

Postural Theory of Non-Specific Low Back Pain (NSLBP)

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Abstract: Biopsychosocial factors have received great attention in recent years as the causes of non-specific low back pain. But the challenge is, as it has always been, the pathology is still unclear. A postural theory which is based on an increased weight called virtual weight that results from posture change in lumbar spine has been discussed. The mystery of non-specific low back pain is unraveled, pain mechanism clearly explained and the pathology of non-specific low back pain is understood. Intervention order has been proposed. The effectiveness of postural theory as the basic science theory that can explain clinical findings is demonstrated.

Key words: Non-Specific • Low Back Pain • Weight • Theory • Posture • Intervention • Pain Mechanism • Stress • Innervation and Injury

INTRODUCTION

History and Definition: Since the Bronze Age, Low back pain has been identified with humans. Edwin Smith Papyrus, dating to about 1500 BCE in Maharty [1] describes a diagnostic test and treatment for a vertebral sprain. Also in Maharty [1], Hippocrates (c. 460 BCE-c. 370 BCE) was the first to use a term for sciatic pain and low back pain; Galen (active mid to late second century CE) described the concept in some detail. Physicians through the end of the first millennium did not attempt back surgery and recommended watchful waiting. Through the Medieval period, folk medicine practitioners provided treatments for back pain based on the belief that it was caused by spirits [1].

Another school of thought by physicians at the start of the 20th century was that low back pain is caused by inflammation of or damage to the nerves [1]. Neuralgia and Neuritis were the frequently mentioned cases in the medical literature of the time [2]. However, during 20th century the popularity of such proposed causes decreased [2]. Harvey Williams Cushing an American neurosurgeon in Monusov [3] boosted the acceptance of surgical treatments for low back pain in the early 20th century. In the 1920s and 1930s, new

theories of the cause arose, with physicians proposing a combination of nervous system and psychological disorders such as nerve weakness (neurasthenia) and female hysteria [1]. Muscular rheumatism (now called fibromyalgia) was also cited with increasing frequency [2].

The introduction of technologies such as X-rays provided physicians with new diagnostic tools. This helped in revealing the intervertebral disc as a source for back pain in some cases. In 1938, orthopedic surgeon Joseph S. Barr in Lutz et al [2] reported on cases of disc-related sciatica improved or cured with back surgery. As a result of this work, in the 1940s, the vertebral disc model of low back pain took over [1], dominating the literature through the 1980s, aiding further by the rise of new imaging technologies such as CT and MRI [2]. The discussion subsided as research showed disc problems to be a relatively uncommon cause of the pain. Since then, physicians have come to realize that it is unlikely that a specific cause for low back pain can be identified in many cases and question the need to find one at all as most of the time symptoms resolve within 6 to 12 weeks regardless of treatment [1]. These many unidentified cases have been called nonspecific low back pain (NSLBP).

Non-specific low back pain is tension, soreness and/or stiffness in the lower back region for which it is not possible to identify a specific cause of the pain. It is a multidimensional problem i.e. several structures in the back, including the joints, discs and connective tissues also neurophysiological, physical and psychosocial factors, may contribute to symptoms [4, 5].

Management Treatment: There is a generally accepted approach to the management of back pain of less than 6 weeks' duration. What has been less clear is how low back pain should be managed in people whose pain and disability has lasted more than 6 weeks [5]. Many treatment options exist, they include: cognitive behavioural therapy, drug therapy, bed rest, supportive corsets, braces, "back schools", spas, moist heat, cold cabinets, manual therapy etc. [5-10]. Some of these treatments are outdated [5] and none of the therapies have shown superiority over another most especially in the treatment of sub-acute and chronic Non-specific low back pain [11-14] and the reason for this may be lack of understanding of the underlying mechanism deriving the disorder [2, 4]. Diagnoses have become very difficult to achieve despite of a large number of pathological conditions that is capable of causing back pain [15, 16].

As a result of not getting a specific diagnosis in the majority of cases, uncertainty in the treatment seems to be very evident [17]. In fact, some treatments tend to aggravate the disorder [11, 13, 18]. To overcome this challenge, classification system and targeted treatment has been advocated in recent years. The classification systems that exist are: McKenzie, [19] Spitzer, [20] Delitto, [21] Sahrman, [22] Petersen, [23] O'Sullivan, [4] and Quebec Task Force classification system [16, 24]. Each of these classifications system has its strength and weakness as discussed by Fersum, [16]. The O'Sullivan classification system which is the most recent seems to be more encompassing as it targeted classification from biopsychosocial perspective and is based on the underlying mechanism of the disorder [4, 16].

MATERIALS AND METHODS

Research has established that LBP is a multi-dimensional problem. These dimensions consist of pathoanatomical, neurophysiological, physical and psychosocial factors [4, 15, 25, 26]. What remains unclear is which of the factors predisposes which in the vicious cycle of nonspecific low back pain (NSLBP) mechanism.

Hypothesis: Our hypothesis is that 'Posture, which is a physical factor, is the trigger for nonspecific low back pain (NSLBP)'.

Theory: Mafuyai, [27] shows that peoples' weight varies with change in posture of the lumbar spine which in turn varies the stress that every anatomical part of the lower back bears. These variable quantities called virtual weight and virtual stress are given, by Mafuyai, [28] as:

$$W_v = \left(\frac{d}{d_N} - 1 \right) W_t$$

And,

$$S_v = \left(\frac{d}{d_N} - 1 \right) \frac{W_t}{A_0 \cos \theta}$$

The two opposite posture of the lumbar spine are concave (lordotic/extension) and convex (flexural) postures [29]. When in a concave posture, virtual weight and stress are positive thereby adding to the original weight and stress borne by the lumbar spine. In a convex posture, the virtual weight and stress are negative thereby reducing the original weight and stress borne by the lumbar spine.

Observations That Support this Theory: There exist a number of observations both natural and experimental that validates this theory. They include:

- *Old Age:* At old age, inter-vertebral disc problems begin to manifest [30-33]. And standing upright/or bending backward results in concave posture which increases the weight on the lumbar spine unusually. This results in peripheral pain generation [4, 32]. To avoid the pain, people naturally bend forward and this creates a convex posture which takes away weight and stress from the lumbar spine.
- *Pregnant Women:* In advanced stage of pregnancy, it is always difficult for pregnant women to walk some reasonable distances without being highly stressed up. It is easier to speculate that the weight of the baby is the major cause. The average weight of newly born babies is about 3.5Kg except for some abnormal cases of 6.1Kg, 10Kg etc. [34]. But, can these compare to a 15-20Kg load (water, firewood etc.) women carry when they are not pregnant and go to distances of kilometers? If no, then the concave posture [13] created by pregnancy is more responsible for the great stress than the supposedly weight of the baby.

- *Experimental:* Mafuyai [35] measured the weight of a subject using a weight measuring scale and found out that the weight increased from 60Kg to 63Kg as the concavity of the lumbar spine increase. Though the increment may seem small, but the stress generated can be much as in equation (2) and this is because θ ranges from $0 - 15^\circ$ [28, 31].

RESULT AND DISCUSSION

In this section, three among many controversial phenomena of non-specific low back pain are explained using the theory to demonstrate its efficacy. Phenomena such as: Vicious cycle of NSLBP phenomenon (Pain mechanism), Prevalence of NSLBP across all age groups and gender and Intervention challenges.

Pain Mechanism/vicious Cycle of Nlbp Phenomenon:

Non-specific low back pain is classified in stages as acute, sub-acute and chronic NSLBP [15, 31, 36, 37]. And the factors often blame are pathoanatomical, neurophysiological, physical and psychosocial factors [4, 15, 25, 26].

Acute NSLBP, according to postural theory, is mostly caused during a convex posture and the pain results only from strains and sprains of muscular tissues in the lumbar spine [32, 38, 39] since this posture does not bring about increase in weight or stress rather decrease, no serious damage of the lumbar spine structural parts results [28]. This therefore, points out:

- That acute NSLBP is the common type of LBP among the subsistence farmers in the under developed and developing nations of the world since these farmers always bend forward (forming a convex posture) to do their work. And this may be the reason for low level of consultation of medical facilities, in regards to this challenge, in these parts of the world [29] since tissue strains and sprains will heal within few days or normal tissue healing period [13] and therefore the sufferer perceives it as commontiredness resulting from heavy physical work and no need for medical intervention.
- The fact that acute NSLBP with or without intervention resolve within few days and that most interventions equally work fine in resolving the problem [16, 20, 40]. This is so since all that is needed is postural adjustment and little time of rest to allow the muscles regain normalcy.

Sub-acute and chronic NSLBP are caused by concave posture. These two categories of NSLBP result from micro-injuries [39] sustained by the structural parts of the lumbar spine as the result of increased weight and stress brought about by this posture. These injuries are not obvious as the popularly acclaimed anatomical injuries such as disc herniation, disc protrusion and degeneration etc. [16]. Imaging may hardly reveal it.

Nature presupposes that every part of a system develop in accordance to the increasing demand of it function. Therefore every part of the lumbar spine develops, as people grow, including the capacity of the inter-vertebral disc to bear the increased weight due to this development. But increase in weight due to posture change is unprecedented, hence injurious to the lumbar spine. When one vertebral body is tilted against another, surface area in contact is reduced as seen from equation (2). The nucleus pulposus is not able to distribute the compressional stress evenly on the disc and therefore, the weight is concentrated on small portion of the anulusfibrosus [31] at the anterior part of the disc (Figure 3.1.2) and peripheral pain is generated due to sinuvertebral nerve [31] (Figure 3.1.1). Under such condition, any rotational movement of the vertebrae can lead to lesion on the sinuvertebral nerve which brings about sub-acute NSLBP and repetitive movement can lead to deterioration of the lesion which now becomes chronic NSLBP. This is the reason interventions such as physical exercise and manual therapy do not resolve pain in these categories of NSLBP but rather aggravate it sometimes [5, 41].

Someone may ask if increase in weight is the cause, then what happen when people carry load on their head. This situation is less dangerous than what have been described for the following reasons:

- The increase in weight does not result in a corresponding decrease in surface area of contact of the two vertebral bodies or the reference anatomical parts which could lead to concentration of the stress on a particular portion of the disc. Hence, the nucleus pulposus distribute the compressional stress evenly on the disc [31].
- The upper and lower surfaces of the disc are cartilaginous and not innervated. Therefore there is no nociception due to tear or wear resulting from the increased friction that comes from the load carried.

But note, this may lead to disc herniation in which case the LBP is no longer NSLBP [39].

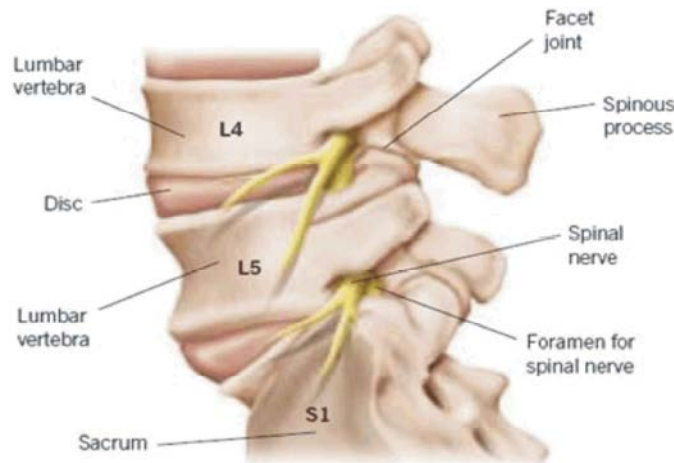


Fig. 3.1.1: Structure of Lumbar Vertebrae Showing IVD. [27]

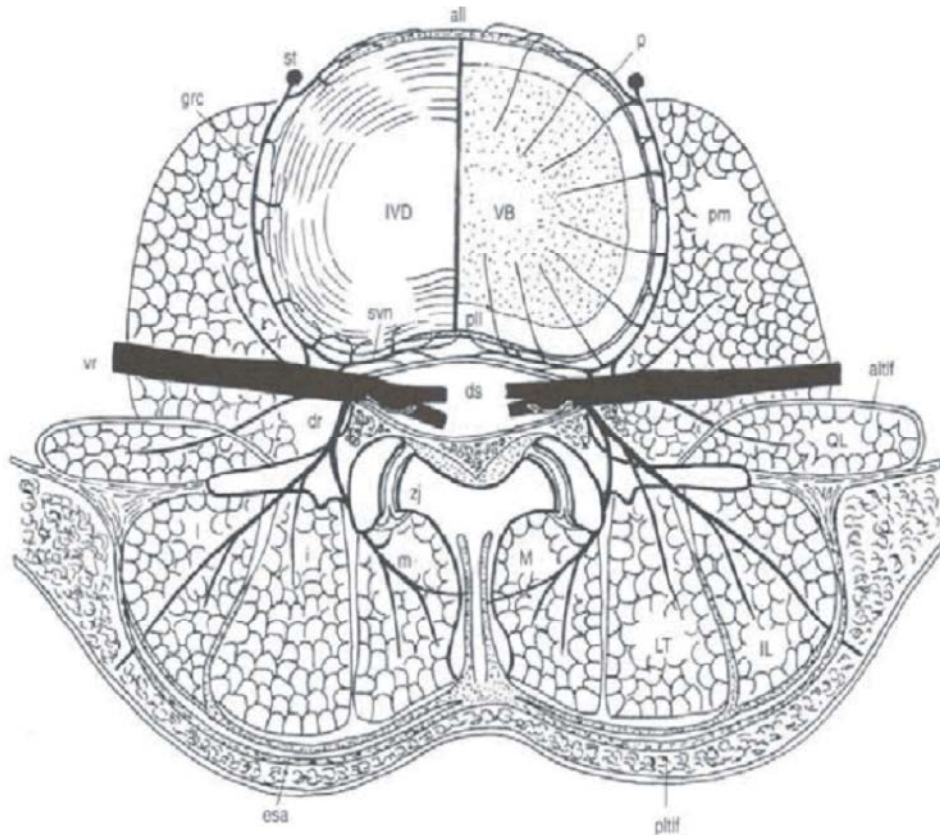


Fig. 3.1.2: Innervation of the Spine Structures

Finally, from the above pain mechanism, it is clear that the vicious cycle of the factors is as follow: physical, pathoanatomical, neurophysiological and psychosocial

Nerves: Ventral ramus (vr), dorsal ramus (dr) and its medial brach (m), sinuvertebral nerve (svn). Muscles: M. psoas major (pm), m. quadratuslumborum (QL), m. multifidus (M), m. longissimusthoracis (LT), m.

Iliocostalislumborum (IL), erector spinaeaponeurosis (esa). Thoracolumbar fascia; anterior layer (altlf), posterior layer (plttf).Intervertebral disc (IVD).Vertebral body (VB).Zygapophyseal joint (zj) [31].

Prevalence of Nslbp Across All Age Groups and Gender: Research has shown that non-specific low back pain is not just an old age phenomenon but a problem common

even among young and middle-age people [23], [42-48] From postural theory, this is so because posture changes are possible in all persons irrespective of age and gender. And going by the pain mechanism outlined, it is not doubtful that this NSLBP is found among all age and across gender. There has been a varied conclusion among researchers on the rate of prevalence across gender. While some concluded that it is higher in female than male, others concluded that it is higher in male than in female and yet others say there is no significant difference, and that the cause of the variation or lack of it is not clearly understood [49-51]. These conclusions may and may not be correct depending on the physical activity the various genders are engaged in. Mafuyai, [29] shows that there is higher prevalence among those involved in occupations that result in concave posture than those involved in occupations that result in convex posture.

Intervention Challenges: Many treatments for NSLBP exist. While majority of them independently work well for acute NSLBP, none has been independently effective in treatment of sub-acute and chronic NSLBP [11-13]. This has necessitated the combination of two or more intervention strategies. But the challenge still was in which order interventions would be given so that it is effective since the underlying mechanism of pain is not clear [4]. This has led to the discouragement of administering interventions such as bed-rest, cold cabinet etc. as they are said to increase sub-acute and chronic NSLBP [5, 41]. In recent times, sub-classification has been advocated to help administer the appropriate intervention [4, 31]. However, the efficacy of this approach has not yet been established [31, 37, 52]. Going by postural theory, the discouraged interventions are highly needed- in fact they are the first to be administered but in a manner that they produce a convex posture so as to allow for the healing of the sustained lesions and thereafter, therapies such as physical exercise and manual etc. that resolve strains and sprains, then psychosocial therapy can be given to enable the patient believe that their NSLBP has been healed and finally, physical therapy such as avoidance of dangerous posture in order that recurrence will be avoided.

CONCLUSION

Postural theory has been proposed. Pain mechanism has been logically discussed and the efficacy of the theory in explaining many natural observations is undoubted. Many controversial phenomena of

non-specific low back can be explained with ease using the theory. Lack of correct ordering of interventions for non-specific low back pain has been identified as one of the major problems bringing about ineffectiveness of these interventions. Waddell [53] made a clarion call that “we must seek the basic science that helps to explain our clinical findings, rather than trying to force patients to fit our basic science”. And postural theory is an answer to that call.

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