American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-6, Issue-1, pp-104-107
www.ajer.org
Research Paper Open Access

Health of the spine: a review about our basis

Guilherme Lisboa de Serpa[1], Paula Matias Soares[2], Roberta Cristina da Rocha e Silva[1], Francisco Sérgio Lopes Vasconcelos Filho[2], Welton Daniel Nogueira Godinho[2]

[1](Universidade Estadual do Ceará, Brazil)
[2](Universidade Estadual do Ceará ,Instituto Superior de Ciências Biomédicas, Brazil)

ABSTRACT: *The foundation of the human body, the spine presents several characteristics that imply in everyday and sports practice. This structure, besides having ligaments and muscles, is also part of the nervous system, due to the presence of the spinal cord in this region, so there is a great risk when it comes to limb mobility when there is some type of severe spinal injury. The maintenance of the health of this structure is of fundamental importance for the athletic longevity of athletes and quality of life of non-athletes. The objective of the present study was to review important points related to the anatomical constitution, biomechanical and kinesiological aspects of the spine, besides highlighting important points related to causes of spinal dysfunctions such as: scoliosis, disk hernias and lumbago, Characteristics of acute injury processes suffered by the spine during work activities and during the practice of physical activity, also showing some ways of preventing and treating injuries in this structure. We used articles in the database: Scielo, Pubmed and SciencDirect resulting in a total of 22 articles used to produce this paper. Knowledge of the issues related to the morphology, kinetics and kinematics of the spine is of fundamental importance for professionals working with human movement.*

Keywords: *Spine, biomechanics, health, performance, kinesiology*

I. INTRODUCTION

The spine is an important structure of the human body, usually composed of 33 vertebrae, 7 cervical, 12 thoracic, 5 lumbar and 5 sacral and 4 coccygeal, functioning as a rigid structure that serves to make the connection between the others Parts of the skeleton [1],allowing movements in the sagittal, coronal and transverse planes [2].

This structure is affected by compression forces in the intervertebral disc, which are: compression, shear and traction, these forces increase linearly with the increase of compressive loads, as for example: when flexing the trunk, extending it, or flexing laterally, Compressive force acts on the inclined side and the tension force on the opposite side [3].

A problem pertinent to the world population is low back pain, because poor posture, incorrect lifting of the load and long sitting in a seated position is a common habit of the population. Poor posture, sedentary lifestyle, contribute to the onset of low back pain [4]. When doing a squat without doing hip, knee and ankle flexion, the spine undergoes a much greater compression force than when doing the same movement, but flexing these three joints [5].

Thus, it is of fundamental importance knowledge about the anatomical, kinesiological and biomechanical aspects of the spine, so it is of extreme interest to health professionals, especially physical educators, orthopedists and physiotherapists, in order to prevent pathological degrees from arising or progressing. In this way, justifying a revision that addresses some evidence of this important structure.

II. MATERIALS AND METHODS

To do so, a study was carried out in the database Scielo and Pubmed and SciencDirect, of which there were 40 studies, and 22 articles were selected. In the period that includes the month of December 2016. The descriptors used were: spine; Low back pain; Spine diseases; Spine treatment. Evidence that did not communicate the proposal, whose purpose was not the biomechanical, kinesiological and rehabilitation aspects were discarded.

III. RESULTS AND DIRSCURSSION

III.1 KINESIOLOGICAL AND BIOMECHANICAL ASPECTS

The presence of curvatures in the spine is important to dissipate the compressive forces acting on the longitudinal axis, thus reducing the risk of back pain [6]. In the absence of external forces, the major contributor

to the loads comes from the muscular activity of the trunk. [7]. The anteroversion and pelvic retroversion movements are related to movements of the lumbar region, however, the pelvic retroversion movement is detrimental to the spine, as it attenuates the compressive loads in this structure and causes fatigue in the erector muscles of the spine (muscles important in maintaining the position [8]. A very important muscle for the maintenance of the anatomical curves of the spine is the psoas major, since this muscle is the dominant one in hip flexion, [9] its good activation is fundamental for the performance of Exercises and prevention of inflammatory processes in the antagonist musculature. In the spine, more precisely between the vertebrae are the intervertebral discs, these structures are composed of a nucleus pulposus and a fibrous ring [10], their importance is due to the damping against the forces of axial compression, preserving the structure of the Articulation and vertebrae [11] .Performed an in vivo measurement study in which they analyzed the pressure exerted by the intervertebral discs in different positions and observed, among other things, that the resting position supinated is the one that generates less compression on the disc and that the sitting position generates More compression than standing, a fact confirmed by [12].

III.2 LOW BACK PAIN

Low back pain is a recurring problem in the world population. In 1998, Andersson [13] states that 85% of the population suffers or will suffer at some point in life with some kind of low back pain, the causes vary, for example: obesity [14] lifting loads in a non ergonomic position [4], works that involve a great deal of movement in several planes [2]. In addition to psychological factors, however, mechanical factors still play a leading role in relation to the cause of low back pain [15]. Men often present back pain four times more [16]. Children may also be affected by low back pain, but unlike adults, their cause is a result of increased physical activity and flexor muscles Strong back [17].

III.3 HERNIATED DISC

Herniated disc is a sequel to the process of degeneration of the vertebral disc, there is classification for each stage of disc degeneration, they are: protrusion, extrusion and sequestration [18]. The causes may arise from mechanical stress arising from poor ergonomics by lifting a weight by a sudden increase of the compressive forces on the segment of the column being biased [19], or from damages suffered by small-scale compression forces for years. Experimental studies have shown that the compression made by the discs in the nerve roots, has led to the formation of edema. [20]

III.4 SCOLIOSIS

It is characterized by a three-dimensional deformity of the spine, the level of scoliosis is diagnosed after radiography and may require surgical intervention [21]. The abnormal curvatures present in scoliosis are located mainly in the thoracic segment of the spine [22]. It is often found in 32% of people over 50 years of age]23]. It can become painful and undermine the social life of Carriers of this disease [24,25].

III.5 ACUTE FRACTURES IN SPINE

Commonly addressed in sports, especially in contact sports such as football, acute fractures in spinal or transverse processes may be caused by extremely strong mechanical shocks or a high contracture of the musculature [26]. The cervical region is commonly affected by indirect trauma, In which applied forces are applied to the head and torso. [27] The excess of compressive loads in sports or daily activities, also presents risk. Vertebral fractures usually cause concern, because as one of the functions of the spine is the protection of the spinal cord, it can result in irreversible paralysis and lead to death. [28].

III .6 SPINAL AND PHISICAL ACTIVITY

The practice of physical activity requires great care with the spine, especially in sports in which the main characteristic is weight lifting, since according to a study of Adams and colleagues[29], a disc compression of 6.700kN (± 2.5 kN) would already be sufficient to occur Some kind of damage to the intervertebral disc. The maintenance of a good posture in the execution of exercises is very important both in terms of performance and the maintenance of the health of the spine. A very interesting fact, comes from the study of McGill, Hughso and Parks [30], in which they observed that not maintaining the lumbar curvature, would leave the individual more susceptible to some type of injury in that region.

III.7 PREVENTION AND REHABILITATION OF SPINE PROBLEMS

In the attempt to treat and avoid problems of back pain, especially in the lower back, some evidence shows what would be more interesting, such as: strengthening the trunk muscles, flexing the knees when doing abdominal [31], training programs There are also fractures occurring in the cervical region that can be caused by

subluxation in the articular facet, unilateral, bilateral or complete displacement of the facet [32] .The diagnosis, in this case, is made by image, through Radiography [33,34] and the treatment is done with the degree of neurological damage. The treatment for back pain in general should be complete, aiming at ergonomic and clinical issues, because in this way recovery can be more efficient.

IV. CONCLUSION

The preservation of the health of the spine is of fundamental importance, both for the well being and for the physical performance, it is relevant that health professionals, especially those working with human movement are aware of proposals for intervention and prevention for back problems, avoiding Pathological processes.

In relation to the treatment of back pain, the most recommended would be the strengthening of intrinsic and extrinsic trunk muscles, flexor muscles of the thigh must be in perfect activation with their antagonistic pairs, thus avoiding pain in the core region and a greater Stabilization in exercises and regarding prevention would be ideal a good ergonomics in daily activities.

The kinesiological and biomechanical analysis of the spine are extremely relevant for athletic longevity, quality of life and injury prevention.

REFERENCES

[1] Najarian S, Dargahi J, and Heidari B. Biomechanical effect of posterior elements and ligamentous tissues of lumbar spine on load sharing, Biomed Mater Eng;15(3),2005,145-158.
[2] Davis KG and Marras WS, The effects of motion on trunk biomechanics, Clin Biomech,15(10),2000,703-717.
[3] M. Lindh . Biomechanics ofthe lumbar spine (Philadelphia: Lea & Febiger, 1989).
[4] McGill SM. The biomechanics of low back injury: implications on current practice in industry and the clinic.J Biomech, 30(5), 1997, 465-475.
[5] Babak B, Aboulfazl S, and Navid A. Analysis of squat and stoop dynamic liftings: muscle forces and internal spinal loads.Eur Spine J, 16(5),2007, 687–699.
[6] Christensen ST, and Hartvigsen J. Spinal curves and health: a systematic critical review of the epidemiological literature dealing with associations between sagittal spinal curves and health.J Manipulative Physiol Ther, 31(9),2008,690-714.
[7] Deed EH, Christopher J C , Donald DH, Tadeusz JJ, Jason WH, and Tony S K. Anterior thoracic posture increases thoracolumbar disc loading.Eur Spine J, 14(3),2005, 234–242.
[8] Pynt J, Higgs J, and Mackey M. Seeking the optimal posture of the seated lumbar Spine. Physiother. Theory Pract, 17(1), 2001 ,5-21.
[9] Santaguida PL, and McGill SM. The psoas major muscle: a three-dimensional geometric study. J Biomech, 28(3), 1995, 339-345.
[10] Bogduk,N. Clinical Anatomy of the lumbar spine. (New York :Churcill Livingstone,1997)
[11] Nachemson A, and Morris JM. In vivo measurements of intradiscal pressure. discometry, a method for the determination of pressure in the lower lumbar discs,J Bone Joint Surg Am, 46(5),1964,1077-1092.
[12] Wilke HJ, Neef P, Caimi M, Hoogland T, and Claes LE. New in vivo measurements of pressures in the intervertebral disc in daily life.Spine ,24(8),1999,755-762.
[13] Andersson GBJ: Epidemiology of low back pain. Acta Orthop Scand Suppl ,69(281),1998,281:28-31.
[14] Heuch I, Hagen K, Heuch I, Nygaard, and Zwart JA.The impact of body mass index on the prevalence of low back pain: the HUNT study.Spine,35(7), 2010,764-768.
[15] Frymoyer JW, and Pope MH. The role of trauma in low back pain: a review. J Trauma, 18(9),1978, 628-634.
[16] Kuwashima A, Aizawa Y, Nakamura K, Taniguchi S, and Watanabe M. National survey on accidental low back pain in workplace. Ind Health, 35(2),1997, 187-193.
[17] Newcomer K, and Sinaki M. Low back pain and its relationship to back strength and physical activity in children. Acta Paediatr,85(12),1996,1433-1439.
[18] Victor N, and Cassar-Pullicino. MRI of the ageing and herniating intervertebral disc. European Journal of Radiology, 27(3),1998,214-228.
[19] Adams MA, and Hutton WC. Prolapsed intervertebral disc. A hyperflexion injury 1981 Volvo Award in Basic Science. Spine,7(3),1982,184-191.
[20] Olmarker K, Holm S, Rosenqvist AL, and Rydevik B. Experimental nerve root compression. A model of acute, graded compression of the porcine cauda equina and an analysis of neural and vascular anatomy. Spine, 16(1), 1991, 61-69.
[21] Archana PS, Carl EA, Hubert L, Ian AFS, Lawrence GL, Roger J, and Peter N. Three-Dimensional Classification of Thoracic Scoliotic Curves. Spine ,34(1),2008,91-99.
[22] Coonrad RW, Murrell GA, Motley G, Lytle E, and Hey LA. A logical coronal pattern classification of 2,000 consecutive idiopathic scoliosis cases based on the scoliosis research society-defined apical vertebra. Spine, 23(12),1998,1380-1391.
[23] Kobayashi T, Atsuta Y, Takemitsu M, Matsuno T, and Takeda N. A prospective study of de novo scoliosis in a community based cohort. Spine, 31(2),2006, 178-82.
[24] Schwab F, Dubey A, Gamez L, El Fegoun AB, Hwang K, Pagala M, and Farcy JP. Adult scoliosis: prevalence, SF-36, and nutritional parameters in an elderly volunteer population. Spine, 30(9),2005, 1082-5.
[25] Berven S, Deviren V, Demir-Deviren S, Hu SS, and Bradford DS. Studies in the modified Scoliosis Research Society Outcomes Instrument in a dults: validation, reliability, and discriminatory capacity. Spine, 28(18),2003, 2164–2169.
[26] George DR. Low Back Pain in Athletes, Physician Sportsmed, 15(1),1987, 105-106.
[27] Byun HS, Cantos EL, and Patel PP.Severe cervical injury due to break dancing. A case report. Orthopedics, 9(4), 1986, 550-551.
[28] Silver JR. Spinal injuries as a result of sporting accidents. Paraplegia, 25(1),1987,16-17.
[29] Adams MA , Freeman BJ, Morrison HP, Nelson IW, and Dolan P. Mechanical initiation of intervertebral disc degeneration. Spine, 25(13), 2000, 1625-1636.

[30] McGill SM, Hughson RL, and Parks K. Changes in lumbar lordosis modify the role of the extensor muscles.Clin Biomech , 15(10),2000, 777-80.
[31] Axler CT, and McGill SM. Low back loads over a variety of abdominal exercises: searching for the safest abdominal challenge. Med Sci Sports Exerc, 29(6),1997,804-11.
[32] Khezri N, Ailon T, and Kwon BK. Treatment of Facet Injuries in the Cervical Spine.Neurosurg Clin N Am ,2017,28(1):125-137.
[33] Bailitz J, Starr F, Beecroft M, Bankoff J, Roberts R, Bokhari F,et al.CT should replace three-view radiographs as the initial screening test in patients at high, moderate, and low risk for blunt cervical spine injury: a prospective comparison. J Trauma,66(6),2009,1605-1609.
[34] Widder S, Doig C, Burrowes P, Larsen G, Hurlbert RJ, and Kortbeek JB. Prospective evaluation of computed tomographic scanning for the spinal clearance of obtunded trauma patients: preliminary results. J Trauma,56(6),2004,1179-1184.