Chapter 14

Manual Therapy: Art or Science?

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Additional information is available at the end of the chapter

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Abstract

Manual Therapy is one of the most widely used therapeutic solutions in the treatment of pain and musculoskeletal disorders. Its evolution began several centuries ago and culminated in the modern reference methods in the field of physiotherapy, osteopathy, and chiropractic, which mainly address the treatment of joint and myofascial tissues. The advent of evidence-based medicine and the ever-growing literature available in the field of Manual Therapy has led this therapeutic approach to be heavily criticized on the basis of studies that have shown its limitations with regard to manual and palpatory assessment techniques, the poor biomechanical validity of therapeutic methods, and the poor long-term results in the treatment of patients with musculoskeletal pain. A better understanding of the mechanisms underlying the effectiveness of Manual Therapy, as well as of the mediators of the medium- and long-term effectiveness of musculoskeletal rehabilitation processes, has made it possible to reconsider the role of Manual Therapy and the healthcare professionals specializing in manipulative therapy within the framework of the biopsychosocial model, which focuses on the patient and their functionality.

Keywords: Manual Therapy, manipulations, myofascial, biopsychosocial model, clinical reasoning, effectiveness, evidence

1. Introduction

Manual Therapy is currently one of the main therapeutic options in the field of rehabilitation and more specifically in the treatment of musculoskeletal disorders. In recent years, the advent of evidence-based medicine has led to the publication of several studies on Manual Therapy, thereby enabling a better understanding of the mechanisms underlying its effectiveness in clinical settings. However, this method originated in ancient times. Indeed, testimonies show that it was applied in very distant times and places and in very different forms, contexts, and

cultures, such as by shamans in Central Asia and bone setters in Mexico, Nepal, Russia, and Norway [1]. We have direct evidence by Hippocrates (ca. 400 BC) who described the use of manipulative and physical therapy for the treatment of scoliosis and vertebral dysfunctions. Similar techniques were described by Galen, a roman surgeon (ca. 150 CE), and illustrated in his treatises [2].

In the Western world, modern Manual Therapy dates back to the seventeenth century and has undergone a progressive evolution that has led to current manual practices in physiotherapy, osteopathy, and chiropractic [1].

Most of the current clinical practice and manual techniques used by the majority of practitioners defined as "experts in manipulative treatments," are based on biomechanical assumptions at the root of the patient's symptoms, with palpatorily identifiable dysfunctions, that can be treated by means of specific techniques aimed at joint tissue [3–5], myofascial tissue [6–8], or nervous tissue [9].

All these concepts, based on anatomical theoretical models of musculoskeletal and health disorders, were born and developed as a result of the often brilliant intuitions of different authors, but they must be interpreted within the context in which they were born, the knowledge, the cultural contexts, and the technological and instrumental options available at the time [2].

Each author has, in some way, enabled the development of our approach to the patient and their management: witness symptom modification (Mulligan Concept) [4], the role of self-treatment (McKenzie Method) [3], and the need to focus clinical practice on the patient's daily demands and difficulties (Maitland Approach) [10].

However, the biomechanical effects and elements at the basis of the effectiveness of these approaches have been increasingly challenged by the advent of an evidence-based medicine culture [11]. Although expert opinion is part of the evidence pyramid that should guide clinical practice, it is only the lowest level of evidence [12].

Studies published in the last 30 years have seriously challenged both the "tissue-related" and "biomechanical" bases of these manual approaches and the validity and reliability of the techniques involving palpatory assessment as well as manual and manipulative treatment [13–15].

As healthcare professionals, we have a duty to ask ourselves questions: "Are we really able to accurately palpate a specific target tissue from an assessment point of view? [16] Are we able to identify a specific tissue as responsible for the patient's symptoms? Are we able to differentiate it from the surrounding tissues and identify any dysfunctions? [14, 17]".

From a therapeutic point of view, are we able to make structural changes to peripheral tissues, whether they consist in joint repositioning or orientation of collagen fibers in the myofascial tissue?

Above all, is the modification of peripheral tissues related, and therefore necessary, to the achievement of clinical improvements in patients experiencing musculoskeletal pain?

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How important are these factors in changing the prognosis of musculoskeletal patients? How much must a manual technique and a healthcare professional be "biomechanically specialized" to achieve a positive outcome in the patient? Highlighting these elements is extremely important, as they are still the basis of the clinical practice, care, and treatment of millions of patients worldwide and thus have a major clinical impact [18]. What technique or approach can improve the symptoms of patients with musculoskeletal pain, and why?

Today, there is a wealth of literature supporting the effectiveness of Manual Therapy in improving pain and mobility in patients with musculoskeletal disorders [19–21]. However, these improvements are mainly short-term and have a reduced efficacy, particularly in subjects with chronic symptoms [21].

The limited efficacy in patients with chronic pain and the overlapping course of clinical symptoms in the long term irrespective of manual treatments [22, 23] cast doubt on the clinical assumptions that still often guide manual and manipulative clinical practice.

The lack of a shared model supported by evidence and the limited diagnostic, therapeutic, and prognostic role of approaches linked to exclusively manual and biomechanical interventions has led to the development and implementation of what has been defined as the biopsychosocial model, also in the field of rehabilitation [24].

The biopsychosocial model is currently the reference model when it comes to taking care of and managing patients with musculoskeletal disorders. It focuses on the patient as a person, particularly with regard to disability and quality of life in relation to their disorder, considering the impact that internal and external factors, including non-biomechanical ones, can have on their status and prognosis [20, 25].

Enter psychosocial factors. Elements such as fear of movement, anxiety, depression, and self-efficacy have been shown to play a central role in mediating and modulating the symptoms and prognosis of these patients [25], particularly in the transition from the acute to the chronic phase of the disorder and the resulting disability [26, 27], far more than exclusively biomechanical impairments such as range of movement (ROM) or muscle strength [28].

While a manual clinical practice based on musculoskeletal impairments and aimed at improving the patient's signs and symptoms may be useful and reasonable in the clinical management of the patient [19], it is important to consider that any therapeutic intervention is directed towards a person, with both explicit and implicit consequences on the individual's beliefs, convictions, and cognitive processes [29].

Indeed, while a manual technique can be effective in the short term, the narrative that guides it, which the practitioner presents when framing the patient and taking care of them, can have very significant consequences on the meaning that the patient gives and will give to their own disorder [30].

To date, several authors have linked pain to the body's perception of a threat/danger [31]. A manipulative technique that is effective in reducing a patient's lumbar pain may have significant long-term consequences if associated with concepts related to a "repositioning" of the intervertebral disc with respect to the nerve roots. The patient will indeed be able to convince

themselves that they have a fragile back, with structures that could face possible neurological damage, thereby promoting hypervigilance, anxiety, and fear of movement [32].

In addition to short-term beneficial effects, it is therefore important to consider possible "nocebo" effects of Manual Therapy in the long term when not properly presented to the patient [32]. It is no coincidence that manual techniques have shown insignificant results in the long run, even when compared with nontreatment. However, if we want to change the patient's prognosis, we need to act on the most significant prognostic factors, which have been shown to be psychosocial [33].

All of this has an impact not only on the individual but also on the community. This is particularly the case at a time when the availability of economic resources for supporting healthcare and personal health services is constantly subject to spending review. As a matter of fact, we know that most of the resources are allocated to the treatment of chronic disorders.

The effectiveness and efficiency of health decision-making processes and the appropriateness of the therapies proposed and supported are and will increasingly be central to social choices [34]. However, these same considerations apply to every single practitioner, even in the private sector. From an ethical standpoint, what are the best therapies that can be offered to patients with musculoskeletal disorders? Which patients need complex therapies, and when can unimodal therapies achieve satisfactory clinical results? Is there an evidence-based approach to Manual Therapy that can allow for its full integration within a biopsychosocial model focused on the improvement of the patient's disability not only in the short term but also in the medium and long term? Can the patient be involved in these issues, even if mainly passive techniques are used? At the end of the day, what is Manual Therapy? What does it do, and why can it be so decisive in some cases for both the patient and the practitioner? We will try to answer all these questions in this chapter.

2. Manual Therapy: from theoretical speculations to research

Even today, most Manual Therapy approaches are based on the evaluation of biomechanical factors that may be the cause or consequence of symptoms reported by the patient, with a feeling of pain and reduction in function, either directly at the local and segmental level or indirectly in neighboring regions [35].

The basic assumption entails the possibility, on the part of the healthcare worker, to be able to identify the said dysfunctions, correlate them to the clinical picture of the patient, and correct them by the use of palpatory analyses and therapeutic techniques that can be refined over years of practice, thereby making the rehabilitation process increasingly efficient and effective. In general terms, these elements are transversally present in almost all of the most commonly suggested and used Manual Therapy methods, especially in the direct approaches to the assessment and treatment of myofascial and articular tissues [8, 36].

Being able to fully understand and judge the scientific nature and validity of the proposed notions can be complex, especially at the beginning of one's personal and professional training, especially when presented by charismatic teachers with years of experience. Moreover,

at first, the disciple can often find it difficult to manually perceive the biomechanical impairments the teacher refers to.

One may intuitively think that, as with any learning process, palpation skills can be developed and learned through training, repetition, and clinical practice, as it has been observed in the improvement in in the two-point discrimination threshold [36]. But is this really the case from a clinical point of view? How much can daily clinical practice improve one's palpatory ability, with consequent clinical repercussions in the treatment of patients with musculoskeletal pain? And how much of this progressive understanding of and expertise in patient management depends on effective manual specialization?

The above example may be familiar to many of those who are reading this chapter. However, many of the theoretical assumptions upon which these models are based were wrong. Indeed, the manual assessment methods adopted in most manipulative approaches have not shown adequate levels of validity and reliability for application in the management of patients with musculoskeletal pain.

For instance, techniques for the assessment of the physiological intervertebral motion of individual vertebral levels have not shown a correlation with the actual mobility assessed by means of radiological tests [37]. As a matter of fact, vertebral levels deemed hypomobile upon manual assessment have not shown a reduction in mobility when investigated through dynamic MRI [38].

Moreover, the same possibility of investigating the passive physiological and accessory mobility of a single vertebral level by means of manual assessments has been heavily criticized. Indeed, the proposed techniques have been shown to produce movements on multiple vertebral levels [17, 39]. The same assessments, even when made by experienced clinicians, have not shown a correlation with the patient's symptoms. Indeed, the assessors were not able to tell subjects with pain from an asymptomatic control group [40].

The same palpatory identification of the target structures proved to be poorly reproducible, with little agreement also as to the identification and pinpointing of anatomically evident elements such as the posterior superior and anterior superior iliac spines [30]. It is therefore not surprising that the assessment of any hypomobility or hypermobility of the selected segments shows low agreement values among different assessors [41, 42] and that different therapists choose treat different joints [43].

This seems to be related to the technique used and the actual total mobility of the considered joints [44]. As a matter of fact, it appears to be good in the assessment of the osteokinematic mobility of large joints [45], but it is almost useless or comparable to random chance in the assessment of joints with particularly limited mobility, such as sacroiliac joints [46]. Therefore, the more emphasized the role of specialized manual skills in identifying possible dysfunctions, the more statistically insignificant the results of these tests, even when conducted by experienced clinicians [47].

Similar analyses have been performed as to the palpatory assessment of extra-articular soft tissues, thereby showing that even very experienced assessors are hardly able to identify the anatomical location of the target tissues [48], grade the muscle stiffness [49], pinpoint any

tissue dysfunction, or tell a subject with pain from a healthy one. In some cases, even the creators of some of the methods proved inadequate [50].

Therefore, while different training proposals involving Manual Therapy may initially seem logical, intuitive, and fascinating, their biomechanical and tissue-related bases have often proven to be incorrect, for instance, by failing to consider the very high prevalence of bone asymmetries in 85% of the general population [51, 52].

The phenomenon defined as "pareidolia" seems to play a significant role when it comes to the lack of accuracy of these theoretical models, which were conceived in, and are therefore inevitably related to, historical periods in which the available technologies did not allow for a thorough understanding of the body and its biomechanical properties. Pareidolia [53] is the tendency to detect patterns and information known to the observer on the basis of random, vague, and undefined inputs, hence the tendency to pinpoint an alteration or a dysfunction exclusively on the basis of one's own personal experience, be it training-related or not.

However, several cognitive biases can affect the reasoning and clinical practice of a healthcare professional, particularly in Manual Therapy [54–56]: witness anchoring, confirmation, group biases, or the illusion of frequency. A group bias is the tendency to overestimate and deem more competent those who belong to one's group, such as a teacher or a colleague who uses our same assessment and treatment method, compared to other professionals. A similar mechanism is found in frequency bias, based on which we tend to detect factors and elements more easily once we have spent time studying them in depth: witness the possibility of finding an increased prevalence of positional or tissue alterations in our patients following a course focused on these aspects, regardless of their clinical significance. Anchoring bias highlights the tendency to focus on relatively unimportant aspects, thereby attaching central significance to them in the overall picture. In clinical practice, witness the tendency to focus on the restoration of ideal soft tissue consistency, thereby either underestimating or not considering the lack of improvement in the pain perceived by the patient during the rehabilitation process. On the other hand, confirmation bias refers to the tendency to irrationally focus on the first clinical hypothesis that one may have developed with regard to a specific patient and clinically research elements that confirm the said hypothesis, thereby discarding any significant aspects that would invalidate it [54–56]. All of these elements can be related to heuristics [55], that is, mental shortcuts that enable you to obtain quick answers even without considering all the factors involved. While such aspects allow for faster and more efficient reasoning, in clinical practice they can also lead to errors in the decision-making process and to a nonoptimal management of the patient and thus to an incorrect reading of clinical phenomena [57]. Such observations are obviously not only part of Manual Therapy but also of rehabilitation approaches based on therapeutic exercise [58], which, when proposed in an orthodox manner, can lead to a "guru-based" clinical practice in which the core of the rehabilitation process is no longer the patient, but the method or mental scheme of the practitioner themselves.

Therefore, an ethical model of patient treatment and care cannot be separated from a thorough understanding of the scientific literature, in which many of the aspects described above have been studied and deepened, thereby giving answers to many of the questions that may arise during daily clinical practice [34]. Only in this way is it possible to have a clinical practice

that can improve the medium- and long-term prognosis of patients with musculoskeletal disorders, thereby reducing the negative influence of cognitive bias and theoretical models.

Building upon the said assumptions, it is indeed possible to strongly support the effectiveness of Manual Therapy in the improvement of various impairments that characterize the clinical pictures of patients with musculoskeletal disorders, especially with respect to pain and range of movement and with particular reference to the short and medium term, with a high level of satisfaction on the part of the patients who receive it [19, 20].

However, the mechanisms underlying its effectiveness seem different from those considered up to now. As a matter of fact, the clinical improvement observed as a result of manual techniques does not appear to be related to a realignment of the articular heads [59], a displacement of the disc tissue [60], or a structural modification of the soft tissues [61], which to date have never been demonstrated, despite years of scientific research [60]. Fortunately, these changes do not appear to be necessary in order to achieve a significant therapeutic effect, nor do they appear to be related to the clinical picture of patients with musculoskeletal pain [62].

Indeed, models based on biomedical and biomechanical assumptions have been shown to play a clinical role mostly in strictly pathoanatomical pictures and in relation to particularly significant structural alterations such as the presence of severe osteoarthritis, which are related to significant alterations in the articular surfaces where the pathognomonic data shows a marked reduction in joint ROM [63].

Nevertheless, these elements have been shown to have limited clinical or scientific value in the management of most musculoskeletal disorders. As a matter of fact, verifiable modifications observed in radiological investigations were present in a large part of the general population, without showing, in the great majority of cases, a significant correlation with the clinical picture reported by the patient [64]. This has been observed in clinical pictures related to the axial skeleton but also to the limbs: witness patellofemoral pain syndrome [65] or shoulder pain [66]. Indeed, most patients with musculoskeletal pain have multifactorial disorders. The attempt to translate the determinism typical of the biomedical model and orthopedic medicine into musculoskeletal rehabilitation is probably at the root of the limitations of many Manual Therapy methods, which show resistance to change in the face of the latest scientific findings in the field of Manual Therapy and musculoskeletal pain.

Uncertainty management in medicine is one of the most debated issues in healthcare-related clinical reasoning and can be disorienting and complex to integrate into one's vision and clinical practice [67]. However, once accepted, it enables one to confidently respond to various criticalities that may arise on a daily basis: witness patients who do not adequately respond to therapies despite the correct manipulation of specific target segments or still show symptoms despite a palpatory analysis that is normalized with respect to the initially identified dysfunctions.

The very multifactorial nature of these disorders requires multifactorial treatments also involving peripheral tissues, for example, manual techniques, which can allow for significant improvements with respect to symptoms and thus in the quality of life of the patient, regardless of the search for actual anatomical changes. Fortunately, these changes, as mentioned, do

not seem to be necessary [60]. Manual Therapy can be extremely effective in reducing pain and improving ROM in these patients. Its effects seem to be mainly mediated by neurophysiological mechanisms [68].

Several studies have described the mechanical stimulus applied through Manual Therapy techniques as able to activate a cascade of peripheral, spinal, and supraspinal neurophysiological effects related to pain modulation and ROM improvement [68]. For example, as a result of joint tissue techniques, a reduction in the concentration of inflammation mediators was observed [68]. The role of spinal mechanisms was suggested by the change in temporal summation and muscle tone [69]. Finally, studies conducted using functional magnetic resonance imaging have shown the activation of areas related to mechanisms leading to a downward modulation of pain, such as the periaqueductal gray [69]. These scientifically proven observations thus seem to establish a very significant correlation between the clinical efficacy of Manual Therapy and the possibility of activating neurophysiological mechanisms linked to the modulation of pain perception. This seems to be confirmed by studies that have shown an inability to produce therapeutic effects in subjects with alterations of the said mechanisms, that is, in the presence of augmented temporal summation, which is indicative of increased dorsal horn excitability, or of a clinical state of widespread pain with a generalized reduced pressure pain threshold, which is indicative of the presence of central sensitization with regard to pain [69].

However, there are other aspects of Manual Therapy that are not closely linked to the mechanical stimulation of the technique used and can mediate its therapeutic effect. The said aspects are an integral part of the biopsychosocial model. As a matter fact, there is an affective and cognitive dimension that involves the patient in the therapeutic act linked to the therapeutic "touch" [70]. In accordance with the gate theory, in addition to a reduction of pain perception due to tactile stimulation, touch applied in an "empathic" way has proven capable of reducing pain perception in itself and acting on the concentration of biomarkers related to stress, negative emotions, and mechanisms related to the perception of threats. Furthermore, several contextual and verbal communication and relationship aspects have been shown to play a role in making a manual technique effective with regard to pain reduction. An open, positive, and empathetic style of communication adopted by a healthcare professional capable of listening to the patient and convincingly answering their questions has indeed been associated with greater short-term pain reduction and higher patient satisfaction [71]. The same can be said for the patient's possible preferences, which may be related to previous experiences or personal beliefs. All these effects are attributable to what has been defined as "placebo mechanisms," not intended as a psychological response to inert therapies, but as generalized and non-specific "psychologically and physiologically active process associated with a robust hypoalgesic response" [72, 73]. Finally, psychosocial factors such as anxiety and fear of movement or motion (kinesiophobia) and self-efficacy seem to play a very important role when it comes to the effectiveness of a given technique or approach [74].

All these observations show that, irrespective of the criticism levelled at the most commonly proposed clinical models, a scientific approach focused on the patient, based on Manual Therapy and founded on the biopsychosocial model, is possible without the need to resort to imaginative holistic or pseudoscientific theories.

The second part of this chapter will show when and how it is possible to adopt the said approach in the most common clinical pictures that can be dealt with in clinical practice.

3. Manual Therapy: from research to clinical practice

3.1. Joint manual therapy

As described, Manual Therapy techniques targeting joint or extra-articular soft tissue can be very effective in relieving pain and improving ROM in individuals with musculoskeletal disorders, both in the spine and in the limbs [21].

Joint techniques can be divided into mobilization and manipulation techniques [75]. Joint mobilization has been defined as "a Manual Therapy technique comprising a continuum of skilled passive movements involving the joint complex that are applied at varying speeds and amplitudes, which may include a small-amplitude/high velocity therapeutic movement [manipulation] with the intent to restore optimal motion and function and/or reduce pain." Joint manipulations have been defined as "passive, high velocity, low amplitude thrusts applied to a joint complex within its anatomical limit with the intent to restore optimal motion and function and/or reduce pain" [75].

In studies conducted on standardized populations of subjects with musculoskeletal pain, no manual technique could be shown to be more effective than the other. Research has shown an overlap in the therapeutic effectiveness of different techniques, be it among different types of joint mobilization techniques [76, 77] and different kinds of vertebral manipulation techniques [78] or mobilization and manipulation techniques [79]. These results have been mainly observed in non-specific spinal pain but also when comparing different techniques targeted towards peripheral joints, that is, in subjects with knee osteoarthritis [80]. Similarly, research comparing joint techniques with soft tissue techniques has shown similar clinical results [81, 82].

3.2. Myofascial Manual Therapy

Several manual techniques have been proposed for the treatment of soft tissues, from more intense manual approaches following methods that seek the elicitation of significant pain in the patient during their application [8] to painless techniques seeking the elimination of symptoms by using positionings and maneuvers primarily aimed at shortening the tissues [83].

Again, manual techniques have been shown to alleviate pain and improve ROM [84]. Likewise, no one technique can be said to be superior to another, either among different Manual Therapy techniques or between manual techniques and the use of instruments such as dry needling or instrument-assisted soft tissue manipulation (IASTM) [84, 85].

3.3. Which technique to choose? successful predictors in joint Manual Therapy

According to most Manual Therapy methods, the likelihood of therapeutic success in patients with spinal pain strictly depends on the identification of the dysfunctional vertebral level; the

appropriate "corrective" technique, which is to be targeted towards the intended segment using the correct parameters of direction, is thus to be applied with the correct direction, intensity, and duration parameters with respect to the stimulus [10].

However, the need for specific therapeutic techniques is not supported by the literature. As already seen in this chapter, manual and palpatory assessment methods have been found to be ineffective and unreliable. Experienced assessors taking part in a blind study showed agreement levels equal, if not inferior, to random chance in the identification of the tissues to be treated [43]. These same models did not prove valid even with regard to the proposed therapeutic techniques. Indeed, sacroiliac [15], lumbar [15, 86], thoracic [86], and cervical [87] manipulation techniques have been shown to produce clinical and biomechanical effects on different vertebral levels, which are therefore not specific to the target segment and lead the practitioner to produce unpredictable vertebral movements [88]. This data is confirmed by clinical studies that have shown an overlap between the therapeutic effect of manipulations theoretically directed at a single vertebral level and "global" manipulation techniques involving the lumbar spine of subjects with low back pain [89].

Nevertheless, in clinical practice, very different clinical responses are commonly observed in different patients as a result of the application of the same technique. In the last 20 years, several studies have tried to identify the clinical elements present at the baseline that could indicate the best therapeutic solution for each specific patient [90]. In particular, the so-called clinical prediction rules (CPRs) [91] have been studied and developed for the issues referred to in this chapter, also with reference to manipulative treatment in patients with lumbar [92], cervical [93], and shoulder pain [94], among others. Despite promising initial studies, these rules have not proven to be good enough for application in clinical practice. In particular, evidence has shown that, upon modification of the statistical value considered as the indicator of "therapeutic success" [whether it be pain reduction or improvement of the disability, either in proportional or absolute terms], these rules also change in a very significant way [95]. In addition, subjects positively responding to CPRs with respect to lumbar manipulative treatment were found to be equally responsive to joint mobilization techniques [96] and McKenzie exercises [97]. In essence, a positive response to these rules proved able to generally predict a positive prognosis following a rehabilitation program, regardless of the proposed therapy [98].

3.4. Pain mechanisms

The presence of similar therapeutic effectiveness following treatment approaches that are sometimes in direct opposition to each other [8, 83] both in their theoretical bases and in their clinical application is a further element supporting the poor biomechanical validity of these techniques and the predominant role of neurophysiological factors in their effectiveness. Neurophysiological elements have proven to be fundamental in determining the clinical picture of the patient and mediating the effectiveness of techniques targeting peripheral tissues [68].

As a matter of fact, Manual Therapy has been shown to be more effective in the presence of mechanical pain, which is by definition elicited during the execution of specific movements

and refers to clinical pictures of peripheral nociceptive pain [69]. Clinically speaking, this kind of pain is a typical feature of patients experiencing sudden problems, such as subjects with acute lumbar block following a poorly controlled movement. On the contrary, patients with constant, general pain present even at rest, which is indicative of central sensitization, have shown little response to manual treatments [69]. This aspect seems to play an important role with regard to the low effectiveness of manual techniques in subjects with chronic pain, such as patients diagnosed with fibromyalgia syndrome.

3.5. Manual techniques as modulator of peripheral afferences

When it comes to the treatment of musculoskeletal pain, Manual Therapy thus seems to be able to significantly modulate the nociceptive afferences of peripheral tissues, regardless of their structural specificity. Based on this, the literature seems to support a patient-centered clinical practice focused on the mechanisms of pain and musculoskeletal impairment that characterize it based on the reactivity of the clinical picture.

3.6. Pain as a cause of limited ROM and mobility

While no manual approach is superior to the others, the literature itself supports the use of techniques tailored to each individual patient, modulating the force applied during the technique (from low to high), the duration (from short to long), and the prepositioning of the tissues (from relaxed to pretensioned) and acting either within or away from the resistance [75].

In patients (defined by Maitland as "pain dominant") with a clinical picture characterized by severe, often nocturnal pain significantly limiting ROM, applying intense techniques will be difficult and unreasonable. It may therefore be very useful to use painless techniques, far from the tissue barrier and symptom elicitation, which have been shown to alleviate pain, but not to improve the patient's ROM [99]. Witness patients suffering from phase II frozen shoulder or symptomatic disc herniation [100, 101]. On the contrary, or progressively upon decrease in pain, patients with joint limitations and mild/moderate pain elicitable at the end of the joint range (whom Maitland defines as "stiffness dominant") will benefit from more intense, longer-lasting techniques carried out at the end of the joint range, possibly with the reproduction of a symptomatology during application, which have proven capable of improving both pain and ROM in these patients [102, 103]: phase III frozen shoulder or osteoarthritis clinical pictures can be considered as emblematic examples [100, 104].

3.7. Pain as a strength limiter

While biomechanical elements such as an increased mechanical extensibility of the joint capsule cannot be completely ruled out, improvements in functional impairments such as ROM would seem to be linked to the ability of manual techniques to modulate peripheral nociceptive afferences, thereby acting on all related clinical phenomena [105].

This would seem to be confirmed by the possibility of obtaining a short-term improvement in muscle strength following techniques specifically targeted towards soft tissues in patients

with musculoskeletal pain [106, 107]. These observations have led several authors to support the usefulness of manual techniques also in the field of well-being and physical training, with the aim of achieving greater physical functionality. However, studies carried out on healthy subjects or in the absence of peripheral impairments have contradicted this hypothesis by not showing the same benefits in mobility, strength, and functionality found in patients suffering from musculoskeletal disorders [108, 109]. The link between pain and muscle strength, and the possibility that these may be modulated by manual techniques, can nonetheless be of particular clinical interest. Indeed, studies included in the literature have shown the possibility of identifying soft tissue impairments, even within non-specific frameworks, through active and resistance tests, especially when the said active and resistance tests are painful and recreate the symptoms typical of the patient [110]. For example, a dry needling treatment targeted towards multifidus muscle has been observed to be more effective if the patients reported pain while recruiting that muscle [110].

3.8. Patient-centered and impairment-based Manual Therapy

These observations hint at the clinical value of a Manual Therapy clinical practice that is evidence-based as well as focused on the patient and the impairment that can characterize both them and their daily life.

Joint and soft tissue techniques can therefore focus on and be guided by:

- Pain
  - High reactivity/low reactivity
- ROM limitation
  - Osteokinematics
- Soft tissue dysfunctions
  - Active/resistance tests

3.9. Treatment of function

The aspects described so far mainly refer to techniques directed at the anatomical regions responsible for the clinical picture of the patient. However, in accordance with a Manual Therapy model based on the improvement of the patient's function, Manual Therapy techniques can be useful in improving all the musculoskeletal impairments that can biomechanically and neurophysiologically contribute to the patient's symptoms and daily limitations [35]. For instance, sedentary patients with lower back pain may benefit from the treatment of any limitations present at hip level, which due to phenomena related to referred pain and afferent convergence may support pain perception [111–113].

These aspects can play an even more significant role in subjects with high functional requirements such as professional athletes, where the correct functionality of all the structures

participating in a specific movement will be clinically central in enabling their being able to perform at high levels. A typical example is the clinical relevance of a limitation in ankle dorsiflexion in a volleyball player with patellofemoral pain syndrome [114].

3.10. Short-term benefits

The advantages and limitations of Manual Therapy should be known in order to apply it in the best possible way. We know that the clinical effects that can be obtained in the treatment of musculoskeletal disorders tend to diminish over time after the end of the treatment, thereby often overlapping with the natural history of the disorder in the long term. This aspect is often highlighted by the opponents of manual techniques, who attribute many of the benefits observed in clinical practice to the benign and self-limiting nature of musculoskeletal disorders [115].

While these observations can be statistically accurate, it is important not to underestimate the role that an immediate modification of the symptom can play in the patient's need for help [116]. Going back to professional athletes and their need for help, a rapid decrease in symptoms can enable one to resume sports activities just in time to take part in a cup final. The ability to use manual techniques in order to obtain benefits in the short term compared to mere therapeutic exercise will thus have a major impact on their daily activities and quality of life [117]. Similarly, we know that clinical pictures of symptomatic disc hernias have in most cases a positive prognosis within 3–6 months [118]. However, this data does not take into account the impact that a disorder of this type can have in the daily life of the patient in that period of time and the potential benefits of therapeutic techniques that have been shown to be able to significantly modify pain symptoms already in the first month [101]. Finally, symptom modification can play a very important educational role by enabling patients to realize that they are not the bearers of an incurable and unchangeable disorder, thereby acting on psychosocial factors that play an important prognostic role in the chronicity of the symptom [116].

3.11. Psychosocial clinical factors in Manual Therapy

As written above, the presence of biomechanical and functional impairment can be very important in guiding the choice of the therapeutic technique to be used. However, non-biomechanical elements such as psychosocial factors can also mediate the clinical results that can be obtained through Manual Therapy techniques.

In a standardized population of subjects with chronic neck pain, mobilization and joint manipulation techniques have shown to alleviate pain and improve ROM without statistically significant differences among the proposed techniques [76]. However, some elements present at the baseline, such as anxiety levels, were found to be associated with a different response to each technique [74]. As a matter of fact, patients with low anxiety levels showed more significant improvements following vertebral manipulation techniques, while more anxious subjects reported a greater reduction in pain when subjected to joint mobilization techniques. The psychosocial sphere can thus also be very important in the choice of the therapeutic method capable of producing the best clinical results, even in the short term.

3.12. The three EBP pillars

It is important to remember that evidence-based practice is based on three pillars: the preferences, needs and expectations of the patient, the expertise of the practitioner, and the available authoritative literature [11]. All these elements must be taken into account in the decision-making process. Their role is particularly significant in making clinical decisions with a risk of serious adverse events, such as choosing whether or not to perform risky heart surgery. However, they are also relevant in musculoskeletal rehabilitation and Manual Therapy.

Patient preferences have been shown to modulate the response to a specific treatment. For example, in the aforementioned study, the clinical response that could be obtained following vertebral manipulation techniques was also mediated by the opinion that the patients had of the proposed techniques [74]. Placebo mechanisms involving a descending inhibition of pain linked to expectation also seem to play a role in modulating the effectiveness of the techniques used based on the patient's preferences [119]. Useful information can thus be obtained from the patient's medical history. People who report having had negative results following soft tissue therapies and having responded very positively to manipulative techniques are likely to respond better to the latter. Clearly, the possible failure of a given therapeutic approach can be linked to purely clinical aspects, such as an incorrect classification of the patient. Subjects with pelvic pain may not respond to lumbar treatment techniques if the practitioner does not identify possible hip arthrosis as the real cause of the problem [113]. However, the information provided by the patient will play an important role by leading the practitioner to consider different evaluation and treatment hypotheses.

A second pillar of evidence-based practice involves the practitioner's expertise and clinical competence. Also in this case, the possibility of modulating clinical effectiveness may be due to exclusively clinical or non-biomechanical aspects. The literature has shown that, in applying the same technique, the physiotherapist's beliefs about the effectiveness of that specific technique were able to lead to different clinical responses in the patient [120]. This may be due once again to the expectations that, either explicitly or implicitly, the practitioner can give the patient when proposing and applying the said technique. In addition, the very mastery and confidence shown in the execution and application of the technique can convey the feeling of being in "good hands," reduce the sense of threat, and activate central pain-inhibiting mechanisms [70].

Finally, even though the overlap in the clinical effectiveness of different Manual Therapy techniques has been pointed out several times, this entails basic competence in the application of these techniques. When the practitioner is not trained to perform a given technique, or does not have adequate clinical experience, they may have trouble in identifying the correct landmarks, in particular on small joints, or determining the adequate posology, thereby producing either no results at all or even harmful consequences.

3.13. Adverse events

As a matter of fact, clinical practice in Manual Therapy is to be based on advanced knowledge enabling, first and foremost, the identification of patients who do not fall within the scope of

rehabilitation and are to be referred to a physician or who may present contraindications to manual practice [121].

There is a wide debate in the literature on the dangers of manual techniques, particularly with regard to possible vascular or nerve damage as a result of cervical manipulation. These events seem to be mainly related to inadequate background checks as to the patient's medical history and ultimately to the failure to spot red flag factors [122]. In particular, ongoing cervical vascular disorders may initially arise only with symptoms related to the cervical level, thereby mimicking the presence of musculoskeletal disorders. An early identification of these clinical pictures can enable the practitioner to immediately refer the patient to a more suitable clinical management, avoiding the use of treatment techniques whose role will then have to be investigated in the medical–legal field [123]. However, it is worth remembering that there is no completely safe medical and rehabilitation procedure. Indeed, studies have described adverse events even following therapeutic massage sessions [124].

The ability to recognize the appropriateness of any technique with regard to the individual patient will lead to the choice of the most appropriate type of intervention and its modulation, particularly in populations of patients with a higher risk of adverse events, such as pediatric or geriatric patients [125], without having to apply the dictates supported by a specific Manual Therapy training method.

4. Conclusion

Manual Therapy is an extremely effective therapeutic method in the management of patients with pain and musculoskeletal disorders. Like any other therapeutic method, it has its pros but also its cons and drawbacks. Its effectiveness, as described above, is based on the ability to modify the functionality, albeit not the anatomy, of the patient's tissues by means of mainly neurophysiological mechanisms [69].

Therefore, an appropriate and effective clinical practice can only be based on the correct classification of the patient, identifying first of all those clinical pictures, including musculoskeletal ones, which, according to the scientific literature, are not suitable for Manual Therapy, thereby orienting the patient towards a medical, pharmacological [126], or surgical approach [127], or a conservative program based on therapeutic exercise [128], or simply a "wait and see" strategy. Indeed, only by acknowledging the limits of Manual Therapy is it possible to strongly affirm its great merits and potential for alleviating the patient's pain and improving their functionality in the short, medium, and long term [19, 20]. This will involve the great majority of patients with musculoskeletal pain, whose clinical picture is characterized by functional impairment, in particular reduction of ROM and peripheral hyperalgesia, with particular regard to soft tissues. In this respect, Manual Therapy is able to have a very positive effect, leading to rapid and significant improvements when properly applied in accordance with the specific clinical picture and the individual patient.

While there is no such thing as a superior Manual Therapy method, being free from the dogmas of a specific therapeutic approach allows for a truly patient-oriented clinical practice

focused on the patient and their needs, choosing the most appropriate technique and modulating it from time to time on the basis of the clinical picture of that individual patient. This ability to provide a clinical framework and subsequently manage the manual approach proposed to the patient is what defines the role and real competence of healthcare professionals specializing in manual and manipulative therapy, with an approach strongly based on the biopsychosocial model.

While the current main limitation of Manual Therapy is the production of predominantly short-term responses, these observations are primarily based on studies that have investigated the effectiveness of individual techniques. However, we know that the therapeutic relationship in clinical practice is also made up of other things, such as the therapeutic alliance between practitioner and patient, understood as a person [70].

For this reason, a healthcare professional trained in Manual Therapy according to an evidence-based approach can produce results even in the long term by exploiting the immediate reduction of the symptom and the rapid improvement of the functionality as a bridge to reduce the fear of movement and the related anxiety in the patient and stimulate an active coping towards their disorder [116], thereby making them gain confidence in their ability to perform "thoughtless, fearless movement" [129] through an especially active rehabilitation process.

Only in this way can the professional improve their practice for the good of the patient, acting according to science and conscience and reaffirming the central role of their professional figure in the management of musculoskeletal disorders.

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