that Pilates is effective in reducing pain and disability in people with chronic low back pain. This is due to the small number and poor methodological quality of primary studies. The Revised Assessment of Multiple Systematic Reviews provides a useful method of appraising the methodological quality of systematic reviews. Individual item scores, however, should be examined in addition to total scores, so that significant methodological flaws of systematic reviews are not missed, and results are interpreted appropriately.

**Yamato TP, Maher CG, Saragiotto BT, Hancock MJ, Ostelo RW, Cabral CM, Menezes Costa LC, Costa LO. Pilates for low back pain. *Cochrane Database Syst Rev.* 2015 Jul 2;7:CD010265. [Epub ahead of print]**

**BACKGROUND:** Non-specific low back pain is a major health problem worldwide. Interventions based on exercises have been the most commonly used treatments for patients with this condition. Over the past few years, the Pilates method has been one of the most popular exercise programmes used in clinical practice.

**OBJECTIVES:** To determine the effects of the Pilates method for patients with non-specific acute, subacute or chronic low back pain.

**SEARCH METHODS:** We conducted the searches in CENTRAL, MEDLINE, EMBASE, CINAHL, PEDro and SPORTDiscus from the date of their inception to March 2014. We updated the search in June 2015 but these results have not yet been incorporated. We also searched the reference lists of eligible papers as well as six trial registry websites. We placed no limitations on language or date of publication.

**SELECTION CRITERIA:** We only included randomised controlled trials that examined the effectiveness of Pilates intervention in adults with acute, subacute or chronic non-specific low back pain. The primary outcomes considered were pain, disability, global impression of recovery and quality of life.

**DATA COLLECTION AND ANALYSIS:** Two independent raters performed the assessment of risk of bias in the included studies using the 'Risk of bias' assessment tool recommended by The Cochrane Collaboration. We also assessed clinical relevance by scoring five questions related to this domain as 'yes', 'no' or 'unclear'. We evaluated the overall quality of evidence using the GRADE approach and for effect sizes we used three levels: small (mean difference (MD) < 10% of the scale), medium (MD 10% to 20% of the scale) or large (MD > 20% of the scale). We converted outcome measures to a common 0 to 100 scale when different scales were used.

**MAIN RESULTS:** The search retrieved 126 trials; 10 fulfilled the inclusion criteria and we included them in the review (a total sample of 510 participants). Seven studies were considered to have low risk of bias, and three were considered as high risk of bias. A total of six trials compared

Pilates to minimal intervention. There is low quality evidence that Pilates reduces pain compared with minimal intervention, with a medium effect size at short-term follow-up (less than three months after randomisation) (MD -14.05, 95% confidence interval (CI) -18.91 to -9.19). For intermediate-term follow-up (at least three months but less than 12 months after randomisation), two trials provided moderate quality evidence that Pilates reduces pain compared to minimal intervention, with a medium effect size (MD -10.54, 95% CI -18.46 to -2.62). Based on five trials, there is low quality evidence that Pilates improves disability compared with minimal intervention, with a small effect size at short-term follow-up (MD -7.95, 95% CI -13.23 to -2.67), and moderate quality evidence for an intermediate-term effect with a medium effect size (MD -11.17, 95% CI -18.41 to -3.92). Based on one trial and low quality evidence, a significant short-term effect with a small effect size was reported for function (MD 1.10, 95% CI 0.23 to 1.97) and global impression of recovery (MD 1.50, 95% CI 0.70 to 2.30), but not at intermediate-term follow-up for either outcome. Four trials compared Pilates to other exercises. For the outcome pain, we presented the results as a narrative synthesis due to the high level of heterogeneity. At short-term follow-up, based on low quality evidence, two trials demonstrated a significant effect in favour of Pilates and one trial did not find a significant difference. At intermediate-term follow-up, based on low quality evidence, one trial reported a significant effect in favour of Pilates, and one trial reported a non-significant difference for this comparison. For disability, there is moderate quality evidence that there is no significant difference between Pilates and other exercise either in the short term (MD -3.29, 95% CI -6.82 to 0.24) or in the intermediate term (MD -0.91, 95% CI -5.02 to 3.20) based on two studies for each comparison. Based on low quality evidence and one trial, there was no significant difference in function between Pilates and other exercises at short-term follow-up (MD 0.10, 95% CI -2.44 to 2.64), but there was a significant effect in favour of other exercises for intermediate-term function, with a small effect size (MD -3.60, 95% CI -7.00 to -0.20). Global impression of recovery was not assessed in this comparison and none of the trials included quality of life outcomes. Two trials assessed adverse events in this review, one did not find any adverse events, and another reported minor events.

**AUTHORS' CONCLUSIONS:** We did not find any high quality evidence for any of the treatment comparisons, outcomes or follow-up periods investigated. However, there is low to moderate quality evidence that Pilates is more effective than minimal intervention for pain and disability. When Pilates was compared with other exercises we found a small effect for function at intermediate-term follow-up. Thus, while there is some evidence for the effectiveness of Pilates for low back pain, there is no conclusive evidence that it is superior to other forms of exercises. The decision to use Pilates for low back pain may be based on the patient's or care provider's preferences, and costs.

## **PILATES AND PARTIAL ACL INJURY REHABILITATION**

**Celik D, Turkel N. The effectiveness of Pilates for partial anterior cruciate ligament injury. *Knee Surg Sports Traumatol Arthrosc.* 2015 Aug 1. [Epub ahead of print]**

**PURPOSE:** This study explored the effects of Pilates on the muscle strength, function, and instability of patients with partial anterior cruciate ligament (ACL) injuries in situations in which a non-surgical treatment option is preferred.

**METHODS:** Fifty participants 20-45 years of age who were diagnosed with isolated ACL injuries were included in the study. The participants were randomly assigned to either the Pilates exercise group (n = 24) or the control group (n = 26). The subjects in the Pilates exercise group performed basic mat exercises that focused on the muscle strength and flexibility of the lower limbs and core muscles during each class session, which met three times per week for 12 weeks. The control group did not receive any treatment or home exercise programme. All patients were evaluated using the Lysholm Knee Scale, the Cincinnati Knee Rating System, and isokinetic quadriceps and hamstring strength. Patient satisfaction regarding improvement in knee stability was assessed using the Global Rating of Change scale.

**RESULTS:** The Pilates group experienced significant improvement over the control group as measured by the difference in quadriceps strength at 12 weeks ( $p = 0.03$ ). Both groups showed some clinical change over time, but the Pilates group improved for all outcome measurements at the 12-week follow-up, and the control group only improved for functional outcomes. Patient satisfaction with the level of knee stability based on the Global Rating of Change scale was higher in the Pilates group than in the control group.

**CONCLUSION:** Although both groups exhibited improvements in knee strength and functional outcomes, the results suggest that Pilates is a superior management approach over a control treatment for increasing quadriceps strength in participants with partial ACL injury. Pilates may provide clinicians a novel option when choosing a treatment for a partial ACL injury. Further study is needed to determine whether certain subgroups of individuals might achieve an added benefit with this approach.

**LEVEL OF EVIDENCE:** II.



## PILATES EFFECTS ON HEALTHY INDIVIDUALS

**Campos RR, Dias JM, Pereira LM, Obara K, Barreto MS, Siva MF, Mazuquin BF, Christofaro DG, Fernandes RA, Iversen MD, Cardoso JR. The effect of the Pilates method on the physical conditioning of healthy subjects: a systematic review with meta-analysis. *J Sports Med Phys Fitness*. 2015 May 25. [Epub ahead of print]**

**ABSTRACT:** Physical conditioning consists of a variety of health-related attributes and Pilates exercises are described as a form of this conditioning. The objective of this systematic review was to determine the effect of the Pilates method on health and ability outcome of the physical conditioning of healthy individuals. The search was performed in the following databases: Medline, Cinahl, Embase, Lilacs, Scielo, Web of Science, PEDro, Cochrane Controlled Trials Register Library, Scopus, Science Direct and Google Scholar. (1950-2014). Included studies were randomized controlled trials (RCTs) that assessed the effects of the Pilates method on healthy subjects. Nine RCTs met the inclusion criteria. Pilates improved abdominal muscular endurance when compared with no exercises (Mean Difference [MD] = 9.53%; 95% CI [2.41, 16.43]; P = .009), however, there was no difference in flexibility (MD = 4.97; 95% CI [-.53;10.47]; P= .08). Some positive effects (up to 6 months) of the Pilates practice were found in some RCTs' results as follows: Improvement of dynamic balance, quality of life and back muscle flexibility. The results indicate the Pilates exercises performed on the mat or apparatus 2-3x a week, over 5 to 12 weeks, improves abdominal muscular endurance (on average, 10 more abdominals curls in 1-minute sit-up test) for both genders, when compared to no exercises.

**Cruz-Ferreira A, Fernandes J, Kuo YL, Bernardo LM, Fernandes O, Laranjo L, Silva A. Does pilates-based exercise improve postural alignment in adult women? *Women Health*. 2013; 53(6): 597-611.**

A randomized, controlled trial was conducted to determine the effect of Pilates-based exercise on postural alignment. Seventy-four adult women (mean age  $\pm$  SD, 34.9  $\pm$  16.4 years) were randomized to a Pilates-based mat class (n = 40) or a control group (n = 34). Pilates-based exercise participants were taught the Initial Mat of Body Control Pilates for 6 months, twice a week, for 60 minutes per session; the control group received no exercise intervention. Repeated measurements were performed at baseline, 3 months, and 6 months of the frontal alignment of the thoracolumbar spine, shoulder, and pelvis, and sagittal alignment of the head and pelvis. No differences were found in either group, over time, on frontal alignment of the thoracolumbar spine and pelvis. The experimental group showed significant improvements in frontal alignment of the shoulder and sagittal alignment of the head and pelvis at 6 months. The Pilates-based exercise enhanced some parameters of the postural alignment of women, as measured by frontal alignment of the

shoulder and sagittal alignment of the head and pelvis. The significant improvement in sagittal alignment of the head may imply that 6 months of Pilates-based exercise enhances sagittal alignment of the cervical or thoracic spine.

**Donahoe-Fillmore B, Fisher MI, Brahler CJ. The effects of home-based pilates in healthy college-aged women. *J Women's Health Phys Ther.* 2015; 39(2): 83-94.**

**Objectives:** To quantify and determine the effects of Pilates on core endurance, hamstring flexibility, balance, body composition/mass, and perceived stress level in healthy college-aged women.

**Study Design:** Randomized controlled trial design.

**Background:** Emerging research on the Pilates technique is inconclusive regarding benefits to core endurance, flexibility, balance, body mass, and perceived stress.

**Methods and Measures:** Female college students (n = 57; 18-35 years old) were randomly assigned to a Pilates group, who exercised at home with a DVD, or a control group who did not engage in Pilates practice. Core endurance, hamstring flexibility, balance, body composition, and stress measurements were taken at baseline and at 10 weeks.

**Results:** There was a statistically significant difference between groups for multidirectional standing reach test results, specifically reaching to the right, and right hamstring flexibility.

**Conclusion:** Pilates practice resulted in gains in balance and hamstring flexibility among college-aged women. Limitations in this study, including the unknown level of activity of the control group, warrant further investigation. Additional research is needed to determine whether Pilates has a significant effect on core endurance, body composition, and perceived stress level.

**Kibar S, Yardimci FO, Evcik D, Ay S, Alhan A, Manco M, Ergin ES. Is pilates exercise program effective on balance, flexibility and muscle endurance? Randomized, controlled study. *J Sports Med Phys Fitness.* 2015 Oct 16. [Epub ahead of print]**

**AIM:** This randomized controlled study aims to determine the effect of pilates mat exercises on dynamic and static balance, hamstring flexibility, abdominal muscle activity and endurance in healthy adults.

**METHODS:** Female healthy volunteer university students randomly assigned into two groups. Group1 received pilates program for an hour two times a week. Group2 continued daily activities as control group. Dynamic and static balance were evaluated by Sport Kinesthetic Ability Trainer (KAT) 4000 device. Hamstring flexibility and abdominal endurance were determined by sit and reach test, curl up test respectively. Pressure biofeedback unit (PBU) was used to measure transversus abdominis and lumbar muscle activity. The physical activity of the participants was followed by International Physical

Activity Questionnaire-short form.

RESULTS: Twenty-three subjects in pilates group and 24 control subjects completed the study. In pilates group statistical significant improvements were observed in curl up, sit and reach test, PBU scores at sixth week ( $p < 0.001$ ), and KAT static and dynamic balance scores ( $p < 0.001$ ), waist circumference ( $p = 0.007$ ) in eighth week. In the comparison between two groups, there were significant improvements in pilates group for sit and reach test ( $p = 0.01$ ) and PBU scores ( $p < 0.001$ ) at sixth week, additionally curl up and static KAT scores progressed in eighth week ( $p < 0.001$ ). No correlation was found between flexibility, endurance, trunk muscle activity and balance parameters.

CONCLUSION: An eight-week pilates training program has found to have beneficial effect on static balance, flexibility, abdominal muscle endurance, abdominal and lumbar muscle activity. These parameters have no effect on balance.

**Ozer KD, Duzgun I, Baltaci G, Karacan S, Colakoglu F. Effects of calisthenics and Pilates exercises on coordination and proprioception in adult women: a randomized controlled trial. *J Sport Rehabil.* 2012 Aug;21(3):235-43. Epub 2011 Nov 16.**

OBJECTIVE: To assess and compare the effects of 6 mo of Pilates and calisthenics on multijoint coordination and proprioception of the lower limbs at the 3rd and 6th mo of training.

DESIGN: Randomized, controlled, assessor-blinded, repeated-measures.

SETTING: University research laboratory.

PARTICIPANTS AND INTERVENTION: Healthy, sedentary, female participants age 25-50 y were recruited and randomly divided into 3 groups: a calisthenic exercise group ( $n = 34$ , mean age  $\pm$  SD  $40 \pm 8$  y, body-mass index [BMI]  $31.04 \pm 4.83$  kg/m<sup>2</sup>), a Pilates exercise group ( $n = 32$ , mean age  $\pm$  SD  $37 \pm 8$  y, BMI  $31.04 \pm 4.83$  kg/m<sup>2</sup>), and a control group ( $n = 41$ , mean age  $\pm$  SD  $41 \pm 7$  y, BMI  $27.09 \pm 4.77$  kg/m<sup>2</sup>). The calisthenics and Pilates groups underwent related training programs for 6 mo, while the controls had no specific training.

MAIN OUTCOME MEASURES: Coordination and proprioception of the lower extremities with concentric and eccentric performances in the closed kinetic chain assessed with the monitored rehab functional squat system at baseline and at the 3rd and 6th mo of training.

RESULTS: For the within-group comparison, coordinative concentric and eccentric deviation values were significantly decreased for both dominant and nondominant lower limbs at pretraining and at the 3rd and 6th mo posttraining in the calisthenics group ( $P < .05$ ). In contrast, there was no improvement in the Pilates group throughout the training. However, for comparisons between groups, the baseline values of coordinative concentric and eccentric deviations were different in the calisthenics group than in Pilates and the controls ( $P < .05$ ). There were no differences in the

proprioception values of either visible or nonvisible movement in any group throughout the training ( $P > .05$ ).

CONCLUSIONS: It seems that calisthenic exercises are more likely to improve coordination of the lower extremity after 3 and 6 mo of training than Pilates exercises. Calisthenic exercises may be useful for individuals who require improved coordination.

**Phrompaet S, Paungmali A, Pirunsan U, Sitolertpisan P. Effects of pilates training on lumbo-pelvic stability and flexibility. *Asian J Sports Med.* 2011; 2(1): 16-22.**

PURPOSE: This study was performed to assess and compare the effects of Pilates exercise on flexibility and lumbo-pelvic movement control between the Pilates training and control groups.

METHODS: A randomized single-blinded controlled design was utilized in the study. Forty healthy male and female volunteers (mean age  $31.65 \pm 6.21$  years) were randomly divided into Pilates-based training (20 subjects) and the control groups (20 subjects). The Pilates group attended 45-minute training sessions, 2 times per week, for a period of 8 weeks. Flexibility and lumbo-pelvic stability tests were determined as outcome measures using a standard "sit and reach test" and "pressure biofeedback" respectively at 0, 4 and 8 weeks of the study.

RESULTS: The results showed that the Pilates training group improved flexibility significantly ( $P < 0.001$ ) during time intervals. This effect was also significantly greater than the control group for both 4 weeks and 8 weeks of the training period ( $P < 0.001$ ). There were 65% and 85% of the subjects from Pilates group passing the lumbo-pelvic stability test at 4 and 8 weeks of training periods respectively. No subjects from the control group passed the test at any stages.

CONCLUSIONS: Pilates can be used as an adjunctive exercise program to improve flexibility, enhance control-mobility of trunk and pelvic segments. It may also prevent and attenuate the predisposition to axial musculoskeletal injury.

**Vilas-Boas, Machado, Kim, Veloso (eds.). Effects of pilates training on muscular strength and balance in ballet dancers. *Portuguese Journal of Sport Sciences - Biomechanics in Sports* 29 11 (Suppl. 2), 2011.**

ABSTRACT: The purpose of this study was to determine the effects of a Pilates training programme on muscular strength and balance in ballet dancers. Fifteen ballet students were divided in experimental and control groups. Besides the daily technical classes, it was applied a Pilates training programme during 11 weeks in the experimental group. Groups were submitted at two moments of evaluation, before and after the programme. The muscular strength was evaluated through the time obtained in the maintenance of the performance of *penché* and *developpé*. Balance was

evaluated using a Bertec force plate (4060-15). The migration area of the centre of pressure was calculated in the first position and in the *attitude derrière* skills. Results suggest that the Pilates training have a positive effect on muscular strength. No significant differences were obtained in ballet dancers' balance.

