

Taping protocol for two presentations of pregnancy-related back pain: a case series

Crystal Draper, DC¹
 Ayla Azad, DC¹
 Donald Littlewood, DC¹
 Chloe Morgan, DC¹
 Lindsay Barker, DC¹
 Carol Ann Weis, DC, MSc¹

Background: Back pain is common during pregnancy and can have an adverse impact on the quality of life for some, yet treatment options for this population are limited. We document a chiropractic treatment that involves using kinesiology tape (tape) to help alleviate pregnancy-related back pain in two patients.

Case Presentation and Management: Two pregnant women reported to two different chiropractic offices with varying presentations of pregnancy-related back pain. A trial of chiropractic care was rendered in both chiropractic offices, which included the application of tape.

Outcome and Discussion: In both case presentations, the addition of tape in the lumbosacral and/or abdominal regions, decreased pain intensity from 9-10/10 to 4/10 or less on the Numeric Rating Scale (NRS). Including a taping protocol to a plan of management in women with pregnancy-related LBP or

Contexte : Les maux de dos sont fréquents pendant la grossesse et peuvent avoir un impact négatif sur la qualité de vie de certaines femmes, mais les options de traitement pour cette population sont limitées. Nous documentons un traitement chiropratique qui implique l'utilisation de ruban de kinésiologie (ruban) pour aider à soulager les douleurs dorsales liées à la grossesse chez deux patientes.

Présentation et gestion de cas : Deux femmes enceintes se sont présentées à deux cabinets de chiropractie différents présentant des maux de dos différents liés à la grossesse. Un essai de soins chiropratiques comprenant l'application de ruban a été effectué dans les deux cabinets de chiropractie.

Résultats et discussion : Dans les deux présentations de cas, l'ajout de ruban dans les régions lombo-sacrées et/ou abdominales a diminué l'intensité de la douleur qui est passée de 9-10/10 à 4/10 ou moins sur l'échelle d'évaluation numérique (EEN). Le fait d'inclure un protocole d'utilisation de ruban à un plan de prise en

¹ Canadian Memorial Chiropractic College

Corresponding author:

Crystal Draper
 Canadian Memorial Chiropractic College, 6100 Leslie Street, Toronto, ON M2H 3J1
 Tel: 416-482-2340
 E-mail: cdraper@cmcc.ca
 © JCCA 2019

The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript. The involved patients provided consent for case publication.

PGP may be a safe and effective option to alleviate pain in this population.

(JCCA. 2019;63(2):111-118)

KEY WORDS: pregnancy, back pain, chiropractic, kinesiology tape, case series

Introduction

The literature has reported that up to 90% of pregnant women experience some sort of back pain.¹⁻⁵ This large prevalence can be accounted for by the fact that back pain experienced during pregnancy is not just one entity. It can be further separated into (1) pregnancy-related low back pain (LBP), from the bottom of the ribs to the inferior gluteal folds⁶, characterized as dull and resembling back pain that occurs in the non-pregnant state⁷; (2) pelvic girdle pain (PGP), from the top of the iliac crests to the bottom of the gluteal folds and/or pain in the symphysis pubis, often described as stabbing, shooting, dull, burning or an occasional “catching” sensation in the leg while walking⁷. The pain can occur in either one or both sacroiliac joints (SIJs), in conjunction with/or separate symphysis pubis pain, the pain may radiate into the thigh⁷; or (3) a combination of both pains (combined pain)⁸⁻¹⁰. Clinical features of pregnancy-related LBP and PGP can start as early as the first trimester, but more often, it starts around the 18th week of pregnancy, with a peak intensity between the 24th and 36th week. It often resolves within a few weeks to a few months following delivery.⁷

Previous literature has suggested the importance of distinguishing between pregnancy-related LBP and/or PGP for proper management and prognosis of the two conditions.^{7, 11-13} Useful methods of differentiation include the site of pain, its character and severity, provoking factors, resultant disability, and pain provocation tests.^{7, 12} A pregnant woman experiencing LBP will likely present with pain during forward lumbar flexion, pain and/or tenderness with palpation of the lumbar erector spinae muscles, and restriction in the lumbar spine. A woman presenting with PGP will likely experience pain with pain provocation tests such as posterior pelvic pain provocation (P4),

charge chez les femmes présentant une lombalgie ou des douleurs pelviennes liées à la grossesse peut constituer une option sûre et efficace pour soulager la douleur chez cette population.

(JACC. 2019;63(2):111-118)

MOTS CLÉS : grossesse, maux de dos, chiropratique, ruban de kinésiothérapie, série de cas.

FABER (flexion, abduction, and external rotation), and palpation of the dorsal sacral ligament. Specifically, to diagnose symphysis pubis pain, direct palpation of the symphysis pubis, modified Trendelenburg’s test and active straight leg raise will be painful.^{7, 11, 12}

Pregnant women seek out pain relief methods such as pain medication, exercise, education, pelvic support belts, and chiropractic treatments, however, there is limited evidence with regards to their efficacy.¹⁴ In an effort to relieve pain from musculoskeletal injuries, an emerging form of treatment among manual therapists, such as chiropractors, is the use of kinesiology tape, or “tape” as we refer to it in these cases. Taping has been suggested as a treatment for those with musculoskeletal injuries as it has a number of proposed benefits. These benefits include: supporting the affected area, relaxing the muscles and reducing pain sensation^{10, 15, 16}; is designed to replicate the physical properties and characteristics of human skin^{15, 17}; and it has been suggested in the literature that it helps in the normalization of muscular function, increase lymphatic and vascular flow, reduce pain through neurologic suppression, and possibly contribute to corrections of joint misalignments^{15, 16, 18}. Although the full action of tape has yet to be elucidated¹⁶, the effectiveness reported in various clinical conditions has shown both positive^{16, 18-21}, and negative results²²⁻²⁴ in the non-pregnant population.

There are currently a few studies regarding taping and pregnancy-related back pain which have demonstrated an improvement in pain and disability in these women.^{10, 25, 26} In the pregnant population, Kuciel *et al.*²⁵ and Kalinowski *et al.*²⁶ applied tape to participants experiencing pregnancy-related PGP and LBP, respectively. Both research groups found a significant reduction in pain two to five days after tape application.^{25, 26} Although outcomes in

the pregnancy studies show favourable results, the methodology of both studies exhibit weaknesses. One of the strengths of the Kuciel *et al.* study is that they performed a physical examination on participants to determine if their subjects were experiencing PGP²⁵; however, they did not utilize a control group for comparison. Additionally, the study employed a general taping protocol, extending tape from below the posterior superior iliac spine into the scapular region, with an additional horizontal strip over the sacroiliac region.²⁵ Whereas, Kalinowski *et al.* used a more specific taping protocol, no physical examination was conducted to determine the type of back pain the pregnant women were experiencing.²⁶ The purpose of this case series is two-fold: (1) to identify the type of pregnancy-related back pain and (2) to demonstrate that an individualized taping protocol applied in women presenting with different pregnancy-related back pains may help to reduce pain levels over the course of their pregnancy.

Case Presentation #1

A 37-year-old female, six-weeks pregnant, presented to her chiropractor with complaints of PGP, localized to the left SIJ, and pregnancy-related nausea. One treatment of manual therapy was performed at this time, including soft tissue therapy (STT) and spinal manipulation (SMT) to the left SIJ. At 16 weeks gestation, the patient reported that she began experiencing round ligament pain and discomfort with associated symphysis pubis dysfunction. However, the patient did not return to the chiropractor until 20 weeks gestation because she was considered high-risk and was undergoing genetic testing.

20-27 Weeks Gestation

At 20 weeks gestation, the patient returned to the chiropractor with exacerbated left SIJ and right round ligament pain. At this time, she reported that she was not sleeping well, was unable to perform her activities of daily living (ADLs) (i.e. walking for more than five minutes), and her pain was 9/10 on the Numeric Rating Scale (NRS). The chiropractor reassessed the patient. Physical examination revealed lumbar range of motion was limited in all directions, with bilateral rotation and right Kemp's test recreating the round ligament pain, and flexion and extension causing the left SIJ pain. Bilateral straight leg raise, left FABER, left SIJ compression, left P4, left Yeoman's and left Ely's (modified for pregnancy) tests all aggravated the

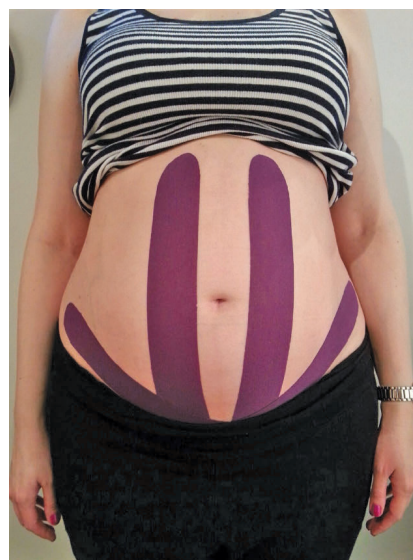


Figure 1.
Front view of patient's abdominal taping (rectus abdominus and external abdominal oblique).

left SIJ pain. Right FABER and right Yeoman's test elicited the right round ligament pain. Palpation revealed tenderness bilaterally in the lumbar erector spinae, quadratus lumborum, and piriformis (worse on left), left dorsal sacral ligament and right round ligament. Additionally, joint palpation of L3-5 and the left SIJ were painful. The patient was diagnosed with combined pain. Plan of management included STT to the aforementioned musculature, SMT to the involved lumbar segments using Diversified technique and the left SIJ using a table drop piece, taping of the abdomen, birth preparation exercises and advice to hold/support abdomen during transitions. Immediately following the treatment of STT and SMT, the patient reported her pain to be unchanged on the NRS (9/10).

Taping protocol: At this point the chiropractor applied tape to the abdomen using four strips: two along rectus abdominus and two along external abdominal oblique. The first two strips were started at the superior aspect of the symphysis pubis with no-tape tension for one-inch. Tape-off tension was applied as the tape coursed over the rectus abdominus muscle up to the xiphoid process, with no-tape tension for the last one-inch. The remaining two strips were started on the medial aspect of the symphysis pubis (overlapping rectus abdominus tape medially) coursing along external obliques and anterior superior iliac spine (ASIS) with tape-off tension; no-tape tension was applied to the starting and ending one-inch of tape, acting as anchors (Figure 1). Home care included Kegel

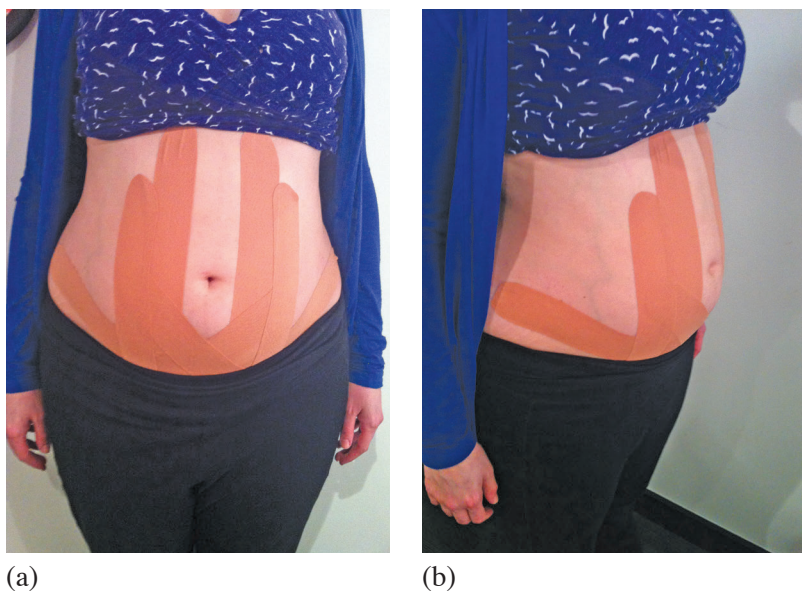


Figure 2.
(a) Front and (b) side view of patient's reinforced abdominal taping (rectus abdominus reinforced, external abdominal oblique, symphysis pubis 'X').

exercises and abdominal bracing. The patient was also receiving care from a naturopath, registered massage therapist and a midwife.

One week later, at 21 weeks, the patient returned to her chiropractor feeling much better; she rated her pain at a 4/10 on the NRS. The patient reported that her combined pain and round ligament pain improved, as well as her sleep. She was able to walk for 10-15-minute intervals with minimal to no pain. The chiropractor performed the same manual therapy intervention as her previous appointment and re-applied tape.

At 23 weeks, the patient reported overall improvement in symptoms, but continued to experience mild combined pain and round ligament pain, as well as interrupted sleep. The chiropractor treated her with the same manual treatments and taping as outlined above. Three days later, the patient returned to the chiropractor stating that she was able to go for a long walk the day before, and that she was experiencing significant relief. However, the patient reported that without the tape, pain returned to 9/10. The tape was re-applied in the same manner outlined above; however, four additional strips were applied for further



Figure 3.
Front view of patient's abdominal and symphysis pubis taping (rectus abdominus, external abdominal oblique, symphysis pubis 'X').

support. Two strips were used to reinforce the rectus abdominus strips and two creating an "X" over the symphysis pubis (Figure 2). The patient's regular manual therapy was provided at this visit. For convenience, and to ensure continued relief for the patient, the chiropractor taught the patient's husband the taping protocol for home application.

28 Weeks Gestation to Delivery

At 28 weeks, the patient reported the tape continued to provide relief with the round ligament pain as well as combined pain. Unfortunately, the patient started to experience symphysis pubis pain and difficulty walking. At all chiropractic appointments from 28 weeks until delivery, manual therapy was performed, exercises were progressed, and the tape was applied by her husband at home. At 37 weeks, the chiropractor added isometric contraction of the hip adductors to adjust and relieve pain in the symphysis pubis and applied additional tape over the symphysis pubis (Figure 3). At 38 weeks, the patient experienced Braxton Hicks contractions almost immediately following the treatment. At this point, the chiroprac-

tor discontinued SMT because the patient expressed concern. For the remainder of the visits, and with the patient's consent, the chiropractor performed instrument assisted adjustments and STT. Treatment continued until just after 40 weeks. At this time, the patient had a successful labour and delivery and continued to seek chiropractic care postpartum. There were no adverse events reported with any of the treatment provided including the manipulation, STT or the taping intervention. Signed consent for release of patient information and photographs was obtained from the patient.

Case Presentation #2

A 32-year old patient presented to the clinic at 35 weeks gestation with back pain of approximately two-month duration. When asked to point to the area of pain, the patient indicated that her pain was bilaterally at the SIJs. She also reported pain along her anterior thigh and posterior hamstring, not extending distal to the knee. She reported the pain intensity was a 10/10 on an NRS. She denied any numbness or tingling into the lower limb and no change in bowel or bladder control. Although her pregnancy was healthy and uneventful, she was having difficulty with ADLs including, turning over in bed and fast cadence gait as she reported experiencing a "zapping feeling down her leg". The patient was active during her pregnancy, owning a Pilates studio where she continued to teach until 37 weeks gestation.

Physical examination revealed that lumbar range of motion was full and pain-free. A P4 test elicited the chief complaint, with the right-side more painful than left. Palpation of the SIJs and dorsal sacral ligaments were painful bilaterally, as was palpation of the right piriformis. Diastasis rectus testing was negative, as was greater trochanteric compression. A lower extremity neurologic examination, including deep tendon reflexes, sensory (light touch) and motor testing and plantar reflex, were all within normal limits. A diagnosis of pregnancy-related PGP was rendered for this patient. Plan of management included STT of the piriformis, dorsal sacral ligaments, gluteus minimus and medius, taping of the SIJs, and birth preparation exercises.

Taping protocol: Tape application consisted of three strips, creating an H-pattern. The first two strips were parallel to each other and started on the lumbar erector spinae running longitudinally until past the SIJs. Tape was ap-

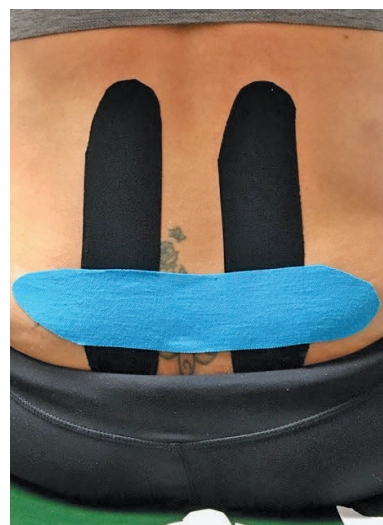


Figure 4.
Posterior view of patient's low back and pelvis (lumbar erector spinae and SIJs creating H-pattern).

plied for one-inch with no-tape tension. Tape-off tension was applied as the tape was applied along the muscle belly of the lumbar erector spinae to below the SIJs, with no-tape tension for the last one-inch. The third strip was applied over the SIJs, starting at the sacral tubercle. Tape-off tension was applied medial to lateral with no-tape tension at the one-inch ends (Figure 4).

Following the first treatment, the patient emailed the chiropractor reporting her pain was non-existent (0/10), she was very pleased with her treatment response. Until she gave birth at 39.5 weeks to a healthy baby, the patient received three more treatments once a week, with the same protocol and same relief. Although the patient has attempted returning for postpartum chiropractic care, she has been unsuccessful with a newborn. There were no adverse events reported with any of the chiropractic care including the STT and taping intervention. Signed consent for release of patient information and photographs was obtained from the patient.

Discussion

It is well known that pregnancy is often associated with the onset or exacerbation of LBP, PGP or a combination of both of these pains.⁶ Despite this, there is limited evidence to the etiology, pathophysiology and treatment strategies for this population.^{6,27} As such, healthcare providers often dismiss complaints by the expectant mother because these are considered normal ailments of pregnancy and often resolve once the baby has arrived.²⁷ Therefore, the im-

portance of differentiating pregnancy-related LBP and PGP for proper diagnosis and management is crucial.^{7,11-13} Both chiropractors in the current case series conducted a thorough history to obtain details of the chief complaint and the ADLs impacted by the patient's back pain. Furthermore, a physical examination using two or more pain provocation tests, was performed in both cases to identify the type of back pain each patient was experiencing. Once a proper diagnosis was identified, taping protocols specific to the patient's symptomatology was rendered.

It has been postulated that the positive results associated with taping may be a result of direct and indirect means.²⁵ Directly, the tape affects the skin and associated receptors (Ruffinis, pain and deep sensory receptors) and indirectly, through supporting lumbosacral structures (such as thoracolumbar fascia). These mechanisms may help reduce tension in overloaded muscles, thereby increasing stability, reducing paraspinal stress, and stimulating connective tissues, resulting in pain relief.^{10,25} Following the application of tape, patients in the current study reported a decrease in pain and qualitative improvement in function and disability. Furthermore, they had less fear of movement with ADLs, which has been noted in previous literature.¹⁹ In the current case series, both patients complained that certain movements were extremely difficult, including changing positions during sleep and an inability to walk quickly and/or longer than five minutes. One patient felt relief immediately, and the other felt relief within one week following the application of tape. Pain scales were originally 9-10/10 and reduced to 4/10 or less. Previous studies have demonstrated that the application of tape increases patients' sense of confidence and safety. It has been suggested that the tape provides a more secure and stable feeling, as well as a proprioceptive reminder to maintain optimal posture.²⁸ This increased confidence and stability may allow the patient to actively perform exercises, contributing to the efficacy of their treatment.⁵

Previous pregnancy taping studies have found similar results to the current case series. Kaplan *et al.* examined the effectiveness of a five-day intervention that included paracetamol and tape versus paracetamol alone on pain and disability.¹⁰ They determined the addition of tape had more superior effect on the outcomes than paracetamol alone. However, they did not employ a sham group in their study; therefore, a placebo effect cannot be ruled

out.¹⁰ Sabbour and Omar randomly assigned pregnant women who were experiencing LBP to receive pelvic tilt exercises or pelvic tilt exercises plus the application of tape (two applications, approximately one week apart).⁵ They demonstrated a significant decrease in pain and functional disability scores in the group who received exercise and tape.⁵ Kuciel and colleagues also found a reduction in pain and improved disability scores on day five and day ten following a five-day taping protocol.²⁵ In a crossover study, Kalinowski *et al.* applied tape to women experiencing low back pain and determined that there was a decrease in pain intensity and disability when women had the taping protocol applied, as opposed to the placebo taping protocol.²⁶ It should be noted that although these can be considered positive results, Kuciel *et al.*²⁵ and Kalinowski *et al.*²⁶ did not use any type of control group to compare outcomes.

One difference between the current case series and what is reported in the literature, is that our study followed patients on a long-term basis with multiple tape applications versus a one-time application with shorter follow-up periods.^{25,26} In the present case series, both patients noted their pain returned immediately following the removal of tape and decreased with their next application. In addition, our case series identified different types of pregnancy-related back pain prior to applying an individualized taping protocol based on their symptomology. Kuciel *et al.*²⁵ utilized the European Guidelines for Treatment and Diagnosis¹¹ to identify PGP in their subjects, and then employed a generalized taping protocol - tape applied from the bottom of the scapula to the bottom of the sacroiliac joints. Similar to the present case series, Kalinowski *et al.*²⁶ and Sabbour and Omar⁵ applied a specific taping protocol; however, unlike the current case series, they did not identify the type of LBP their patients were experiencing. In the current case series, the patient in the first case experienced combined pain with symptoms most pronounced anteriorly, including round ligament and symphysis pubis pain. Whereas, the patient in the second case presented with PGP, specifically involving bilateral SIJs. Therefore, with differing clinical presentations, examination findings and pregnancy-related back pain, the treating chiropractors applied taping protocols to best support the affected areas; Case One, anteriorly along the patient's abdomen and Case Two, posteriorly along the patient's SIJs. Although the results of this case

series are limited, positive outcomes on the quality of life of the affected pregnant patient were achieved.

Tape is another treatment modality available to chiropractors that can be used as a relief mechanism for pregnant patients. It is a simple technique that can be applied to the patient and can be taught to their partner to apply as a form of pain relief. It is noninvasive, inexpensive, and is well tolerated by the patient, with very few adverse effects.^{10,25} This case series demonstrates the effects of individualized taping protocols on pregnancy-related back pains. As tape is easy to apply and relatively inexpensive, we believe it may be an effective option for pain management during pregnancy.

Limitations and future studies

This case series has several limitations. First, one of the patients had a difficult pregnancy with multiple complications. Due to the complicated nature of her pregnancy, she was seeking care from many different healthcare providers and therefore, her pain relief cannot be solely attributed to taping and chiropractic care. Second, both patients presented with different symptomatology and therefore, received slightly varying therapies from their respective chiropractor, including soft tissue therapy and manual adjustments. Consequently, the benefits seen in this case may not be exclusively related to taping. Furthermore, the methodology differed with respect to taping pregnant patients; both chiropractors used different types of tape and neither chiropractor had any formal training with respect to taping pregnant patients. Despite these limitations, there were still positive clinical results. Third, only qualitative measures were obtained in these case reports, including NRS and perceived quality of life. Future studies would benefit from the inclusion of validated outcome measures to assess disability (i.e. Oswestry Disability Index, Roland Morris Disability Questionnaire) or health-related quality of life (i.e. SF-36). Finally, we did not use a sham taping application; therefore, the placebo effect of the taping treatment cannot be discounted.

Our case report highlights the important need for future research. Future studies should focus on the application of an individualized taping protocol that is appropriate for the varying types of pregnancy-related back pain.

Summary

There is limited research on the effectiveness of taping on

LBP and PGP during pregnancy and as far as we know, this is the first case series to follow two pregnant women diagnosed and treated with different pain patterns and taping protocols from presentation in clinic until delivery. Upon each application of tape, the patients experienced significant and immediate pain relief as well as increased quality of life. More research is required to differentiate the types of back pain pregnant patients experience (LBP, PGP, combined pain), and furthermore, if varying types of taping protocols are indicated.

References

1. Ansari NN, Hasson S, Naghdi S, Keyhani S, Jalaie S. Low back pain during pregnancy in Iranian women. *Physiother Theory Pract.* 2010;26(1):40-48.
2. Malmqvist S, Kjaermann I, Andersen K, Økland I, Brønnick K, Larsen JP. Prevalence of low back and pelvic pain during pregnancy in a Norwegian population. *J Manipulative Physiol Ther.* 2012;35(4):272-278.
3. Stapleton DB, MacLennan AH, Kristiansson P. The prevalence of recalled low back pain during and after pregnancy: a South Australian population survey. *Aust N Z J Obstet Gynaecol.* 2002;42(5):482-485.
4. Ramachandra P, Maiya A, Kumar P, Kamath A. Prevalence of musculoskeletal dysfunctions among Indian pregnant women. *J Pregnancy.* 2015;15:437105.
5. Sabbour A, Omar H. The effect of Kinesiotaping therapy augmented with pelvic tilting exercises on low back pain in primigravidas during the third trimester. *Bull Fac Phys Ther Cairo Univ.* 2011;16(1):53-61.
6. Weis C, Barrett J, Tavares P, Draper C, Ngo K, Leung J, et al. Prevalence of low back pain, pelvic girdle pain, and combination pain in a pregnant Ontario population. *J Obstet Gynaecol Can.* 2018;40(8):1038-1043.
7. Vermani E, Mittal R, Weeks A. Pelvic girdle pain and low back pain in pregnancy: a review. *Pain Pract.* 2010;10(1):60-71.
8. Kovacs FM, Garcia E, Royuela A, González L, Abreira V. Prevalence and factors associated with low back pain and pelvic girdle pain during pregnancy: a multicenter study conducted in the Spanish National Health Service. *Spine.* 2012;37(17):1516-1533.
9. Wu W, Meijer O, Uegki K, van Dieen J, Wuisman P, Ostgaard H. Pregnancy-related pelvic girdle pain (PPP), I: terminology, clinical presentation, and prevalence. *Eur Spine J.* 2004;13(7):575-589.
10. Kaplan S, Alpayci M, Karaman E, Cetin O, Ozkan Y, Ilter S, et al. Short-term effects of kinesio taping in women with pregnancy-related low back pain: a randomized controlled clinical trial. *Med Sci Monit.* 2016; 22:1297-1301.
11. Vleeming A, Albert HB, Ostgaard HC, Sturesson

- B, Stuge B. European guidelines for the diagnosis and treatment of pelvic girdle pain. *Eur Spine J.* 2008;17(6):794-819.
12. Albert H, Godskesen M, Westergaard J. Evaluation of clinical tests used in classification procedures in pregnancy-related pelvic joint pain. *Eur Spine J.* 2000;9(2):161-166.
 13. Albert H, Godskesen M, Westergaard J. Incidence of four syndromes of pregnancy-related pelvic joint pain. *Spine.* 2002;27(24):2831-2834.
 14. Liddle Sarah D, Pennick V. Interventions for preventing and treating low-back and pelvic pain during pregnancy. *Cochrane Database Syst Rev.* 2015; (9). Available from: <https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD001139.pub4/full>
 15. Kachanathu S, Alenazi A, Seif H, Hafez A, Alroumim M. Comparison between Kinesio Taping and a traditional physical therapy program in treatment of nonspecific low back pain. *J Phys Ther Sci.* 2014;26(8):1185-1188.
 16. Paolini M, Bernetti A, Fratocchi G, Mangone M, Parrinello M, Del Pilar Cooper M. Kinesio Taping applied to lumbar muscles influences clinical electromyographic characteristics in low back pain patients. *Eur J Phys Rehabil Med.* 2011;47(2):237-244.
 17. Alvarez-Alvarez S, Garcia-Muro San Jose F, Rodrigex-Fernandez A, Gueita-Rodriguez J, Waller B. Effects of kinesiotape in low back muscle fatigue: randomized, controlled, double-blinded clinical trial on healthy subjects. *J Back Musculoskelet Rehabil.* 2014;27(2):203-212.
 18. Castro-Sanchez A, Lara-Palomo I, Mataran-Penerrocah G, Fernandez-Sanches M, Sanchez-Labraca N, Arroyo-Morales M. Kinesio Taping reduces disability and pain slightly in chronic non-specific low back pain: a randomized trial. *J Physiother.* 2012;58(2):89-95.
 19. Gonzalez-Iglesias J, Fernandez-de-las-Penas C, Cleland J, Hulijbregts P, del Rosario Guterrez-Vega M. Short-term effects of cervical kinesio taping on pain and cervical range of motion in patients with acute whiplash injury: a randomized clinical trial. *J Orthop Sports Phys Ther.* 2009;39(7):515-521.
 20. Koroglu F, Colak T, MG P. The effect of Kinesio® taping on pain, functionality, mobility and endurance in the treatment of chronic low back pain: a randomized controlled study. *J Back Musculoskelet Rehabil.* 2017;30(5):1087-1093.
 21. Keles B, Yalcinkaya E, Gunduz B, Bardak A, Erhan B. Kinesio Taping in patients with lumbar disc herniation: a randomised, controlled, double-blind study. *J Back Musculoskelet Rehabil.* 2017;30(3):543-550.
 22. Luz Junior MAD, Almeida MO, Santos RS, Civile VT, Costa LOP. Effectiveness of Kinesio Taping® in patients with chronic non-specific low back pain: a systematic review with meta-analysis. *Spine.* 2019;44(1):68-78.
 23. Araujo A, do Carmo Silvia Parreira P, Junior L, da Silva T, da Luz Junior M, da Cunha Menezes Costa L, et al. Medium term effects of kinesio taping in patients with chronic non-specific low back pain: a randomized controlled trial. *Physiotherapy.* 2018;104(1):149-151.
 24. Nelson N. Kinesio taping for chronic low back pain: a systematic review. *J Bodyw Mov Ther.* 2016;20(3):672-681.
 25. Kuciel N, Sutkowska E, Ceienska A, Markowska D, Wrzosek Z. Impact of Kinesio Taping application on pregnant women suffering from pregnancy-related pelvic girdle pain – preliminary study. *Ginekol Pol.* 2017;88(11):620-625.
 26. Kalinowski P, Krawulska A. Kinesio taping vs. placebo in reducing pregnancy-related low back pain: a cross-over study. *Med Sci Monit.* 2017;23:6114-6120.
 27. Borg-Stein J, Dugan SA, Gruber J. Musculoskeletal aspects of pregnancy. *Am J Phys Med Rehabil.* 2005;84(3):180-192.
 28. de-la-Torre-Domingo C, Alguacil-Deigo I, Molina-Rueda F, Lopez-Roman A, Fernandez-Carnero J. Effect of kinesiology tape on measurements of balance in subjects with chronic ankle instability: a randomized controlled trial. *Arch Phys Med Rehabil.* 2015;96(12):2169-2175.