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Effects of Low Grade Axial Loading on Discogenic Low Back Pain: A Case Report

Low back pain (LBP) is the most common reason for seeking physical therapy (PT) care. Recent studies suggest that axial loading can have a positive impact on the intervertebral disc by improving its tensile strength. Further, whole body vibration (WBV) appears to improve spinal muscle relaxation. Therefore, this case study describes the use of axial loading using a mini-trampoline in a female with chronic LBP. This case report is a single subject design. This patient is a 29-year-old female with a six-month history of low back pain following a motor vehicle accident. MRI found herniated discs at L4 and L5, clinical tests were positive for pain in the L4 and L5 dermatome and myotome the slump test was positive for neural tension, and LBP was constant at 4-6/10 over the past four months. She received axial loading exercises using a mini-trampoline and performed six sessions that were, scheduled twice a week for three weeks. Her Oswestry Disability Index (ODI) score improved from 40% at the time of her first visit to 22% at her final visit. Pain measure on the Numeric Pain Rating Scale (NPRS) after the first treatment was 7/10, and her pain after the final treatment was 0/10. These changes in the pain scores are clinically significant and exceed the minimal clinically important difference (MCID). This patient had a significant improvement in her pain using the NPRS and the ODI. This case study suggests that axial loading may be an effective treatment for some individuals with discogenic chronic low back pain.

Key words: *Trampoline, Bouncing, Intervertebral disc pain, Oswestry disability index*

Duncan Chang, MPT, OMPT., Arantxa Boby, PT, MSc. James Madonna, PT, OMPT.

Oakland University, Michigan USA

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Address for correspondence
Duncan Chang, MPT, OMPT
Department of Physical Therapy,
Oakland University,USA,
Human Health Building
433 Meadow Brook Road
Rochester, MI 48309-4452
Tel : 01-213-700-5788
E-mail: duncanolaf@yahoo.com

INTRODUCTION

Approximately 80% of adults experience low back (LBP) pain during their life and the prevalence of LBP in children and adolescents ranges from 9% to 69%.[1-3]. Low back pain is the primary reason for seeking PT care. Physical therapy treatment for LBP includes modalities, therapeutic exercise, mobilization/manipulation and mechanical tratcion Patient educations for recovery and prevention include body mechanics and postural awareness. Axial loading was not previously considered as a treatment for low back pain.

LBP is defined as pain, muscle tension, muscle spasm, or stiffness below the line of the twelfth rib of the back and above the gluteal fold, with or without leg pain [4]. Low back pain is considered chronic when it persists for 12 weeks or longer. Degenerative disc disease is identified as one of several sources of low back pain. One study by Shwarzer et al reported 39% of chronic LBP were discogenic in nature [5]. An article by Belavy et al pointed out that dynamic axial loading can provide a positive response to the disc. Fast walking or running seems to have a positive impact on improving the health of the disc according to MRI T2 imaging [6, 7]. Although there are a few articles supporting axial loading to improve the health of the disc, and a few articles that demonstrate a change in the disc with axial loading [8, 9], no articles were e found that described

axial loading as a possible treatment to decrease LBP

Whole body vibration (WBV) which can be accomplished by jumping on a trampoline has become more popular over the past decade for relieving musculoskeletal pain. Numerous studies of WBV have shown effects on muscle strength (including a significant increase in back muscle strength), performance, and postural control, especially in older adults. A randomized study by Elfering et al. revealed that a single session of stochastic or random non-specific resonance whole body vibration increased muscle relaxation in young healthy participants [10].

The exercise utilized in this case is not traditional for low back pain. The patient utilized a mini trampoline for bouncing that created random-WBV and also increased axial loading. This bouncing provided axial loading that may improve the health of the disc. This unique exercise movement also provided low-frequency vibration. Low frequency WBV is suggested to decrease LBP by activating stretch reflex and subsequently activating the abdominal and lumbar extensor stabilization muscles11. Dysfunction of the abdominal muscle and lumbar extensors were shown to be another cause of LBP 12. WBV was found to be effective in treating chronic LBP [11-13].

PATIENT INFORMATION

The 29 year old woman was referred to the clinic with the diagnosis of lumbar spine radiculopathy, and the onset of the most recent episode was when she was hit by a motor vehicle in August, 2017. The MRI report found herniated discs on L4, and L5. Her first episode of low back pain was five years ago from repetitive bending and lifting as a shipping company employee. Her first episode of pain was at a level of s 4-6/10 on the Numeric Pain Rating Scale (NRPS) and lasted for two years during her full employment. Her pain decreased to negligible after quitting her job three years ago and did not return until the recent accident in August, 2017.

OUTCOME

On initial examination in August 2017, her pain scale was 7-9/10, with pain radiating down to the ankle on right leg, positive slump test for neural tension test, positive dermatome involvement for L4 and L5, moreover, she was unable to sit longer than 5 minutes without increases in back pain. Her pain subsided to 4-6/10 pain after physical therapy treatment was provided 3 times a week for three weeks. She received treatment of soft tissue massage for iliopsoas, paraspinals, quadratus lumborum, hamstrings, and abdominals, muscle stretching for hamstrings, paraspinals, abdominals, and iliopsoas. This individual also had intermittent manual traction for the lumbar spine for 20 seconds on and 5 seconds off for 7 minutes, and core strengthening exercise for the abdominals, gluteals, and back muscles during each treatment session. Her pain level remained 4-6/10 since her last treatment session in September 2017. She is currently not working and goes to school 3 times a week for approximately 5 hours which requires prolonged sitting. After school, her pain level is increases to 6/10 pain scale. On days she is not at school, her pain is reduced to 4/10 on the NPRS. This person was included in our study because her back pain was discogenic and pain level was consistent over two months. Evidence suggests that 80 to 90 percent of acute low back pain resolves within six weeks [14]. Hence, the patients with low back pain lasting less than two months were excluded. Another exclusion criteria was the increase in pain level more than 2/10 pain from standing to walking. Our hypothesis is that if pain increases with walking, axial loading exercise will more likely aggravate pain rather than reduce it.

For the therapeutic intervention, a small trampoline38 inches in diameter and 8.5 inches in height from the floor was used for axial loading (Fig. 1). The trial study design was two times a week for three weeks, or 6 sessions. No other form of treatment was provided to confound the potential effects of the axial loading. We limited the first session for 30 seconds to reduce the unexpected risk of pain aggravation.

Fig. 1. The therapeutic intervention, a small trampoline

Table 1. Process change NPRS for each session (unit : score)

NPRS for each session	1 Se.	2 Se.	3 Se.	4 Se.	5 Se.	6 Se.
How would you rate your pain now?	7–8	5	5–6	4–5	3–4	3
How would you rate your usual level of pain during last week?	4–5	6–7	5–6	7	5–6	3
How would you rate your best level of pain the last week?	2–3	3–4	2	2	2	2
How would you rate your worst level of pain during the last week?	7–8	7–8	7	8	6	5
How would you rate your pain now after loading exercise?	7	3–4	3–4	3–4	2–3	0

NPRS: Numeric Pain Rating Scale, Se. : session, The intervension of tramopline period was from February 20, 2018 to March 18, 2018.

The remaining five sessions were for 2 minutes each with frequency of 60 cycles/min. A review of cell and whole–disc tissue studies recommended 6–60 cycles/min [15]. The sports literature on IVD degeneration suggests that rapid, high–impact and sudden loading activities are detrimental for the IVD [16, 17]. The magnitude of axial loading was set at the level where the patientwas able to do bouncing without a change in pain level while she was bouncing on the trampoline. When she stopped, there was still no pain.

We used the Oswestry Disability Index (ODI) and NPRS as functional measurement tools. We asked the patient to fill out the ODI before the first trial session and after her sixth session and final session. The patient was also asked to fill out her pain level with NPRS before and after each session. This allowed measurement of immediate and long– term effects of the axial loading exercise on her pain level. The axial loading exercise sessions were on Tuesday and Friday afternoons after her school classes when her pain level was consistently around 6/10 pain scale to reduce confounding factors.Her pain levels decreased by 2–3 points out of 10 on the NPRS immediately following each session which is clinically significant. Her ODI score improved from 40% at the time of her first visit to

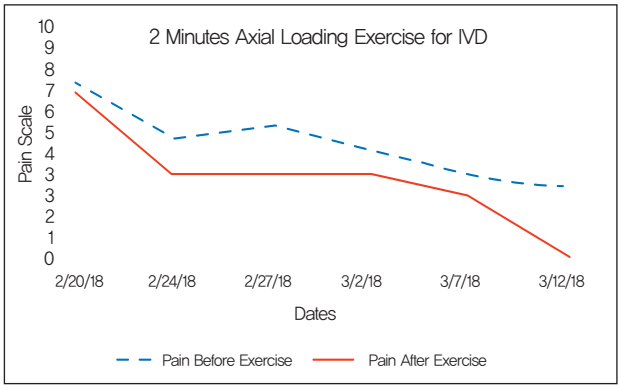

Fig. 2. Process change ODI for each session

22% at her final visit. Pain after the first treatment was 7/10 from 7/10 before treatment, and her pain after the final treatment was 0/10 from 3/10 before treatment (Fig 2).

DISCUSSION

The current case study demonstrates a positive correlation between low–grade axial loading and reductions in discogenic low back pain. The patient showed clinically significant improvements in the perceived levels of pain assessed through the NPRS and the functional status measured using the Oswestry. The patient reported immediate pain relief 1–2/10 NPRS after each session. The current belief is that axial loading is harmful to a degenerating disc [18]. The mechanism behind the observed improvement in pain and functional outcome is unclear but is possibly due to a combination of proprioceptive stimulus and redistribution of fluid in the disc by pumping action. This study is the first to assess the effects of low–grade axial loading exercise on discogenic chronic low back pain. Since there are no previous studies on this method of treatment, this study provides the groundwork for future studies on this topic. The results of this case study are useful as a new line of treatment to improve chronic discogenic low back pain in combination with the conventional methods. This can have interesting implications for clinicians in out–patient physical therapy since a vast majority of low back pain is discogenic in nature [19]. A strength of this study is that it can be easily replicated as most clinicians have access to mini–trampolines and there are minimal risks involved. As most daily weight–bearing activities cause axial loading in the intervertebral discs, the effectiveness of low–grade axial loading exercise as treatment needs to be further investigated concerning large sample size and with

more details of frequency, magnitude, and duration. Considering the chronicity of discogenic low back pain the results of this study are relevant in the manage-mentof LBP. The limitation of our current study is small sample size. Furthermore, the NPRS and Oswestry are both subjective outcomes of measure which can be suboptimal in their reliability as we are dependent on the patient's perception of their pain and functional capacity.

CONCLUSION

These study outcomes contrasted with previous evi-dence that axial loading is detrimental to disc health. The results of this study have positive implications for patients of chronic discogenic low back pain. The case is a precursor for future quantitative and quali-tative studies that may include more subjects, objec-tive measures of outcomes and apply randomization to improve the generalizability of the results along with the inclusion of objective measures to improve the reliability of the study.

REFERENCES

1. Chevan J, Clapis P. Low back pain in the United States. In: Physical Therapy Management of Low Back Pain: A Case Based Approach. Burlington, MA: Jones & Bartlett Learning; 2013: 1-14.
2. Boyle K. Managing a female patient with left low back pain and sacroiliac joint pain with thera-peutic exercise: a case report. Physiotherapy Canada. 2011; 63: 154-63.
3. Calvo-Munoz I, Gomez-Conesa A, Sanchez-Meca J. Physical Therapy treatments for low back pain in children and adolescents: a meta-analy-sis. BMC Musculoskelet Disord. 2013; 2(14):55.
4. Jette AM, Delitto A. Physical therapy treatment choices for musculoskeletal impairments. Phys Ther. 1997; 77(2):145-54.
5. Tonosu J, Inanami H, Oka H, Katsuhira J, et al. Diagnosing discogenic low back pain associated with degenerative disc disease using a medical review. PLOS ONE. 2016; 11: 1-9.
6. Belavy DL, Albracht K, Bruggemann G, et al. Can exercise positively influence the interverte-bral disc?. Sports Med. 2016; 46(4): 473-85.
7. Belavy DL, Quittner MJ, Ridgers N, Ling Y, et al. Running exercise strengthens the intervertebral disc. Scientific Reports. 2017; Article number 45975.
8. Nilsson M, Lagerstrand K, Kasperska I, et al. Axial loading during MRI influences T2-mapping values of lumbar disca: a feasibility on patients with low back pain. Eur Spine J. 2016; 25(9): 2856-63.
9. Kinder A, Filho FP, Ribeiro E, Domingues Rom, Domingues Rob, Marchiori E, Gasparetto E. Magnetic resonance imaging of the lumbar spine with axial loading: a review of 120 cases. Eur J Radiol. 2012; 81(4): e561-4 .
10. Elfering A, Burger C, Schade V, Radlinger L. Stochastic resonance whole body vibration increased perceived muscle relaxation but not cardiovascular activation: a randomized controlled trial. World J Orthop. 2016; 7(11): 758-765.
11. Wang XQ, Pi YL, Chen, PJ, et al. Whole body vibration exercise for chronic low back pain: study protocol for a single-blind randomized controlled trial. Trials. 2014; 15: 104.
12. Hodges PW, Richardson CA. Inefficient muscular stabilization of the lumbar spine associated with low back pain: a motor control evaluation of the transversus abdominis. Spine. 1996; 21: 2640-50.
13. Kaeding TS, Karch A, Schwarz R, et al. Whole-body vibration training as a workplace-based sports activity for employees with chronic low-back pain. Scand J Med Sci Sports. 2017; 27(12): 2027-39.
14. Van Tulder M, Becker A, Bekkering T, et al. European guidelines for the management of acute nonspecific low back pain in primary care. Eur Spine J. 2006; 15 Suppl 2: S169-91.
15. Chan SCW, Ferguson SJ, Gantenbein-Ritter B. The effects of dynamic loading on the IVD. Eur Spine J. 2011; 20: 1796-812.
16. Kraft CN, Pennekamp PH, Becker U, et al. Magnetic resonance imaging findings of the lum-bar spine in elite horseback riders: correlations with back pain, body mass index, trunk/leg-length coefficient, and riding discipline. Am J Sports Med. 2009; 37:2205-13.
17. Bartolozzi C, Caramella D, Zampa V, et al. The incidence of disk changes in volleyball players. The magnetic resonance findings [in Italian]. Radiol Med. 1991; 82:757-60.
18. Adams MA. Biomechanics of back pain. Acupuncture in medicine, 2004; 22(4): 178-88.
19. Schwarzer AC, Aprill CN, Derby R, et al. The rel-ative contributions of the disc and zygapophyseal joint in chronic low back pain. spine (Phila Pa 1976). 1994; 19(7): 801-6.