6 RESPECTING THE BOUNDARIES OF PHYSICAL CONTACT IN THE CLIENT/PATIENT - PHYSIOTHERAPIST RELATIONSHIP IN THE FUNCTIONAL DIAGNOSTICS AND THERAPY OF CENTRAL STABILIZATION DISORDERS

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6.1 Core stability

WHAT IS CORE?

Core stability encompasses the lumbo-pelvic complex and refers to the ability to maintain the balance of the spine within its physiological limits while preserving structural integrity. Several authors have proposed a more functional perspective to describe the core as the foundation of the kinetic chain responsible for facilitating the transfer of torque and momentum between the lower and upper extremities for gross motor tasks of daily living, exercise, and sport. Core stability necessitates instantaneous changes by the central nervous system to elicit appropriate combinations and intensities of muscle recruitment for stiffness (i.e., stability) as well as mobility demands of the system. Core stability requires the activity of the central nervous system (CNS) to trigger the right combination and intensity of muscle recruitment for stability and mobility. (Kibler et al., 2006)

FUNCTIONAL CORE ANATOMY

Core stability involves a muscular cylinder consisting of the transversus abdominis (TVA or TrA) and internal abdominal muscles at the front, the multifidus muscle and the rear fibres of the psoas major muscle at the back, the diaphragm on top, and pelvic floor muscles at the bottom. These muscles are anchored to the thoraco-lumbar fascia and the spine area, creating what's known as the kinematic chain. These muscles help to stabilize the spine, pelvis, and kinetic chain during functional movements. Without these muscles, the spine would become mechanically unstable. One of the parameters influencing spinal mechanics and stiffness is intra-abdominal pressure (IAP). (Frank et al., 2013; Willson et al., 2005).

Intra-abdominal pressure is increased through the tension of the thoracolumbar fascia and the contraction of muscles like the transversus abdominis and multifidus.

The heightened tension of the thoracolumbar fascia and the resulting intra-abdominal pressure, which stem from muscle contraction, also play a role in supporting each spinal vertebra within the region. (Novak et al., 2021; Nelson, 2012).

The lumbopelvic-hip complex, often referred to as the "core," consists of the lumbar vertebrae, the pelvis, the hip joints, and both active and passive structures that either enable or restrict movement in these segments. The stability of any system refers to its capacity to limit displacement and preserve structural integrity. Core stability can be defined as the ability of the lumbo-pelvic-hip complex to prevent the vertebral column from buckling and restore it to equilibrium following perturbations. (Willson et al., 2005)

The core stability kinematic chain, which includes the iliac crest, the trunk, and the pelvic girdle, is responsible for postural control, overall movement control, as well as the distribution and transfer of forces in the lower limb area. The Panjabi model elucidates the mechanisms of central stabilization, consisting of three interconnected subsystems: passive (bony and joint structures), active (muscles), and the neural component (muscle control). The primary function of these static tissues is to maintain stabilization at the end range of motion in the joint. As tensile forces increase, mechanical resistance to movement is also produced to transmit information about position and load to the neural subsystem via mechanoreceptors. The active subsystem consists of the core musculature, and its task is to provide dynamic stabilization of the spine and proximal appendicular skeleton, as well as movement information to the neural control subsystem.

The central element is the neural control subsystem for incoming and outgoing signals, which ultimately create and maintain core stability. Importantly, continuous interaction between the three subsystems is necessary to maintain stability. (Huxel & Anderson 2013; Wirth et al., 2017)

Any dysfunction within the lumbo-pelvic-hip complex can lead to disruptions in the stabilization mechanism. This results in the generation of abnormal movement patterns, followed by the occurrence of structural damage to the musculoskeletal system.

Hodges and Richardson (1997) have described a "feedforward" mechanism, which means that deep muscles are activated before movements of the upper or lower limbs. This early activation ensures the stability of the trunk during these movements.

The "feedforward" process involves recruiting deep muscles to support overall movement, allowing for smooth, uncompensated movements. In healthy individuals, the transversus abdominis and multifidi contract before the shoulders or legs move, stabilizing the lumbar spine. (Vasselin et al., 2012)

The transverse abdominis muscle plays a key role in stabilizing the lumbar spine. Its contraction increases intra-abdominal pressure and tensions the thoracolumbar fascia, which contributes to lumbar stabilization. In this way, the spine is stabilized before peripheral movements are generated, providing the limbs with a stable base for movement, muscle activation, and the production of functional movement in accordance with physiological movement patterns.

Functional motion is defined as the ability to maintain balance, mobility, and stability along the kinematic chain. Integral functional movement is a model of precision and efficiency. Deficits in postural control, impaired balance, altered proprioception, and inefficient motor control contribute to pain, dysfunction, and incorrect movement patterns. (Uddin & Ahmed 2013).

Research results indicate that weak central stabilization can increase the risk of limb injuries in physically active individuals. Many authors describe various classifications of core stability in dynamic stabilization. These include local stabilizers (single-joint deep muscles) and global mobilizers (multi-joint superficial muscles).

Local muscles are located deeply and attach to or near the spine, consisting of Type I (slow-twitch) muscle fibres. These muscles primarily work eccentrically to control movement and maintain static stabilization. They include, for example, the multifidus, transversus abdominis, internal obliques, medial fibres of the external obliques, quadratus lumborum, diaphragm, and lumbar segments of the iliocostalis and longissimus.

Global muscles are located more superficially, with a greater proportion of Type II (fast-twitch) muscle fibres. They connect the trunk to the limbs, working concentrically to generate large torque and power during movement. These include, for example, the rectus abdominis, lateral fibres of the external obliques, erector spinae, thoracic segments of the iliocostalis, and gluteals. Their main function is to generate torque and movement in the joints. (Teixeira et al., 2019; Behm et al., 2022; Zielonka-Pycka et al., 2017)

Gibbons and Camerford (2001) proposed a functional model that further divided global muscles into stabilizers and mobilizers. The functional model maintained the local stabilizers and separated the global muscles into stabilizers (internal and external obliques, spinalis) and mobilizers (rectus abdominus, iliocostalis).

Stabilizers generate force eccentrically to control movement throughout range of motion, while mobilizers concentrically accelerate through range of motion and act as shock absorbers, especially in the sagittal plane. Behm et al. (2010) also maintained the local stabilizer category and divided the global muscles into mobilizers and transfer load categories. The transfer muscles are separate yet integral to core stability because they have fascial attachments that stiffen the core and transfer force through the kinetic chain.

On the other hand, Behm et al. (2010) categorized global muscles into mobilizers and load-bearing muscles. (Gibbons & Comerford 2001; Behm et al., 2010)

6.2 Core stability in the prevention of Low Back Pain and traumatic injuries

Core stability encompasses the passive structures of the thoracolumbar spine and pelvis, as well as the active involvement of the torso muscles. Stability relies on neuromuscular control of the torso in response to both internal and external forces, including those generated by distant body parts and expected or unexpected disruptions. According to the general definition in sports medicine literature, stability forms the foundation for dynamic trunk control, enabling the generation, transfer, and control of force and movement to further segments of the kinetic chain. Core stability is a fundamental element in regular activities, involving integrated activation of multiple segments to provide force generation, proximal stability for distal mobility, and the creation of interactive moments. (McGill et al., 1999; Kibler et al., 2006; Zemková & Zapletalová 2022, Dendas, 2010).

As mentioned by the authors, even slight disruptions in proprioception and core neuromuscular control can influence the risk of the occurrence of Low Back Pain (LBP) and lower limb injuries in active populations. (Butowicz et al., 2016; Huxel & Anderson 2013; Abdelraouf & Abdel-Aziem 2016).

Low Back Pain (LBP) remains a significant health and financial issue for large populations. Spinal misalignments, biomechanical disorders, and overuse injuries influence the incidence of chronic LBP. One case for the development of LBP is a loss of motor control (dysfunction of the abdominal and back muscles). An important risk factor for LBP is weakness and low activity of the muscle system which contains the lumbar multifidus, transversus abdominis, pelvic floor muscles and diaphragm. In the case of this low activity of deep muscles, the global muscles system – rectus abdominis, erector spinae and abdominal oblique muscles compensate to maintain the stabilization of the lumbar region. This compensation is one of the causes of LBP. The transversus abdominis and lumbar multifidus play a very important role in spinal stabilization. Many authors believe that the application of core stabilization exercises yields better treatment outcomes than conventional physiotherapy. These exercises can positively affect the level of functional limitations, improve the function of spinal stabilizers, which correct posture control, and deep muscles, thereby increasing joint mobility and balance. Ali et al. (2022) Based on a conducted meta-analysis, the authors concluded that core stabilization exercises are widely used and increasingly popular among physiotherapists for treating non-specific LBP. The review results indicate the effectiveness of deep muscle exercises in alleviating symptoms and improving patient functioning in patients with acute non-specific LBP. Although the clinical benefits of these exercises have been demonstrated in the short term, the long-term effects remain unclear. (Smrcina et al., 2022)

According to Hlaing et al. (2021) core stabilization exercise is superior to strengthening exercise. It is effective in improving balance, proprioception and reducing functional disability in patients with subacute NSLBP. However, this position is not supported by other authors such as Shamsi et al. (2016), who claim that core stabilization exercises do not have a better therapeutic effect than traditional physiotherapy in alleviating pain in individuals with non-specific LBP.

Comparable results after conventional physiotherapy and McGill stabilization exercises have been observed by other authors. (Ghorbanpour et al., 2018)

The results Puntumetakul et al. (2021) of the two-group studies showed significant differences in the 5-Sit-Stand Test (FTSST) scores and pain intensity between the trunk stabilization exercise (CSE) and trunk strengthening exercise (STE) programs after ten weeks of exercise training and after 3 months of follow-up. The proportion of abdominal muscles improved significantly in the CSE group after ten weeks of exercise compared to the STE group. The study results suggest that both exercises can improve balance and reduce pain intensity in patients with chronic low back pain and clinical lumbar instability. The CSE group observed greater improvement in deep abdominal muscle activation than the STE group. (Lengkana et al., 2019).

Deficit of core stability may lead to increased risk of traumatic injuries including ACL damage. (Kibler et al., 2006) Core stability is described in the literature as dynamic control of the lumbopelvic complex, facilitating the transfer of rotational force and momentum between the upper and lower limbs during large motor tasks associated with sports, exercise, and daily life. During functional tasks, trunk muscles activate prior to upper and lower limb muscles (feedforward mechanism), creating a stable base for limb mobility. Furthermore, trunk muscle strength effectively reduces joint loads and controls the direction of movement of the lower limbs, especially the knees. Poor coordination of trunk muscles may result in compensatory patterns and increase the risk of anterior cruciate ligament (ACL) injury. Systematic review studies (Larwa et al., 2021), have shown that weak trunk stability, weak hip abduction strength, increased knee valgus, and landing on heels may contribute to increased ACL injury risk in young athletes. A three-year prospective study demonstrated that athletes with poor central stability during loaded exercises exhibited excessive internal hip rotation and consequently increased knee valgus. This may potentially contribute to ACL injury. (Larwa et al., 2021; Zazulak et al., 2007)

Attar et al. (2022), in a systematic review and meta-analysis, examined the impact of injury prevention programs incorporating trunk stability exercises on knee injuries and ACL injuries. They found that exercise programs including trunk stability exercises reduce the incidence of knee injuries by 46% in males and 65% in females.

The authors suggest that coordination of trunk muscles is essential for proper generation, transfer, and control of forces and movements within the body. However, weakening or decreased coordination, disrupted timing of trunk muscle activation, may lead to abnormal movement patterns and various types of sports injuries. (De Blaiser et al., 2019; De Blaiser et al., 2021)

It has been demonstrated that trunk stability exercises can correct muscular imbalance and improve trunk muscle coordination, positively impacting knee kinematics, hip strength, and trunk endurance in male athletes following ACL reconstruction (ACLR). Based on the study findings, incorporating simple trunk stability training before routine team training may reduce the risk of secondary injuries. The authors advocate for the benefits of integrating stability training into exercise programming, preventive protocols, and regular rehabilitation programs. According to Lee & McGill (2015), isometric exercises of the trunk in athletes can develop trunk stiffness, while minimizing spine overload. Due to the low load on the spine during these exercises, athletes can perform them almost every day during the training period. Researchers say a 15- to 45-minute isometric training program combined with a strength and conditioning program provides core stability.

For individuals involved in physical activities, such as athletes, having a strong and stable core is essential. Core stability is vital for injury prevention, and there are several reasons why it is so important:

1. Spinal Alignment and Posture

Core stability helps maintain proper spinal alignment and posture, reducing the risk of overuse injuries and strain on the spine.

2. Transfer of Power

A stable core enhances the transfer of power between the upper and lower body during athletic movements, such as throwing, kicking, and jumping, which can improve performance and prevent compensatory movements that lead to injuries.

3. Injury Resilience

By improving core stability, individuals are less likely to experience common injuries such as lower back pain, muscle strains, and joint sprains, particularly during dynamic movements and sudden changes in direction. (McGill, 2010)

Core stability enhances injury prevention through:

1. Muscular Support

Strong core muscles provide support to the spine and pelvis, reducing excessive loading on other structures.

2. Improve Balance and Coordination

A stable core improves balance and coordination, reducing the risks of falls and traumatic injuries.

3. Enhanced Proprioception

Core stability enhances proprioceptive awareness, allowing athletes to respond effectively to external forces and maintain control during movements. (Willson et al., 2005; Behm et al., 2022; Kibler et al., 2006; McGill, 2010).

However, it's worth noting that the concept of core stability has both proponents and critics, and scientists have expressed varying viewpoints on the topic in the existing literature.

According to some authors:

Weak trunk muscles, weak abdominals and imbalances between trunk muscles groups are not pathological and weak or dysfunctional abdominal muscles are not case of back pain.

Damage to abdominal musculature does not seem to be detrimental to spinal stability.

The core stability exercises are no more effective than, and will not prevent injury more than, any other forms of exercise.

There may be potential danger of damaging the spine with continuous tensing of the trunk muscles during daily and sports activities. (Lederman, 2010; Lederman, 2011)

Classification into 'local' and 'global' muscle groups is inappropriate. (Wirth et al., 2017)

6.3 Functional diagnosis of the core

Functional diagnostics is an area of physiotherapy that deals with assessing the musculoskeletal system, including the evaluation of recruitment, strength, and endurance of the core muscles. (Kibler et al., 2006).

It allows for identifying dysfunctions, neuromuscular control disorders, and, based on these findings, planning and implementing a physiotherapy program to improve overall function. Implementing proper diagnostics is key to creating an optimal therapeutic plan. The simplest way to assess core muscle function is to evaluate the voluntary contraction of the transversus abdominis muscle. This involves palpating the transversus abdominis muscle in a medial direction and just below the anterior superior iliac spines, right next to the rectus abdominis muscle. This assessment is performed while the individual taking an abdominal drawing-in manoeuvre (ADIM) technique. (Vasseljen et al., 2012; Willson et al., 2005).

This initial examination helps identify improper recruitment and/or muscle function. In addition to palpation, objective methods like ultrasound (USG) are also used to assess muscle contraction. To evaluate core muscle strength and endurance, diagnostic tests such as the McGill Muscular Endurance Test protocol can be employed.

The test consists of 3 tests, and the results are recorded in a prepared protocol sheet.

1. The Trunk Flexor Endurance Test evaluates the endurance of the deep abdominal muscles, including the transversus abdominis, quadratus lumborum, and erector spinae. It is also a timed, isometric test that focuses on the static contraction of these

muscles, which help stabilize the spine, and continues until fatigue or significant compensatory movements of the torso occur **(Picture 1)**

2. The Trunk Lateral Endurance Test measures the endurance of the lateral muscles, including the transversus abdominis, obliques, quadratus lumborum, and erector spinae. This timed test involves static, isometric contractions of the lateral muscles on both sides of the torso to stabilize the spine. The test is performed with the participant lying on their side, raising their hips, and supporting their body weight on the elbow and feet. This test is conducted for both sides of the body. **(Picture 2)**

3. The Trunk Extensor Endurance Test assesses the endurance of the back muscles, including the erector spinae, latissimus dorsi, iliocostalis, and multifidus muscles. It is a timed, isometric test that involves a static contraction of these extensor muscles, which stabilize the spine. The test is conducted with the participant lying face down, hips and upper torso extending over the edge of a table, while the lower limbs are stabilized. **(Picture 3)**

When performing diagnostic tests, the patient's posture, positioning of the head, pelvis and spine curvatures as well as the correct breathing pattern are important.

Picture 1 The Trunk Flexor Endurance Test

Picture 2 The Trunk Lateral Endurance Test

Picture 3 The Trunk Extensor Endurance Test

The results obtained from the tests, which are measured in seconds, are entered into a prepared study protocol sheet and then subjected to analysis.

Table 1 McGill's torso muscular endurance test battery—record sheet

Trunk flexor endurance test Time to completion: ________________
Trunk lateral endurance test Right side time to completion: ____________ Left side time to completion:____________
Trunk extensor endurance test

Time to completion: _______________	
Ratio of Comparison	**Criteria for Good Relationship Between Muscles**
Flexion:extension	Ratio less than 1.0
Right-side bridge:left-side bridge	Scores should be no greater than 0.05 from a balanced score of 1.0
Side bridge (each side):extension	Ratio less than 0.75
Flexion:extension ratio: ________________ Rating: q Good q Poor	
Right-side bridge:left-side bridge ratio: _________ Rating: q Good q Poor	
Side-bridge (each side):extension ratio: _________ Rating: q Good q Poor	

Source: https://www.acefitness.org/cmes-resources/pdfs/02-10-CMES-McGillsTorsoEnduracneTest.pdf

6.3.1 The method of recording results and Interpretation

Procedure for assessing results according to the McGill Muscular Endurance Test protocol.

To perform accurate calculations and interpret results, it is essential to use a diagnostic card. This minimizes the possibility of errors and enables a precise assessment of outcomes for functional diagnostics before, during, and/or after therapy, as well as intervention programming. (McGill, 2010)

Table 2 Results recording procedure according to the McGill Muscle Endurance Test protocol

Trunk flexor endurance test
Time to completion: ________ 1

Trunk lateral endurance test
Right side time to completion: ________ 2 Left side time to completion: ________ 3

Trunk extensor endurance test
Time to completion: ________ 4

Ratio of Comparison	Criteria for Good Relationship Between Muscles
Flexion:extension	Ratio less than 1.0
Right-side bridge:left-side bridge	Scores should be no greater than 0.05 from a balanced score of 1.0
Side bridge (each side):extension	Ratio less than 0.75

Flexion:extension ratio: ________ 5 Rating: ❑ Good ❑ Poor

Right-side bridge:left-side bridge ratio: ________ 6 Rating: ❑ Good ❑ Poor

Side-bridge (each side):extension ratio: ________ 7 Rating: ❑ Good ❑ Poor

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Step number 1: method of recording obtained data

1). For the "Trunk flexor endurance test" row (1), record the result measured in seconds.

2). For the "Trunk lateral endurance test," record the result measured in seconds for the right side (2) and for the left side (3).

3). For the "Trunk extensor endurance test" row, record the result measured in seconds (4).

Step number 2: calculations/relationships

In the "Flexion: extension ratio" row (5), enter the result - the quotient (ratio) of the score achieved in the trunk flexor endurance test (1) to the score achieved in the trunk extensor endurance test (4).

In the "Right side bridge: left side bridge" row (6), enter the result - the quotient (ratio) of the score achieved in the lateral endurance test for the right side (2) to the score achieved in the same test for the left side (3).

In the "Side bridge (each side): extension ratio row (7), perform two calculations:

- The ratio of the score achieved in the lateral endurance test for the right side (2) to the score achieved in the trunk extensor endurance test (4).
- The ratio of the score achieved in the lateral endurance test for the left side (3) to the score achieved in the trunk extensor endurance test (4).

Table 3 Results recording procedure according to the McGill Muscle Endurance Test protocol.

Trunk flexor endurance test
Time to completion: 75

Trunk lateral endurance test
Right side time to completion: 52   Left side time to completion: 50

Trunk extensor endurance test
Time to completion: 70

Ratio of Comparison	Criteria for Good Relationship Between Muscles
Flexion:extension	Ratio less than 1.0
Right-side bridge:left-side bridge	Scores should be no greater than 0.05 from a balanced score of 1.0
Side bridge (each side):extension	Ratio less than 0.75

Flexion:extension ratio: 75:70= 1.07	Rating:	❑ Good	❑ Poor
Right-side bridge:left-side bridge ratio: 52:50=1.04	Rating:	❑ Good	❑ Poor
Side-bridge (each side):extension ratio: 52:70=0.74 50:70= 0.71	Rating:	❑ Good	❑ Poor

Example calculations:

1. Trunk Flexor Endurance Test: 75s
2. Trunk Lateral Endurance Test:
   - Right side: 52s
   - Left side: 50s
3. Trunk Extensor Endurance Test: 70s

Calculations:

1. Flexion: extension ratio = 75 / 70 ≈ 1.07
2. Right side bridge: left side bridge = 52 / 50 = 1.04

3. Side bridge (each side): extension ratio:
   - Right side = 52 / 70 ≈ 0.74
   - Left side = 50 / 70 ≈ 0.71

Step number 3: interpretation of results

For interpreting the results, utilize the data from the table marked in green color and markers indicated by red squares.

Table 4 Results assessment procedure according to the McGill muscular endurance test protocol.

Trunk flexor endurance test Time to completion: 75	
Trunk lateral endurance test Right side time to completion: 52	Left side time to completion: 50
Trunk extensor endurance test Time to completion: 70	

Ratio of Comparison	Criteria for Good Relationship Between Muscles
Flexion:extension	Ratio less than 1.0
Right-side bridge:left-side bridge	Scores should be no greater than 0.05 from a balanced score of 1.0
Side bridge (each side):extension	Ratio less than 0.75

Flexion:extension ratio: 75:70= 1.07	Rating: ❑ Good ☒ Poor
Right-side bridge:left-side bridge ratio: 52:50=1.04	Rating: ☒ Good ❑ Poor
Side-bridge (each side):extension ratio: 52:70=0.74 50:70= 0.71	Rating: ☒ Good ❑ Poor

Interpretation of results

The Flexion: extension ratio of 1.07 is outside the norm. Therefore, at the marker corresponding to this row, mark the relationship as "poor."

The remaining criteria are met, so mark the relationships as "good."

Recommendations: Focus training on balancing muscular strength between trunk flexors and extensors, with emphasis on trunk extensors. (McGill, 2010)

6.4 Training

After conducting the functional diagnostic tests, such as the McGill protocol, and analyzing the results, a training or physiotherapy program can be planned. The intervention should be individually tailored to the exerciser's fitness level. To increase the intensity of the exercises, progressive training should be applied. This includes upper body movements, diaphragmatic breathing exercises, unstable surfaces, and sport-specific functional training. Progressive exercises improve muscle recruitment and have a positive impact on sports performance and injury prevention. (Kibler et al., 2006)

Training the core muscles is an integral part of physiotherapy and forms the basis for healthy body movement. Dysfunctions in core stability can lead to increased forces on the spine and the development of compensations in the distal parts of the body. This, in turn, can result in spinal overloads and biomechanically inefficient movements, leading to reduced overall function. (McGill, 2010; Lee & McGill, 2015).

Core stability training involves exercises for the muscular corset surrounding the torso and the lumbo-pelvic complex. Its primary purpose is to provide stability and protection for the spine during various movements, ranging from everyday activities to complex motions in sports.

This is linked to their function, which includes:

1. Reducing forces acting on the spine.
2. Facilitating the proper and most efficient transfer of forces from the lower part of the body to the upper part, and vice versa.

Endurance core stability is a vital element in preventing traumatic injuries and Low Back Pain (LBP), as well as enhancing athletic performance. Injury prevention is linked to better spine stability during movement and the ability to perform physiological movement patterns without pathological compensations. To achieve mobility in peripheral joints, it is necessary to establish proximal stability beforehand. An essential aspect of training is proper controlled diaphragmatic breathing, which determines the correct tension of deep muscles.

Core muscle training, like any other muscle training, should be progressive, meaning that the training load should be gradually increased. It's important to remember that too rapid progress can lead to incorrect exercise patterns or compensatory movements. (Willson et al., 2005; Behm et al., 2022; McGill, 2010; Lee & McGill, 2015; McGill & Karpowicz 2009; Mullane et al., 2021).

Core exercises may include: Bird dog, Side plank, McGill sit-ups, Glute Bridge Hold, and Pallof press with a resistance band.

6.5 Ethics and cultural differences

Understanding the rules how to conduct an interview while respecting ethics and cultural differences. The principles of relationship and how to conduct functional diagnostics, including palpation and training/physiotherapy. It's crucial to clarify actions, such as observing how the patient moves and performs tasks or performing abdominal palpation.

An essential aspect to pay attention to is communication between the client/patient and the therapist. Communication can be particularly challenging in therapy where touch, in addition to verbal communication, is a primary means of interaction. This can pose challenges for both the client/patient and the physiotherapist. In the physiotherapist-client/patient relationship, one of the elements of effective communication is the ability to interpret nonverbal signals, including those stemming from the patient's reaction to the type and pressure of the touch applied by the physiotherapist.

Should be aware that the profession of a physiotherapist lacks clearly defined norms that specify the protocol for appropriate behavior in various therapeutic situations and the principles regulating the use of touch as a diagnostic and therapeutic tool. Most behaviors are determined by the cultural context and the therapist's own sensitivity and experience.

According to the principles of a physiotherapist's professional ethics, it is their duty to provide services with the utmost care, adhering to professional and ethical standards of conduct. The Code of Ethics for Physiotherapists adopted by the Polish Chamber of Physiotherapists (KIF) distinguishes fundamental moral values, including care, professionalism, responsibility, fairness, professional integrity, and respect for the dignity and autonomy of the patient/client.

(Bystrzycka et al., 2023)

6.5.1 Therapeutic / non-therapeutic touch

In physiotherapy practice, four distinct types of touch are recognized:

- Diagnostic touch: Used to examine the patient's body and gather crucial medical information to facilitate diagnosis.
- Interventional touch: Treatment (therapeutic intervention classified as task-oriented touch, applied to provide direct, manual therapy such as massage or joint mobilization).
- Assistive touch: Assisting specific movements (touch is used to physically aid the patient. Examples include managing specific movements, such as active range-of-motion assistance or helping a patient transfer).
- Informative touch: Used for obtaining information, supporting diagnostic actions, or informing about symptoms occurring during therapy

Non-therapeutic touch includes:

- Care touch: Contact aimed at comforting, encouraging, showing empathy, or providing support for the patient.
- Building relationships: Handshake for greeting and farewell, aimed at building or maintaining rapport.
- Safety assurance: Touch used to reassure or provide a sense of safety to the patient.
- Preparatory touch: Non-therapeutic touch used to prepare the patient for therapy, such as assisting with dressing or putting on shoes.

A physiotherapist's work with a patient/client's body is based on interventional touch used in therapy. Through touch, a physiotherapist can detect changes as a response to treatment, but touch can also be perceived as support, protection, care, acceptance, and respect. Professional touch is perceived as intended only when the physiotherapist fully focuses on the patient/client during interactions. Maintaining eye contact most of the time is a good sign of concentration. (Przyłuska-Fiszer & Wójcik, 2020).

6.5.2 Use of physical contact in physiotherapy

- Palpation

Palpation is a crucial skill in physiotherapy that involves using touch to evaluate soft tissues, joints, and musculoskeletal structures. Physiotherapists may use palpation techniques to identify areas of tenderness, muscle tension, or restricted mobility, which helps in diagnosing and treating musculoskeletal conditions. While palpation is a valuable clinical tool, physiotherapists must ensure that they obtain informed consent and respect patient comfort and privacy during palpation procedures.

- Examination

Physical examination is a crucial part of the physiotherapy assessment process, allowing therapists to evaluate a patient’s range of motion, strength, flexibility, and functional abilities. During the examination, physiotherapists may employ hands-on techniques to assess joint mobility, muscle length, and tissue texture. Therapists need to communicate openly with patients, explain the purpose of the examination, and obtain consent.

- Treatment

Physiotherapy treatment comprises various interventions that aim to promote recovery, reduce pain, and restore function. Commonly used techniques include manual therapy, massage, and mobilization to alleviate musculoskeletal symptoms and improve tissue mobility. During treatment, physiotherapists must respect patient autonomy and preferences, ensuring that they are comfortable with the level of physical contact involved in the therapeutic process.

- Manual Therapy

Manual therapy involves the skilled manipulation of soft tissues and joints to alleviate musculoskeletal dysfunction and pain. These techniques may include joint mobilization, manipulation, soft tissue mobilization, and myofascial release. Physiotherapists are trained to perform these techniques safely and effectively, considering individual patient needs and preferences. Before administering manual therapy, therapists should obtain informed consent and explain the intended benefits and potential risks of the treatment.

It seems imperative, therefore, that patients are able to give informed consent to touch and have the need and methods of work explained to them in the specified areas. Conversely, for patients/clients of physiotherapy clinics, awareness of continuous attention, observation, and, if necessary, reactions to overly intense stimuli and their modification are essential. (Chochowska & Marcinkowski, 2013a; Chochowska & Marcinkowski, 2013b).

The physiotherapist must obtain permission to use various forms of touch and body work during therapy. Patients expect cues, whether it's a smile or brief eye contact, which, combined with

a handshake or a touch on the arm, can form the foundation of a relationship, enhance the patient/client's well-being, and build trust. As a result, better therapy outcomes can be expected. (Roger et al., 2002; Przyłuska-Fiszer & Wójcik, 2020)

6.5.3 Cross-culture aspect, respect for socio-cultural norms

Professional organizations play a vital role in establishing guidelines and codes of ethics to guide physiotherapy practice. These standards highlight the importance of patient autonomy, dignity, and consent in all aspects of care, including physical contact. The American Physical Therapy Association (APTA) in the United States and the Chartered Society of Physiotherapy (CSP) in the United Kingdom provide clear guidance on professional conduct, emphasizing the need for informed consent, clear communication, and respect for patient preferences.

Similarly, the World Confederation for Physical Therapy (WCPT) has established international standards for physiotherapy education and practice, promoting principles of professionalism, cultural competence, and ethical conduct. The guidelines emphasize the importance of tailoring treatment approaches to individual patient needs while acknowledging and respecting cultural diversity and ethical conduct. The guidelines emphasize the importance of tailoring treatment approaches to individual patient needs while acknowledging and respecting cultural diversity.

Preparation is an important for collaboration with individuals from different cultures and different socio-cultural norms. It's important to be culturally sensitive and open to understanding and accommodating diverse perspectives and needs.

World Confederation for Physical Therapy (WCPT). (n.d.). Policy statement: Ethical principles. Retrieved from https://www.wcpt.org/policy/ps-ethical-principles

The physiotherapist should ensure the protection of privacy, respect the intimacy and boundaries of the client/patient, maintain an appropriate distance, and uphold the confidentiality of information. This involves employing suitable verbal and nonverbal communication, the ability to read emotions and signals conveyed, and providing a sense of safety and respect for the patient. It's crucial to prepare for the athlete/patient's reactions to pain, injury, movement execution, or obtaining weak results in functional tests. Understanding how individuals may respond emotionally and physically to these situations is an important part of being an effective physiotherapist. This empathy and understanding can help you provide the necessary support and guidance to help them through their physical challenges and rehabilitation process.

The client/patient, regardless of age or gender, has the right to medical care that respects their principles, values, and customs. During the interview, important is to establish a diagnostic-therapeutic action plan with them. If the client/patient does not fully accept the proposal for cultural reasons, it is good practice to emphasize that physiotherapist respect worldview and are open to making changes with mutual consent. Physiotherapist should present alternative possibilities, which may include adjusting the examination room, providing additional explanations about the rationale for introducing touch as a diagnostic-therapeutic tool, specifying the area of touch, or suggesting alternative forms of treatment. It is important for the client/patient to consciously accept the planned treatment. Touch is an integral and essential part of the physiotherapist's profession, playing a crucial role, and the ability to apply appropriate touch is linked to the practical experience of the physiotherapist. Not only may the client/patient have difficulty with this, but also an inexperienced physiotherapist. Touch should not be too aggressive, but intense enough to achieve the intended diagnostic or therapeutic goal. It is recommended that obtain consent for the application of touch and indicate the specific area to be touched and the goal you intend to achieve. Starting the diagnosis with an observation of the patient's silhouette, abdominal position, spine, ribcage, and pelvic alignment is a common practice. However, it's essential to acknowledge that in some cultures, this approach may pose challenges or discomfort.

Therefore, it's important to have an initial conversation with the client/patient about the diagnostic process, explaining its significance.

Important is how to observe the body and movements during exercises while considering cultural norms and customs in different countries. This is vital for ensuring that your approach is culturally sensitive and respectful.

In certain scientific studies, issues related to physical boundaries have been raised. Questions have been asked about whether a patient's gender and their associated sexual sphere might present a barrier for a physiotherapist during manual work. These are important topics to consider and discuss, especially when respecting personal boundaries and cultural sensitivities.

It is even emphasized that touch is one of the fundamental ways of social and sexual communication, so contact with a physiotherapist can sometimes evoke sexual connotations. During physiotherapeutic procedures, physical contact occurs, which, on one hand, helps build a deep, trust-based relationship and, on the other hand, implies the emergence of challenging situations for both parties. Jokes and flirting can be interpreted ambiguously and may encourage the establishment of inappropriate relationships. This applies to both the physiotherapist and the client/patient. Boundaries should be clearly defined, with no possibility of crossing them by either party. It is essential not to respond to ambiguous proposals and to refrain from making inappropriate jokes. The physiotherapist should inform and clarify the form of intervention with respect to ethical norms and cross-cultural differences.

The therapeutic relationship generates a certain type of intimacy because during treatment, there is physical, psychological, and social contact between the physiotherapist and the patient. This kind of situation can lead to boundary violations by either party, sometimes entirely unintentional. Physical contact with the patient on a therapeutic level through touch brings many benefits and should not be a burden for both the physiotherapist and the client/patient, taking into account the norms and cultural customs of different countries.

During collaboration with the client/patient, must be established positive relationships and gain their trust. Important is by beginning with positive comments, highlighting errors with constructive criticism, and concluding with positive feedback. Emphasize what they are doing correctly, for example, "You are holding your head correctly, but pay attention to maintaining your breath; your pelvis is positioned correctly," "You breathe diaphragmatically excellently; adjust your pelvis to a neutral position, you engage your abdomen" "You corrected your posture well; work on endurance, you've already improved your position." With positive support and an appropriate, but non-judgmental, attitude, you can achieve the desired results faster. The interaction must be consistent with cultural norms.

The client/patient should be dressed in appropriate sportswear (a snug-fitting shirt, shorts, socks, and athletic shoes) for performing tasks. If this poses a cultural issue, they should have attire that allows task execution. This should be mutually agreed upon, respecting cultural differences. You should also obtain approval for the location where diagnostic tests and exercises will be conducted. If the client/patient requires a separate room, physiotherapist should respect that.

Touch in physiotherapy ensures privacy protection, respects the patient's intimacy and boundaries, maintains distance, and keeps information confidential. It constitutes an appropriate form of verbal and non-verbal communication. Through touch, the physiotherapist perceives emotions and signals conveyed by the patient. They are also aware of the non-therapeutic significance of touch, respecting the emotional, psychological, and physical boundaries of the patient/client in relation to cultural differences. (Przyłuska-Fiszer & Wójcik, 2020; Dadura & Wójcik, 2014).

Obtaining informed consent, explaining the purpose and necessity of working with the patient's/client's body, and adapting to expectations with mutual acceptance seem to be obvious and essential actions. Physiotherapists should pay particular attention to their primary tool used in functional diagnostics or manual therapy—hands. Taking care of the hands and their temperature is crucial during manual therapy. Physiotherapists should observe the patient's reaction to touch to ensure their comfort and safety. Different reactions from the patient to the exact same action can be expected, often depending on individual characteristics, previous touch experiences, and other life experiences.

The touch of a physiotherapist serves not only a therapeutic but also a psychosocial purpose. Touch is also a form of non-verbal communication with the patient. In the physiotherapist-patient/client relationship, care is a significant value expressed through professional action for the patient/client, respecting their autonomy, sensitivity to their needs and experiences, building trust based on respect for standards and competencies, and moral integrity understood as fidelity to professional ethics. (American Physical Therapy Association, 2021; Przyłuska-Fiszer & Wójcik, 2000). The professionalism of a physiotherapist, similar to that in medicine, entails acting in accordance with professional and ethical standards (World Confederation for Physical Therapy 2021; Długołęcka et al., 2024; Przyłuska-Fiszer & Wójcik, 2020).

6.5.4 Practices in different countries

United States

In the United States, physiotherapists follow ethical guidelines set forth by the American Physical Therapy Association (APTA). APTA is the source for standards of ethics and professionalism in the physical therapy profession. These guidelines prioritize patient-centered care and respect for autonomy. This Code of Ethics describes the profesional behavior of physical therapists in their multiple roles (eg, management of patients/clients, consultation, research, education, and administration), addresses multiple aspects of ethical action and reflects the values of the physical therapist. Physical therapists shall act in a respectful manner toward each person regardless of age, nationality, gender, race, religion, ethnicity, social or economic status, sexual orientation, health condition, or disability. They receive training in effective communication to ensure patient comfort and safety during treatment sessions. Physiotherapy education programs emphasize the importance of obtaining informed consent and setting clear boundaries around physical contact.

American Physical Therapy Association (APTA). (n.d.). APTA Code of Ethics for the Physical Therapist and Standards of Ethical Conduct for the Physical Therapist Assistant. Retrieved from https://www.apta.org/your-practice/ethics/code-of-ethics

American Physical Therapy Association (APTA). (n.d.). Guide to Physical Therapist Practice. Retrieved from https://www.apta.org/patient-care/practice-resources/guide-to-physical-therapist-practice

United Kingdom

The Chartered Society of Physiotherapy (CSP) is the professional, educational and trade union body for the chartered physiotherapists, physiotherapy students and support workers.

Physiotherapists in UK adhere to the standards set by the CSP, which highlights the importance of professionalism, respect for diversity, and evidence-based practice. Physiotherapy practice in the UK is focused on providing patient-centered care, with therapists valuing patient input and preferences regarding treatment approaches and physical contact.

Chartered Society of Physiotherapy (CSP). (n.d.). Professionalism and Values for Physiotherapy Practice. Retrieved from https://www.csp.org.uk/professional-clinical/professionalism/professionalism-values-physiotherapy-practice

This is an international standard also valid in the Maltese “Code of Ethical Conduct for Physiotherapists” (MAP 2017) and French “Code de déontologiedes masseurs-kinésithérapeutes” (ORDREMK 2022).

MAP. 2017. Code of ethical conduct for physiotherapists. Malta Association of Physiotherapists. Retrieved from

https://physiomalta.com/wp-content/uploads/2018/04/Code-of-Ethics-FINAL.pdf

Codes of professional conduct, therefore, provide support for people for whom ethical professional practice is important but who are not always able to make the judgement by themselves.

The interaction between the physical therapist and the patient/client is based on protecting privacy, respecting the intimacy and boundaries of the patient's privacy, maintaining distance, preserving the confidentiality of information, and appropriate verbal and non-verbal communication. The physical therapist possesses the ability to interpret the patient's feelings and signals, ensuring a sense of security and respect for the patient. The physical therapist is aware of the non-therapeutic significance of touch and respects the emotional, psychological, and physical boundaries of the patient/client.

Department of Health and Social Care. (2019). Professional standards for physiotherapy practice. Retrieved from https://www.gov.uk/government/publications/physiotherapy-and-podiatry-standards-for-education-and-training/physiotherapy-and-podiatry-standards-for-education-and-training#history

Respecting the boundaries of physical contact in the client/patient-physiotherapist relationship is essential for maintaining promoting therapeutic effectiveness, trust, and upholding ethical standards of practice. By understanding and acknowledging cultural and social influences on perceptions of physical touch, physiotherapists can provide care that is respectful, client/patient-centered, and culturally sensitive, regardless of geographical location or cultural background.

6.5.5 Cultural Considerations (Polish Context):

- Older persons typically adhere to modest dress codes. Be mindful of this during the assessment and offer modifications to the testing procedures.
- Polish culture can be more indirect in communication. Be patient and allow the patient to express herself comfortably.
- Physiotherapists are considered healthcare professionals and deserve respect. However, avoid overly assertive communication, especially with a religious Picture.

1. What similarities have you noticed in your culture?
2. What differences have you noticed in your culture?
3. What should you pay attention to when caring for a patient with different cultural values?

6.6 Example of a Training Plan

Core muscle training should be progressive, meaning that the training load is gradually increased. Increasing the number of repetitions or making appropriate changes to the pace of work (such as maintaining an isometric contraction in the exercises below), altering the rest time between sets, or the training volume over the week should not result in a loss of quality in movement patterns. The table below presents a basic 4-week Core Stability training cycle built on the principle of a reverse ramp. Each weekly training is repeated three times, with at least one day of rest between sessions. The training plan can be applied to individuals with weakened spinal stability, but the results depend on the patient's age, level of fitness, body awareness, and the type of dysfunction.

(McGill & Karpowicz (2009); Mullane et al., 2021)

Table 5 **Training Plan**

Week 1

Exercise	Repetitions	Sets	Rest between sets (s)	Work tempo (s) *
Bird dog ##	5-3-2	3	30	4-0-4-5
Side plank #	5-3-2	3	30	2-0-2-10
McGill Sit up	5-3-2	3	30	1-0-1-5
Glute bridge Hold	5-3-2	3	30	4-0-4-10
Pallof press #	5-3	2	30	4-0-4-5

Week 2

Exercise	Repetitions	Sets	Rest between sets (s)	Work tempo (s) *
Bird dog ##	6-4-2	3	30	4-0-4-5
Side plank #	6-4-2	3	30	2-0-2-10
Mcgill Sit up	6-4-2	3	30	1-0-1-5
Glute bridge Hold	6-4-2	3	30	4-0-4-10
Pallof press #	6-4	2	30	4-0-4-5

Week 3

Exercise	Repetitions	Sets	Rest between sets (s)	Work tempo (s) *
Bird dog ##	7-5-3	3	30	4-0-4-5
Side plank #	7-5-3	3	30	2-0-2-10
Mcgill Sit up	7-5-3	3	30	1-0-1-5
Glute bridge Hold	7-5-3	3	30	4-0-4-10
Pallof press #	7-5	2	30	4-0-4-5

Week 4

Exercise	Repetitions	Sets	Rest between sets (s)	Work tempo (s) *
Bird dog ##	7-5-3	3	30	4-0-4-6
Side plank #	7-5-3	3	30	2-0-2-15
Mcgill Sit up	7-5-3	3	30	1-0-1-6
Glute bridge Hold	7-5-3	3	30	4-0-4-15
Pallof press #	7-5	2	30	4-0-4-5

* Work tempo refers to the duration of each phase of the exercise expressed in seconds (s), i.e.,

- The first position refers to the duration of the eccentric phase of muscle work.

- The second position refers to the duration of the phase of maximum muscle stretch.

- The third position refers to the duration of the concentric phase of muscle work.

- The fourth position refers to the duration of the phase of maximum muscle tension.

In the Pallof Press and Side Plank exercises, it is recommended to repeat the set on each side.
In the Bird Dog exercise, the number of repetitions pertains to each side individually.

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