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Abstract

Pelvic floor dysfunctions are a widespread health issue that significantly disrupts the quality of life of those afflicted. This paper aims to present the research that proves how physical therapy, specifically pelvic floor muscle training, is an effective way to treat and prevent pelvic floor dysfunctions in women. Extensive research was done on the topic by exploring numerous scholarly databases and analyzing relevant articles on experimental trials, studies, and their results. After gaining an understanding of pelvic floor dysfunctions, studying the methodology of pelvic floor physical therapy, and examining numerous successful clinical trials, it has been determined that physical therapy is indeed beneficial in treating and preventing certain pelvic floor dysfunctions. Further research must still be conducted to establish the exact efficacy of pelvic floor physical therapy, determine which combination of treatment modalities achieves optimal results, and see if it is effective for various kinds of dysfunctions. However, pelvic floor physical therapy may be the key to restoring the quality of life in women suffering from pelvic floor dysfunctions.

Introduction

Pelvic floor dysfunctions (PFD) are extremely prevalent. Millions of women are affected by this widespread health problem which significantly affects their quality of life and decreases productivity. As many as 46% of women report having at least one form of PFD, and many suffer from more than one dysfunction (Milsom, 2015). PFDs can be described as weakness or damage to the muscles or tissue of the pelvic floor, primarily due to trauma or overuse of the muscles, and hinders their ability to contract or relax correctly. It causes uncomfortable symptoms such as urine or stool leakage, bloating, constipation, pelvic pain, and frequent urination. Besides for being a severe medical condition, PFDs create social difficulties as well. People with PFDs will avoid social interactions and physical activities, fostering embarrassment and negative self-perception, which affects their emotional and psychological health (Dumoulin et. al., 2018). This withdrawal may be further debilitating to a woman's overall well-being because physical activity is crucial to maintaining health and preventing anxiety, depression, high blood pressure, heart disease, obesity, and some cancers (Bø, Sherburn, 2005).

Women's Health Physical Therapy, a relatively new and growing specialty in the physical therapy world, refers to specific training done by a physical therapist to assess and treat diagnoses pertaining to women, especially those related to the pelvic floor muscles (King, 2013). With the emergence of this field, pelvic floor physical therapy became patients' first choice line of treatment due to its low risk and availability. The question then became, is physical therapy an effective way to treat PFDs? Moreover, if it is an effective treatment, can it also be used as a preventative measure for those at risk for PFDs?

Methods

This research was done by critically analyzing peer-reviewed and original articles accessed through Touro's online library database. Literature was taken primarily from the PubMed, ProQuest, and Google Scholar databases. A comprehensive review and analysis were done on each article to determine its relevance to the thesis of the effectiveness of physical therapy in treating and preventing pelvic floor disorders.

Anatomy of the Pelvic Floor

In order to properly understand the connection between weak pelvic floor muscles and their dysfunctions, a brief review of the anatomical structure of the pelvis is required. The bony pelvis, or pelvic girdle, is comprised of two hip bones fused to each other at the pubic symphysis. Each hip bone contains three parts; the ilium, the ischium, and the pubis. The broader, superior section is known as the greater pelvis, and the narrower, inferior section is known as the lesser pelvis. The pelvic inlet separates the greater and lesser pelvis. The pelvic outlet is the inferior opening of the pelvis, and it is closed by the pelvic floor (Herschorn, 2004). The space between the pelvic inlet and the pelvic outlet, which contains the urinary bladder, colon, and reproductive organs, is known as the pelvic cavity, or true pelvis. The female pelvis differs from that of a male because it has a wider diameter and a more circular shape. This wider pelvic outlet predisposes women to pelvic floor weakness (Herschorn, 2004).

The pelvic floor is made up of numerous muscles, classified into superficial and deep muscle layers. The levator ani and coccygeus muscles comprise the deep muscle layer and form the pelvic diaphragm. Two major muscles make up the levator ani: the iliococcygeus and pubococcygeus muscles. These originate from the pubic bone and insert into the coccyx. The puborectalis muscle originates from the pubic symphysis and encircles the rectum. Although it lies between the deep and superficial layers, the puborectalis is generally viewed as part of the levator ani. The pelvic diaphragm supports the pelvic viscera, maintains muscle tone, and can adjust the muscle tone to balance intra-abdominal pressure. The superficial muscle layer contains the ischiocavernosus and bulbocavernosus muscles, thin strips of transverse perineal muscle, and the

sphincter urethrae muscles. This layer comprises the urogenital diaphragm, which lies anteriorly over the pelvic outlet, under the pelvic diaphragm. The superficial muscle layer closes the urogenital hiatus, the gap through which the urethra and vagina pass through. It supports and acts as a sphincter at the distal vagina, and aids in continence (Herschorn, 2004). Both muscle layers of the pelvic floor work together as one functional unit. They are enveloped in a fascia that connects to the pelvic organs' fascia and helps support the organs (Bø and Sherburn, 2005). Sacral nerve roots, the pudendal nerve, and levator ani nerve innervate the muscles of the pelvic floor. These nerves, along with the pelvic floor muscles, help maintain urinary and fecal continence by offering continuous muscle tone to the pelvic floor (Wallace, 2019).

The pelvic floor muscles have numerous vital functions. They regulate bladder and bowel continence by maintaining control of the sphincters, provide support for the pelvic organs by keeping them inside the pelvic cavity, manage sexual function, and aid in lumbar and hip stability (King, 2013). In order to properly carry out these functions and avoid dysfunction, a strong, stable pelvic floor is essential (Herschorn, 2004).

Pathology of PFDs

The bone, muscles, and connective tissue of the pelvic floor together provide support for the pelvic girdle and its organs and aids in urinary, defecatory, and sexual function. In order to function properly, contraction, relaxation, and coordination of the pelvic floor muscles and urinary and anal sphincters are necessary. Therefore, the inability to properly contract or relax the pelvic muscles impairs voiding or defecation and causes pelvic pain and sexual dysfunction (Faubion, et. al. 2012). While pregnancy and childbirth are the leading risk factors for developing PFDs (Milsom, 2015), increasing age, number of births, and BMI are also factors correlated with a greater prevalence of PFDs (Wu, et. al., 2014).

Just like any other group of muscles, the pelvic floor may become overstretched or too tense. Hypotonus or low-tone dysfunctions are caused by a loss of muscle, nerve, ligament, or fascia of the pelvic floor muscles and create weakness and laxity of the muscles. These dysfunctions can occur as a result of traumatic injury, childbearing, gynecologic procedures, obesity, chronic constipation, or hormonal changes. Some examples include stress incontinence, urgency incontinence, and pelvic organ prolapse (Wallace et. al., 2019). Hypertonus or high-tone dysfunctions are due to the pelvic floor muscles becoming too tense. (Fox, 2009) Often, it is a result of repeated voluntary urine holding. Examples include pelvic myofascial pain, dyspareunia, vulvodynia, and sexual dysfunction (Wallace et. al., 2019). Abnormal gait or posture, skeletal disproportion, and excessive sitting may also cause pelvic dysfunctions. The hip, abdomen, pelvis, and spine are an interconnected kinetic chain, each one affecting the others during movement. Any disfunction in one area may cause another area to overcompensate and create further dysfunction. However, the specific cause of a person's PFD is often never identified and may be due to several contributing elements (Faubion et. al., 2012).

The three most common types of PFDs are urinary incontinence, fecal incontinence, and pelvic organ prolapse. Urinary incontinence is involuntary control of the bladder. It ranges in severity and causes random leakage and sudden urges to urinate. Similarly, fecal incontinence is the inability to control bowel movement causing stool leakage. The most common type of incontinence is stress-related, where leakage occurs due to physically straining activities that put pressure on the pelvic floor like coughing, sneezing, sports activities, or sudden changes in position. Urgency incontinence is when one experiences frequent strong urges to urinate and nocturia. A person can also have mixed incontinence, a combination of stress and urgency incontinence (Jundt et. al., 2015). The third widespread PFD is pelvic organ prolapse. This is when the pelvic organs drop from their original positions or press into the vagina due to weakness in the muscles and tissue supporting the organs. These three are all low-tone dysfunctions.

Pelvic Floor Physical Therapy

Pelvic floor physical therapy (PFPT) is a specialized form of physical therapy which aims to reduce symptoms of PFDs and improve the function, strength, and coordination of the pelvic floor muscles. The main goal of PFPT is pelvic floor muscle training (PFMT), an exercise program created to increase the strength, endurance, and relaxation of the pelvic floor muscles (Dumoulin et. al., 2018). To achieve maximum results, physical therapists combine PFMT with other therapeutic modalities such as behavioral education, manual therapy, biofeedback, electrical stimulation, and home-based exercise programs. PFPT is minimally invasive and is used as the first line of treatment for most pelvic floor disorders (Wallace et. al., 2019).

At an initial evaluation, a physical therapist will begin by reviewing the patient's demographics, symptoms, the onset of the condition, medical history, medications, and psychological or social stressors aiming to identify contributing factors to the condition. A thorough orthopedic assessment will be conducted, focusing mainly on the lumbar spine area, abdomen, hips, posture, gait, and lower

extremity strength and range of motion. Both internal and external examinations will be done to evaluate the pelvic floor muscles' strength and coordination and detect sore or tender areas (Fox, 2009).

There is no one standard method used to assess the physiological and functional condition of the pelvic floor. A visual inspection is generally done first, followed by a study of the contraction and relaxation of the patient's pelvic floor muscles. The contraction will yield an inward squeeze and lift of the pelvic floor when done correctly. The contraction is often not performed appropriately, resulting in straining instead of contracting the muscles. Many women require guidance for proper contractions. Digital palpation is a method used to evaluate the contraction, relaxation, areas of pain, tension, tenderness, and tone of the muscles. Women are asked to squeeze around the palpated finger, and the strength of their contraction is rated as either absent, weak, normal, or strong (Faubion et. al., 2012). Other diagnostic assessments are done to evaluate the pelvic floor muscles. Anal or vaginal manometry measures the resting pressure and pressure increase during contractions and gauges muscle tone and contractility using a perineometer or other pressure sensor. Electromyography (EMG) measures the electrical activity in the pelvic floor muscles and its accessory muscles to determine if the nerves innervating the muscles are intact and the precision of each contraction (Pedraza et. al., 2014). Ultrasound and MRI have also recently been used to evaluate the action of pelvic floor muscles during contraction, specifically to measure the actual muscle lift inside the pelvis. More research needs to be done to prove its validity, but ultrasound is a popular clinical diagnostic test due to its economic availability (Bø and Sherburn, 2005).

The physical therapist must determine the cause of the patient's symptoms and categorize the disorder into either low-tone or high-tone dysfunctions. The low-tone dysfunctions are caused by general muscle weakness in the pelvic floor and can be addressed with strengthening modalities such as Kegels and other strengthening exercises. High-tone dysfunctions are caused by exceedingly strong muscles and are addressed through muscle relaxation training. Biofeedback and electrical stimulation can be beneficial for both kinds of dysfunctions.

After the evaluation, the physical therapist will create a treatment intervention program choosing from numerous therapeutic modalities. The program is individualized for each patient based on the results of their diagnostic evaluation. The primary modality is therapeutic exercises for core strengthening, postural correction, and PFMT. The Kegel exercises are frequently utilized for training, reinforcing, and increasing elasticity of the pelvic floor muscles. Other modalities include manual therapy, electrical stimulation, and biofeedback. Manual therapy is a series of techniques applied to treat tension in the pelvic floor muscles and fascia by releasing internal and external soft tissue. Techniques used are stretching, trigger point therapy, massage, and connective tissue manipulation. Electrical stimulation is a painless and effective treatment for incontinence, urgency, and frequency and strengthens the pelvic floor. An electrode is placed into the vagina and stimulates the muscles to contract in a coordinated manner. Alternatively, electrical stimulation can be used to relax and soothe tight pelvic floor muscles. The effect it produces is similar to the muscular response of the Kegel exercises. Biofeedback is a system where sensors monitor the muscular activity of the pelvic floor, and the results are displayed to the patient while the exercises are performed. This technique offers patients motivational support based on the reinforcement method of the operant conditioning theory. With biofeedback, patients can see which muscles are being used and learn how to isolate the correct muscles (Fox, 2009). Through an improved awareness of correct contractions and relaxation, a patient can relearn how to manipulate his pelvic floor muscles in various positions properly. After the treatment period, patients are given a home exercise program to maintain the skills and incorporate them into their routines.

How does PFMT Work?

Dr. Arnold Kegel, an American gynecologist, was the first person to introduce PFMT exercises to treat and prevent incontinence and pelvic organ prolapse, based on his theory of strengthening the weak pelvic floor muscles (Park and Kang, 2014). Kegel defined pelvic muscle training as tightening and contracting the pelvic floor muscles multiple times a day in order to strengthen them. He claimed that training the pelvic floor muscles yielded a cure rate of 84% for various incontinence types. Kegels' trials were uncontrolled and not randomized, yet multiple controlled and randomized trials have since supported his claim and demonstrated the effectiveness of PFMT (Bø and Sherburn, 2005). Each muscle of the pelvic floor has its own function, yet combined, the pelvic floor muscle can do one voluntary mass contraction, which can be described most accurately as a squeeze and inward lift of the area surrounding the pelvic organs. The contraction stabilizes the muscles, resists downward movement, and closes the urethra (Bø, 2004). The muscle strength training theory is that leakage will stop or decrease by improving the strength, timing, and support of contractions, and pelvic pain will be reduced, giving the patient a

greater quality of life (Bø and Sherburn, 2005).

Physical therapists teach patients how to contract the pelvic floor muscle right before a stressor or physical exertion and to maintain the contraction throughout the stressor. This way, the urethra and bladder are unable to descend, preventing leakage from occurring (Bø, 2004).

Generally, skeletal muscles are strengthened by altering their morphology to have a greater cross-sectional area, enhanced neuromuscular function, and increased muscle tone. The pelvic floor muscles are regular skeletal muscles, so their muscle strength training should be like that of typical skeletal muscles. Furthermore, connective tissue is found inside and surrounding all skeletal muscles, providing strength, stiffness, and support for muscle loading. Exercise and strength training increase connective tissue mass, which also indicates effective muscle training (Bø, 2004).

PFPT in Treating PFDs

Numerous studies demonstrate the efficacy of PFPT in treating PFDs. Dumoulin and colleagues conducted a study that reviewed clinical trials to assess the effectiveness of PFMT on urinary incontinence. This was done by comparing the results of two randomly assigned groups, one that engaged in PFMT and one that did not engage in any treatment or used inactive treatments such as management techniques. Cure or improvement of the condition, quality of life, frequency of leakage, amount of urine loss, and side effects are factors considered in the study. They found that after doing PFMT, women were, on average, five times more likely to report being cured and two times more likely to report cure or improvement from any urinary incontinence. Leakage episodes from the PFMT group were reduced to one less episode in a 24-hour period, and side effects were rare. The PFMT group had an improved quality of life and a higher treatment satisfaction rate compared to the control group, who had a greater likeliness of pursuing additional treatment (Dumoulin et. al., 2018).

Tosun et. al. also wanted to determine whether symptoms of urinary incontinence could be decreased through PFMT and if strengthening the pelvic floor muscle to grade 5 on the Oxford scale can completely abolish incontinence. The oxford grading system is a six-point scale used to measure pelvic muscle strength. It starts at zero, which rates no contraction, and goes up till five, which rates strong. They conducted a randomized and controlled clinical trial of 130 incontinent women divided into a PFMT group and a control group. Urinary incontinence symptoms and their severity were evaluated by a gynecologist utilizing the Incontinent Impact Questionnaire and Urogenital Distress Inventory. Urine loss and frequency were measured by bladder diaries, stop tests, and pad tests. A physical therapist then evaluated pelvic floor muscle strength and function using palpation, perineometer measurements, and ultrasound imaging. These evaluations were done before and after the treatment period. The PFMT program for the experimental group consisted of patient education, instruction on correct pelvic muscle contractions, and exercises individualized towards each patient's strength and tolerance, which were adjusted as they progressed. After a 12-week treatment period, results showed that the PFMT group had significant improvement in symptoms after treatment, whereas the control group had no significant difference. The PFMT group achieved better results in all measured assessments than the control group. According to their bladder diaries, nearly all the patients who reached a grade 5 in muscle strength, were cured of incontinence and nighttime urination (Tosun et. al., 2015). This experiment further proves that PFMT is an effective treatment for urinary incontinence.

Research suggests that women with PFDs have a reduction in the cross-sectional area (CSA) of the levator ani muscle. When skeletal muscles are strengthened, their CSA increases. Therefore, measuring for an increase in the CSA of levator ani muscle would be an effective way to see if PFMT is a successful treatment for PFDs. Bernardes et. al. did this by performing an experiment to test the efficacy of PFMT in increasing the CSA of the levator ani in women diagnosed with pelvic organ prolapse. Women were randomly allocated into three groups. The treatment for the first group consisted of only pelvic floor muscle contractions. The second group did a more comprehensive treatment consisting of pelvic floor muscle contractions, hypopressive exercises, and diaphragmatic breathing. The third group was the control group and received no treatment. The CSA of the levator ani muscle was measured using two-dimensional ultrasonography before and after the three-month PFMT treatment period. It was found that groups one and two had considerable differences in the CSA of the levator ani, while the control group did not. These findings suggest that PFPT significantly increases the CSA of the levator ani in women with pelvic organ prolapse (Bernardes et. al., 2012).

PFPT in Preventing PFDs

Since multiple studies indicate that PFPT is an effective treatment for PFDs, and the risk factors for PFDs are known, researchers sought to determine if PFPT could go as far as preventing PFDs from occurring in people who are at risk. In a systematic review data from six different clinical trials suggests that those who performed PFMT during

pregnancy decreased incontinence during late pregnancy and up to six months postpartum compared to those who engaged in usual care (Woodley et. al., 2017).

A randomized and controlled trial was conducted to determine whether PFMT during pregnancy was an effective prevention for urinary incontinence. Three hundred and one women attending their routine ultrasound scan at 18 weeks gestation, who were pregnant with their first child and continent before pregnancy, received instruction on the anatomy of the pelvic floor and correct pelvic muscle contractions. They were then randomly split into two groups. The experimental group received intense training consisting of PFMT twice daily and a weekly one-hour exercise class given by a physical therapist, which included pelvic floor muscle contractions, breathing exercises, and muscle strength training for the abdomen, back, and thighs. The control group engaged in standard antenatal care. After the treatment period, the PFMT group was 33% less likely to self-report urinary incontinence at 36 weeks gestation and 39% less likely at three months postpartum. These results indicate that supervised, intense PFMT in early pregnancy decreased the risk of self-reported urinary incontinence by approximately one-third in late pregnancy and three months postpartum compared to usual care (Hay-Smith, 2003).

Discussion

While there is a plethora of research on the effects of PFPT on PFDs, many question the accuracy of the research. Many of the trials done on the subject do not have an ideal sample size. Sample size strongly influences the outcomes of a trial, as a huge sample size may overestimate the results, while a small sample size may not reveal results accurately due to low power and higher margins of error. The length of the training periods, type of exercises, frequency, duration, and intensity also impact the results of a trial. Since researchers have different interpretations of 'intense training,' different intensity levels yield different outcomes (Mørkved and Bø, 2013). Therefore, a set, intense exercise program must be established specifying the duration, frequency, and intensity of each exercise so that studies can compare results accurately.

Patient supervision during training is another aspect that must be considered. If a physical therapist is present during training, he can verify that the exercises and contractions are being done correctly. Often, patients are not aware of how to perform a proper pelvic floor contraction and instead contract their gluteus, abdomen, or hip adductor muscles. Improper contractions can cause straining of the pelvic floor, which results in further dysfunction (Bø, 2006). If the contractions are done wrong, the entire study is counterproductive because the patients can be worsening their conditions instead of improving them. When patients are not supervised, there is no way to know if they adequately adhered to protocol, which is a crucial factor in the outcome of a trial. The results will then be ineffective because the true effect of PFMT cannot be evaluated. In future studies, new methods for monitoring patient adherence in a supervised manner must be developed to determine if the results are accurate.

Another significant aspect that questions the accuracy of this research is that diagnosis, results, and adherence are mostly based on self-reports from the patients using general questionnaires, interviews, or diaries. Patients are subjective and can over or underestimate their symptoms, compliance, and participation. Perhaps, better techniques must be utilized in evaluating patients to gather more objective data. Additionally, there is a lack of research studying the timeliness factor in the studies done. How early a person begins muscle training may have a positive effect on treatment and prevention outcomes (Romeikiene and Bartkevičienė, 2021). Also, researchers only analyzed the effects of PFMT for up to six months postpartum. More research is required to see if PFPT is an effective long-term treatment as well.

There is an abundance of clinical trials, systematic reviews, and experiments regarding the prevention and treatment of urinary incontinence. However, there is a lack of adequate research done on the effects of PFPT in the prevention and treatment of pelvic organ prolapse and other kinds of PFDs. Based on the few trials and reviews that do exist, it seems that PFPT is effective, although there is no concrete evidence that it is beneficial for all kinds of PFDs. Therefore, it is still an area of dispute and requires further investigation. One reason for the lack of studies may be because intense physical exertion, especially when the activities are performed incorrectly, can trigger or exacerbate PFDs. In the postpartum period, there is an increase in physical activity due to the return to the lifestyle prior to pregnancy and caring for a baby, which involves lots of exertion. For this reason, trials and reviews are unable to offer strong evidence that PFPT is effective because other factors may be worsening PFD symptoms at the same time. (Romeikiene and Bartkevičienė, 2021).

Conclusion

After studying the causes and detrimental effects of PFDs and exploring the field of PFPT, one can understand and appreciate the positive impact PFPT may have on the lives of suffering women. Research thus far indicates that PFPT is an

effective way to treat and prevent PFDs in women. Additional investigation is still required to determine the exact efficacy of PFPT under more supervised and controlled conditions. There is hope that further research will prove the effectiveness of PFPT, making this preferred treatment method more widespread and accepted in the medical world and giving women the quality of life they desire.

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