REVIEW

MUSCULOSKELETAL DISORDERS AND THEIR RELATIONSHIP WITH PHYSICAL ACTIVITIES AMONG OFFICE WORKERS: A REVIEW

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ABSTRACT

Lower back, neck and shoulder pain are the most prevalent musculoskeletal problems affecting office workers worldwide, and they have both personal and socioeconomic consequencesas well. Several hypotheses regarding the underlying mechanisms and the maintenance behind office work-related musculoskeletal disorders have been presented. There is some evidence, based on epidemiological studies as well as studies upon smaller groups of subjects, that individuals who sit and work for a long time not only show cognitive impairment at the workplace, but also suffer from poorer and fragmented daytime sleep, in addition toincreased risks of developing variouspsychological, physiological and medical impairments and musculoskeletal disorders. The related physical mechanisms behind musculoskeletal disorders are discussed in the context of new findings. The main causes, as well as varying levels in severity of musculoskeletal disorders,not to mentionthe link between such disorders in the neck, shoulder and lower back regions and physical activity among office workers are also stated. The main objective of this review paper isto conduct a systematic review to identify musculoskeletal disorders and how these disorders are correlated with physical activity among office workers. The results of this review indicate that the musculoskeletal disorder is a critical issue among office workers and the main cause is related to the absence of physical activity as well as the subjects' sedentary lifestyle. As a practical message, regular physical activity can be effective in the prevention and decrease of physical discomfort among office workers who suffer from musculoskeletalpain.

***Keywords**:Office training; neck pain; shoulder pain; lower back pain*

INTRODUCTION

Musculoskeletal issues (mainly lower back, neck and shoulder pain) are particularly prevalent in industrialized countries, affecting roughly 70% to 80% of adults at several points in their lives, with about 1% of the U.S. population chronically disabled as a result of lower back, neck or shoulder pain[1]. Such a disability causes poor quality of life while increasing the amount of daily work absenteeism and the number of long-term disability claims. Those who are affected often experience sleep disturbances, chronic fatigue and nervousness, and many fall victim to prescription medication abuse[2]. The scale of this problem is anticipated to grow with both an aging population and increasing pace of industrialization in the developing world. A variety of risk factors contribute to lower back, neck and shoulder pain, including age, race, sex, and marital status, but the most prevalent factor—especially among adolescents—is the amount of time spent on sitting [3].The term musculoskeletal disorders (MSD) refers to a broad range of conditions that can affect any part of the musculoskeletal system, including the muscles, bones, nerves, joints and spinal discs, along with supporting blood vessels and connective tissues such as tendons, ligaments and cartilage[4]. Injuries can occur, such as sprains, tears and strains, in addition to any form of acute or chronic soreness or pain within the support frame of the body. These disorders are normally degenerative, worsening over time if the conditions that lead to them are not addressed properly[5].

There is a growing interest in research on the occupational hazards related to lower back, neck and shoulder pain and its risk factors among large populations of office workers. It is necessary to conduct studies on the prevalence of musculoskeletal disorders (MSD), as well as evaluate the effectiveness of practical treatment methods for lower back, neck and shoulder pain. Identifying the specific risk factors for individuals and minimizing those factors are crucial steps in dealing with this issue in its varied forms [6].

A number of studies have supported the claim that people who work in offices are particularly prone to experiencing musculoskeletal discomfort, creating an increased awareness of, and concern for, the welfare of office workers[7]. The most commonly cited reasons for the high percentage of lower back, neck and shoulder pain are related to factors including the ergonomic conditions of one's workplace and a sedentary lifestyle[8], as well as the absence of routine physical activity[9]. Unfortunately, even though the prevalence of the problem is increasing, little attention is paid by neither government nor company,despite the fact that prolonged sitting and working have already beenaddressed.

According to the European Guidelines for the prevention of lower back, neck and shoulder

pain, such pain is generally divided into three categories: acute, sub-acute, and chronic pain. The principle upon which this classification is based relies on the duration of the pain. Acute pain is an episode which lasts for less than 6 weeks; sub-acute pain lasts between 6 to 12 weeks, and chronic pain lasts for about 12 weeks or longer[10]. Several studies point to physical inactivity associated with a sedentary lifestyle resulting from prolonged periods of time spent in sitting positions that suggest an incorrect posture (which leads to damage and weakening of postural muscles). Another potential issue is muscle spasms resulting from various forms of psychological stress[11]. It seems that taking a short break or brief walk during working hours can be useful.

Physical activity is a necessary precursor to healthy living, and it is vital in keeping the musculoskeletal system in proper functioning order. Lack of exercise is able to cause or worsen lower back, neck and shoulder pain as a result of increased stiffness and damaged muscles. Individuals who live sedentary lifestyles lose not only the strength but flexibility of their muscles, both of which are important components of health-related physical fitness and natural posture. However, these people fail to benefit from the benefits of usual exercises in ways that go beyond the more common and obvious associations of cardiorespiratory fitness, muscular strength and flexibility - regular exercise provides nourishment of the ligaments, spinal discs and soft tissues. When a person's lifestyle lacks exercise, these tissues become malnourished and begin to degenerate[9]. In addition, sitting in a workplace chair for hours at a time provides a cause for or worsens existing lower back, neck and shoulder pain. Sitting forward or slouching in a chair for extended periods stretches the spinal ligaments frequently and puts undue strain on the intervertebral discs and nearby structures in the vertebral columns[12].

After a while, improper sitting positions and poor office ergonomics can contribute[8] to or cause repeated encounters with back pain[7]. Strengthening and stretching movements for the muscles of the back, neck and shoulders can assist in the recovery as well as preserve the health of the spine. Physical therapists and other professionals use stretching and resistance training to assist individuals in regaining lost motion and strength resulting from pain or immobilization. Being active in a standard exercise plan that contains stretching as well as strength conditioning promotes the recovery of existing problems [13] and prevents future ailments[14]. Getting regular exercise increases people's overall abilities to perform daily tasks. Improving the flexibility and strength of their muscles can also boost their vertebral column and decrease the frequency of injuries in this area of the body. As a result, the amount of pain they experience will be reduced, thereby allowing much easier and more restful sleep, which in turn lowers levels of fatigue[9].

A good deal of research has been done on this topic, but most of it has simply highlighted the prevalence of these issues among office workers; some studies have suggested a general and simple training protocol for the whole body, whereas others have recommended ways to modify the ergonomic conditions of their working environments. However, there has been a lack of research related to introducing a specific routine for training office workers to deal with lower back, neck and shoulder pain. In order to clarify the effectiveness of any methods used by office workers, a specific comparison of the effects of any program upon lower back, neck and shoulder pain has to be made first. Research done up to this point has demonstrated a significant connection between the physical and ergonomic demands of an individual's life and musculoskeletal disorders of the lower back, neck and shoulder regions, especially among office workers. However, some issues regarding methodology will have to be addressed carefully in this research in order to develop specific risk-assessment tools for identifying the complex array of interactive factors involved in office work. The accurate identification of these risk factors will, in turn, facilitate establishment of targeted forms of intervention to reduce the incidence of musculoskeletal disorders at work.

MATERIALS AND METHODS

In this study, systematic review methods are used based on the purpose of research. A systematic investigation of recurrent literature databases was navigated between 2003 and 2014. Science Direct, PubMed and Scopus were searched for the subsequent key words: office worker, musculoskeletal disorders, neck pain, shoulder pain, lower back pain, physical activity as well as health and field studies. Papers were also recognized and used by the chief author's collected works. Initially 800 researches were recognized. As there are a huge number of researches about office working disorders, we could not analyse all the original articles, so we analysed and reviewed previous researches. It is notable that there is a lack of review research from 2005 till 2010. From the year 2010 onwards, the number of review articles in this field is increased. In some cases, based on the importance of the study, we have incorporated the original articles that were cited in the previous review articles. Moreover, it must be noted that, the results of this review are dictated by our search terms.

RESULTS

Musculoskeletal disorders can affect any person, regardless of age or gender, and are often

directly related to a person's job[15]. In instances where this connection exists, either as a result of the working environment or a work-related incident of some kind, these conditions are referred to as work-related MSD. A study performed in Nigeria reveals that musculoskeletal disorders were prevalent throughout the workforce; Fabunmi et al. [16] reported that, within a 12-month period of time, the rate of self-reported musculoskeletal disorders at any given work site was 91%. MSD's canthus account for anywhere between 42% and 58% of work-related health concerns[17]. However, MSD's vary across different industries as well as between different countries, and particular occupations - whether within or across different industries - can have rates of musculoskeletal disorders three to four times higher than the overall average of the general workforce[18].

One major risk factor that has a strong connection to the development of MSD's is computer usage. People who work in an office environment have an increased likelihood of developing MSD's, as their jobs typically require them to spend long hours in front of a computer[19]. Therefore, industries in which a large percentage of employees work in office environments are likely to have a higher vulnerability to MSD's. The banking industry is one such example, and studies indicate that the prevalence of MSD's among bank workers ranges from 60% to 80%, indicating that they have a high susceptibility to these kinds of injuries[20].The connection between occupation and the incidence of MSD's is not entirely based on the physical strain of the working environment. Risk factors for musculoskeletal complaints among office workers who spend large amounts of time using computers are associated not only with physical but also with psychosocial characteristics[21].

A study performed in Europe provides evidence that socioeconomic status can contribute to the burden of musculoskeletal disorders, specifically for arthritis, spinal conditions and osteoporosis[22]. Another study performed in the UK shows that musculoskeletal disorders, particularly those of the back, knee, neck and shoulders, were more widespread in economically disadvantaged areas[23]. Even so, the prevalence of MSD's has been prominently associated with its connection to occupation, which seems to be the largest overall factor– hence the use of the term "work-related MSD's". In an extensive systematic review using 1761 articles and 63 separate studies, Costa and Vieira (2010) highlight that the labor-intensive nature of an individual's occupation, body mass index (BMI), smoking, and psychosocial work demand, as well as past injuries or history of any MSD, are the most important individual risk factors. Repetitive motions, prolonged awkward postures and heavy lifting are the most commonly cited ergonomic risk factors mentioned in the literature (Table 1).

Other reviews and epidemiological studies, along with a major report from the National Research Council (NRC) and Institute of Medicine (IOM) commissioned by the US Congress in 2001, have clearly demonstrated substantial relationships between MSD and the work environment [5].

Lower Back, Neck and Shoulder Pain

Lower back, neck and shoulder pain, which affect the lumbar spine, are the most commonly reported musculoskeletal disorders. Approximately 80% of the general population is affected by these disorders at a certain point during their lifetime, with some estimates being as high as 84%. The specific etiology of lower back, neck and shoulder pain is often unknown, leading to frequent usage of the diagnostic label "non-specific pain" when no precise pathologic process or structure is identifiable[24]. While these are usually benign disorders that can often be resolved within a few weeks, approximately 10% of the patients develop chronic pain, which not only has a significant effect on an individual's quality of life, but also creates a burden to a society's healthcare system while simultaneously lowering productivity levels and increasing work absenteeism[25]. The proportion of people disabled by lower back, neck and shoulder pain is between 11% and 12% of the population[24]. From an economic standpoint, such types of pain have become one of the most financially burdensome disorders as a result of their growing prevalence in industrialized countries[26]. Recent figures have put the estimated direct expenditures at around US $91 billion per year and, on average, people who experience lower back, neck and shoulder pain incur overall healthcare costs that are approximately 60% higher than individuals who are pain-free[27].

The most commonly used approach for the treatment of MSD's is exercise therapy[28]. For most cases of lower back, neck and shoulder pain, moderate exercise therapy is generally an effective treatment. However, treating those with non-specific pain has often proved more challenging, largely due to the wide range of potential causes involved[29]. Unfortunately for healthcare professionals, a large percentage of those who suffer from lower back, neck and shoulder pain fall into this category. More than 80% of all patients who complain of lower back, neck and shoulder pain suffer from nonspecific pain, in which no direct organic signs or immediate structural correlations to the sensations they experience can be observed[30]. Insufficient diagnostic procedures may, among other potential factors, contribute to the lack of certainty in this area.

In most cases of non-specific lower back, neck and shoulder pain, the effectiveness of physical therapy is limited. The kinds of treatment used for such non-specific issues tend to be inconsistent, ranging from psychosocial care and pharmacotherapy to radiotherapy and surgery, and the results are often mixed[31]. Some evidence suggests the influence of psychosocial factors in the development of lower back, neck and shoulder pain, in addition to such organic causes as spinal instability resulting from poor ligament function and deficits in neuromuscular coordination. Whatever the cause, in order for a treatment to be truly effective, it should not only relieve pain, but also bring about a tangible change in the body's level of functionality and the individual's overall quality of life[32].

Table 1 Past studies on different methods of treatment for musculoskeletal disorders, especially lower back, neck and shoulder pain.

Author	Subjects	Issue	Treatment
Robertson MM, 2003	Officers workers	Musculoskeletaldiscomfort	Office ergonomics workplace and training
Sherman KJ, 2005	101 adults	Chronic low back pain	Yoga or conservativehealingtrainingcourses or a self-care
Robertson M, 2009	96 office workers	Musculoskeletal disorders	Office ergonomics training
Sherman KJ, 2011	228 adults	Chronic lower back, neck and shoulder pain	Yoga and stretching
Irmak A, 2012	39 healthy office workers	Musculoskeletal pain	Exercise reminder software programs
van NiekerkSM, 2012	Review	Musculoskeletal dysfunction	Workstation modifications
Del Pozo-Cruz B, 2012	100 office workers	Sub-acute low back pain	Web-based multidisciplinary involvement and standard care
Sihawong R, 2014	563 office workers	Lower back, neck and shoulder pain	Exercise program consisting of muscle stretching and endurance training
Lomond KV, 2014	58 subjects with chronic, recurrent lower back, neck and shoulder pain	lower back, neck and shoulder pain	Trunk stabilization vs. general strength and conditioning exercises
Durmus D, 2014	121 patients with definite CLBP	Chronic low back pain	Modified exercise programs
Partner SL, 2014	20 LBP individuals	Lower back, neck and shoulder pain	Exercise with biofeedback

Classification

Lower back, neck and shoulder pain are generally classified according to the signs and symptoms exhibited. Pain that is spread throughout the back region, which does not respond to any specific motion and which remains localized within the back without radiating to bodily regions, is classified as nonspecific - which is by far the most prevalent[33]. Pain that radiates down the leg beyond the knee, which can be either localized to a particular side or on both sides and which changes in sternness in reply to positive positions or maneuvers, is measured in radicular terms - accounting for roughly 7% of lower back, neck and shoulder pain cases. If pain is accompanied by such symptoms as trauma and fever, an extra grave primary issue may be present and such a case would be classified as in need of urgent or specialized attention[34]. Duration is another method of classification, and pain can be categorized using such criteria as acute, sub-chronic (sub-acute) or chronic[35]. There is no universally agreed duration required to classify an individual into these categories, but prolonged bouts of pain lasting fewer than six weeks would usually be classified as acute, while pain lasting six to twelve weeks would be considered sub-chronic, and anything beyond twelve weeks would fall into the realm of chronic pain. Depending upon the duration of

symptoms, the initial prognosis and subsequent management of the pain may change[36].

Signs and Symptoms of Lower Back, Neck and Shoulder Pain

Acute lower back, neck and shoulder pain normally presents itself following activities that involve lifting, twisting or bending forward. The onset of symptoms may occur soon afterwards, or soreness may appear the next morning upon awaking from sleep. The varietyof symptoms normally ranges from mild discomfort at a particular region of the body to extensive pain spread across the entire lower back, neck and shoulders. It will often get worse with more strenuous actions, such as raising a leg or hand, or when the body is in particular positions, such as sitting or standing, although this may not always be the case. Sciatica - a pain radiating down the legs - may also occur. Most people typically have their first experience of lower back, neck and shoulder pain between the ages of 20 and 40 and, as mentioned above, this type of pain recurs in a significant proportion of individuals, by means of repeated encounters that are typically more severe than the initial bout[37].

Other problems may also occur in conjunction with this type of pain. Sleep problems are particularly prevalent, and may include requiring much longer periods of time to induce sleep itself, in addition to turbulence throughout sleep, shorter periods of sleep, and less restful sleep. The majority of those who suffer from chronic lower back, neck and shoulder pain also begin to exhibit symptoms of mental disorders such as depression or anxiety[24].

Causes of Lower Back, Neck and Shoulder Pain

Pain in the lower back, neck and shoulders are not specific ailments in their own right, but are, instead, symptoms caused by a variety of probable and fundamental issues, some more serious than others. They do not have a single or obvious root cause. Rather, it is supposed to be the effect of muscular or skeletal issues such as sprains or strains, often complicated by other factors. Some of these may include obesity, smoking, rapid weight gain (particularly as a result of pregnancy), stress, low overall physical fitness, poor posture and awkward positioning during sleep[38].

Such pain may also be caused or complicated by less common conditions, like osteoarthritis or degeneration of vertebral discs, or injuries such as spinal disc herniation, a broken vertebra or, in extremely rare instances, an infection of or a tumor in the spine. Women are at additional risk from a handful of medical conditions that specifically affect the female reproductive system, as well as ovarian cysts and ovarian cancer[39].

Pathophysiology

Back structures

The backbone is made up of 33 vertebrae, between which are fibro cartilaginous discs, which function as cushions and serve the dual purpose of preventing inter-vertebral friction while simultaneously protecting the spinal cord. Nerves connect to the spinal cord from side to side a series of gaps between the vertebrae, providing messages and sensations to the muscles and skin[40]. An individual intervertebral disc has a gelatinous core which is surrounded by a ring of fibrous material. In its usual condition, the majority of the disc is not directly connected to the circulatory or nervous system, as it is composed of particular cells that can stay alive without a straight blood provide[41]. Over time, the flexibility of the discs starts to dissipate, which subsequently reduces their ability to take up physical stress. This reduced aptitude creates increased stress to other parts of the spine, which results in a thickening of the ligaments of the spine and causes bony growths to expand on the vertebrae, resulting in fewer spaces from first to last, which the spinal cord and nerve roots can bypass.

When a disc degenerates as a consequence of damage or illness, changes in its structure are bound to follow suit: blood vessels and nerves may be formed its center, and it is possible for herniated disc substances to be forced directly onto the root of a nerve, all of which are changes that may lead to back pain. Ligaments and muscles of the back and abdomen provide the vertebral column with stability, while a group of small joints referred to as facet joints direct the motion of the spine while limiting its range[42].

A group of muscles known as the multifidus muscles run along the back of the spine, providing additional stability and ensuring that the spine remains straight while the body is engaged in a myriad of rudimentary activities such as sitting, walking and lifting. These are commonly injured in the bodies of those who suffer from chronic back pain, as the initial pain often causes them to use their back muscles sporadically in an attempt to avoid the pain. Problems with the back muscles often persist even after the initial bout of pain has been treated, and are also probably responsible for recurring pain[43].

Pain Sensation

Pain is usually an uncomfortable sensation resulting from an activity that injures or can potentially harm the body's tissues. There are four major ladders in the procedure of feeling pain: transduction, transmission, perception and modulation[44]. The nerve cells that become aware of pain contain cells situated in the dorsal roots of ganglia and sensory fibers with the aim of sending out signals to the spinal cord. The

procedure of feeling pain starts when the pain-inducing activity or incident triggers the endings of sensory nerve cells that respond specifically to certain sensations, such as pain. These cells then convert the response when intensified by an electrical signal through transduction. More than a few different kinds of nerve fibers transmit the electrical signal from the transducing cell to the tip of the spinal cord, from near to the brain stem, and after that from the brain stem to several parts of the brain, such as the thalamus and the limbic organization[45]. Inside the brain, the pain signals are processed and the individual is soon aware of the pain inflicted on his/her body. Throughout this process, the brain is able to carry out additional nerve impulses by lessening or adding the release of the neurotransmitters involved in the sensory and ascending pathways[45].

However, there are times when parts of the pain-feeling process and dispensation organization might not be conducted correctly, especially while the sensation of pain is arbitrarily induced, or while a particular activity or incident has caused tremendous pain to the body, or even while pain is triggered by an activity or incident that does not usually inflict pain. Apart from that, the pain modulation mechanisms might not function correctly either. These phenomena are linked to chronic pain[46].

Lower Back, Neck and Shoulder Pain and Office Work

After stress, lower back, neck and shoulder pain are the most common causes of long-term sickness in the UK. From 2010 to 2011, roughly 7.6 million working days have gone to waste due to work-related lower back, neck and shoulder pain and other musculoskeletal disorders among office workers[4]. The primary causes are strained muscles or ligaments, routine wear and tear, prolonged periods of retaining a particular position involving bad posture, as well as stress. Extended periods of time spent on sitting on an office chair have been shown to cause or worsen lower back, neck and shoulder pain[47]. The primary reason for this is that sitting, whether on an office chair or in general, is a static posture that places continual stress on the back, shoulders, arms and legs, and is particularly hard on the back muscles and spinal discs.

The natural tendency for most people is to slouch on a chair after an extended period of sitting, and this posture is able to overstretch the spinal ligaments and place undue strain on the spinal discs and related structures. Over time, repeated instances of prolonged sitting using an incorrect posture can damage spinal structures and result in or worsen lower back, neck and shoulder pain. Most people will experience pain in the lower back, neck or shoulders at some point in their lives, and despite the discomfort it poses, most cases of such pain are not fatal. For most people, the pain lasts anywhere between a few days to a few weeks and will usually dissipate in about six weeks[48]. Currently, the most common way to measure the severity of musculoskeletal disorders is using standard questionnaires.

Table 2 Questionnaires in musculoskeletal disorders assessment

No	Questionnaires	Description
1	Nordic Questionnaire	The questionnairecontains of prepared, compulsory, dual or multiple option variants and be able to be used as self-administered questionnaires or in interviews. There are two kinds of questionnaires: a general questionnaire, and specific ones concentrating on the low back and neck/shoulders.
2	Oswestryquestionnaire	The Oswestry index is an index resulting from the Oswestry Low Back Pain Questionnaire presented by clinicians and scientists to measure disability for low back pain. The self-completed questionnaire includes ten topics about strength of pain, lifting, capability to mind for individual, capability to walk, sit, sexual performance, stand, life, sleep value, and travel.
3	Cornell questionnaire	Cornell Musculoskeletal Discomfort Questionnaires (CMDQ) have been developed by Dr. Alan. The questionnaires are based on earlier published researches of musculoskeletal disorder among office workers.

Lower Back, Neck and Shoulder Pain and Physical Activity

The importance of exercise and physical activity (PA) is a main component in the care and cure of acute and chronic pain. Those who suffer from chronic pain are advised to remain physically active, and early and gradual physical activity is encouraged while bed rest is discouraged in primary care guidelines[49]. However, managing such pain effectively, and preventing it from recurring and becoming chronic, remains a major

challenge. There is an increasing focus on preventing long-term negative consequences of chronic pain, and a potential role for PA has thus been planned. A new assessment has established proof to support the use of physical activity as a key part in active self-management amongst people with chronic pain[50]. At the same time, as graded activity programs have been experimented on as a collectiveorganizational plan for populations in which both acute and chronic forms of lower back, neck or shoulder pain are hypothesized to be present, these researches did not evaluate activity levels in daily life outside a controlled environment. Therefore, it is not possible to infer the existence of aconnection linking any change in physical activity to instances of recovery from pain based on this research[51].

The planned result of pain on activity levels of patients with lower back, neck or shoulder pain has largely been based upon the deconditioning model of these types of pain, which is supported by the confirmation of changes in physical performance, neuromuscular changes, psychological property, decreased levels of physical fitness, and alterations in the patterns and levels of activity of patients [52]. This evidence has been challenged, and there are several studies which report no difference in either fitness or activity levels of patients with lower back, neck or shoulder pain in comparison with healthy control groups[53]. In this context, there is little conclusive data about whether the activity levels of patients with lower back, neck or shoulder pain are associated with LBP (low back pain) outcomes, and the role of physical activity in such populations has yet to be determined. The activity level of patients with lower back, neck or shoulder pain does not appear to be a significant predictor of prognosis, although it has not often been specifically examined in most studies[54]. Overall, remaining active as a supplement to physiotherapy healing seems to have positive consequences for both acute and chronic lower back, neck or shoulder pain populations; however, the literature which supports this hypothesis does not contain researches that deliberately take PA of such individuals into account.

The possible function that PA might play regarding the frequency of lower back, neck or shoulder pain has also been investigated, but with no definitive conclusions[55]. A recent review that examines the connection between physical movement and the prevalence of lower back, neck and shoulder pain reported that both high and low levels of activity heightened the probability of chronic post-activity pain, particularly in female subjects[56]. Only one longitudinal study has specifically divided the levels of movement into low, moderate and high levels at baseline before using self-reporting as a measure to explore the link between activity level and pain outcome[57]. This study has found no meaningful connection between the levels of activity recorded at baseline and changes in pain and disability 5 years later. No other researchers have specifically gone on to discover if the implementation of maintained moderate physical activity while dealing with lower back, neck or shoulder pain, in comparison with low or high levels of movement, can actually affect longer-term outcomes. Therefore, additional longitudinal research into the potentially undesirable effects of inadequate or extreme activity levels is necessary.

Impact of Physical Activity on Lower Back, Neck or Shoulder Pain

Lower back, neck or shoulder pain, which often precipitates diminished physical activity and negative mood changes, may actually lead to a decline in fitness or be perceived as such, and the significance of this problem should be addressed. The influence of LBP on physical activity is not absolutely clear, even though health and fitness are generally thought to influence the prevalence of lower back, neck and shoulder pain[58]. A previous study has shown that exercise provides many benefits for individuals suffering from lower back, neck or shoulder pain. This study has also revealed that exercise has imparted positive effects in the same individuals with regards to their feelings as well as stress and anxiety levels, in addition to their encounters with depression[59], even though they seldom attended any exercise program prior to the study. However, a multi-purpose conditioning exercise with aerobic conditioning has proven to be effective in minimizing the number of sick-leave days among workers with chronic lower back, neck or shoulder pain[60]. It is discovered that the overall benefits of flexibility are to be seen in biomechanical, neurological as well as molecular systems, which include myofibrillogenesis as a long-term consequence. Increases in size of overall flexibility can also be considered to enhance resistance to soreness and viscous elastic properties in the muscles and tendons. After subjecting participants to muscle conditioning, a period of rest that lasts anywhere between thirty six to forty eight hours is recommended as an intermission between workout sessions. Also, since flexibility exercises alter muscle proteins, a relaxation period of 36-48 hours between exercise sessions is imperative to avoid excessive catabolism[29].

Physical Capacity and Intensity of Exercise

The scientific literature indicates that workouts produce positive effects on patients suffering from lower back, neck and shoulder pain, and such patients who have completed workout programs show statistically substantial improvements in cardiovascular capacity as well[61]. It has also been found that an exercise

routine involving 20 cluster sessions has dramatically reduced the frequency of low back pain recurrence in patients who have experienced it in the past[62]. That being said, not only does pain decrease, but many patients have found that their physiological health has improved, too. One study has found that a power >50% VO2 maximum and >10 minutes of workout were necessary to eradicate workout analgesia. A number of scientific studies have indicated that individuals working out at 80% VO2 maximum show substantial reductions in anxiety levels[63]. Kemppainen et al. have also found that exercise intensities at>70% maximum in cardiovascular capacity can heighten both exercise capacity and pain limits[64]. Another study has found that those with normal cardiovascular health who have participated in workouts acquired above-average cardiovascular fitness[65].

Exercise and Pain/Disability

A workout may also be helpful in reducing aches after exercise, with one study finding that exercise-induced analgesia existed for 50 minutes after exercise. Additionally, people who performed workouts on a regular basis displayed better resistance towards aches, as opposed to non-active controls[66]. Koltyn et al. have found that, immediately after exercise, the pain limit was at a considerably higher level and the amount of pain experienced was considerably lower[67].

Long-term decreases in lower back, neck or shoulder pain as a result of participation in exercise programs have been detected, and high-intensity workouts have been observed to lower levels of pain, physical impairment and mental strain in those with long-term lower back, neck or shoulder pain. People with long-term lower back, neck or shoulder pain have thus revealed significant improvements in pain scores and heart rates after exercise, and pain was significantly lowered 30 minutes after workout sessions that involved lower-limb cycling. Furthermore, pain relief for at least half an hour after workouts was found in healthy subjects as well as in those with long-term lower back, neck or shoulder pain[68]. In addition, Van der Velde and Mierauhave observed a statistically significant loss of pain and decreased difficulty in standing among individuals participating in exercise regimes[69], while others have reported decreases in lower back, neck and shoulder pain as well as general physical disabilities among patients a year after an exercise regimen[59].

Several reports have dealt with participants suffering from extreme or sub-acute lower back, neck or shoulder pain[60]. Also, Mortimer et al. have recruited similar individuals who did not seek proper medical care in the last 6 months, and were thus classified as acute or sub-acute[70]. Other reports have recorded the effects of training by using self-reports and accelerometry, but found little change with regards to physical incapacitation[60]. In populations such as these, the link between lack of physical exercise and problems due to chronic lower back, neck or shoulder pain emphasizes the possibility that increasing physical activity might be advantageous in decreasing the amount of disabilities. When resources are scarce, it is always possible that physicians will assume that patients with greater physical difficulties tend to exercise less, and can devise a suitable exercise treatment with this in mind.

Furthermore, directly overseeing the exercise regimen is likely to be beneficial; for instance, overseeing a new patient's use of a pedometer and accelerometer will enable specific advice to be given[60]. Heneweer et al. have identified that the relationship between training and risks connected with persistent lower back, neck or shoulder pain was U-shaped, indicating that excessive exercise might introduce further problems[71]. That being said,Depalma et al. have compared patients suffering from persistent lower back, neck or shoulder pain with controlled, healthy subjects undergoing identical amounts of training. They found that habits connected with training may vary between patients and healthy controls, with this imbalance usually contributing to the patient's difficulties[72]. In conjunction with this point, it has often been assumed that a person with pain-related impairments (due to lower back, neck or shoulder pain) trains less, and treatment should aim at the maintenance and gradual increase in the amount of activity. Such a reduction in activity need not apply to all those with such pain, even though the disadvantages of reduced levels of activity during training are clear[60].

Physical Activity and Movement among Office Workers

Office workers do not have enough time to engage themselves in physical activity, and thus suffer often from musculoskeletal disorders, especially lower back, neck and shoulder pain. Previous studies have shown that walking during a short break reduces their discomfort, and other academic scholarship has discovered that stretching exercises for a period of 6-8 weeks pose benefits in curbing pain. These results indicate the positive effects of physical activity on reducing pain[73]. The theory behind the value of stretching exercises, especially for back muscles, is related to muscle tightness. Sitting for a long time and the absence of physical activity can lead to muscle tightness. The flexibility exercises used in previous researches were general and not specifically for back muscles[74]. Also, there was no research to show the effect of strength training on lower back, neck or shoulder pain among office workers. However, some past researches have revealed

that positive effects can be obtained from thermotherapy and manual therapy in reducing muscle pain among office workers[36]. Unfortunately, a package of exercises specific to flexibility and strength training for office workers does not exist.

An absence of physical activity leads to a decreased range of movement (ROM). Measuring ROM is part of the clinical measurements used by physiotherapists and orthopedics when investigating lower back, neck and shoulder pain. ROM is measured with the use of a goniometer. Previous studies have shown that decreased ROM is related to lower back, neck or shoulder pain. Therefore, flexibility exercises can be used to increase ROM in the neck, shoulder and lower back joints. Decreased physical activity and sitting for a long time can thus affect ROM adversely[24]. However, there is, to this day, little research with adequate methodology involving office workers concerning the effect of flexibility exercises on ROM, especially in the neck, shoulder and lower back joints, and its association with lower back, neck and shoulder pain.

Modified Risk Factors and Ergonomics Intervention in Office Workers

Two physical aspects among office workers can easily lead to injuries amongst themselves. The body posture usually leads to extension or compression of muscles, and anxiety is present as well. The more time invested in a limited or perhaps difficult physical activity, the more likely it is for the body to build up musculoskeletal disorders (MSD's). For instance, working with the body bent forwards, backwards or perhaps alternatively can easily induce excessive stress in the lower back region[75]. In addition, flexing the shoulders and neck will contribute to MSD'sas well. In order to perform any controlled movement using the arm, the shoulder and neck muscles need to remain contracted throughout the movement. Contracted muscles exert pressure on blood vessels, which in return reduces the flow of blood towards the muscles that are used for hand movements[76].On the other hand, increased blood flow is required during intense muscle effort. Two consequences arise: 1. the neck, shoulder or lower back muscles become fatigued, even though there may be little or no motion involved; 2. at the same time, the decreased blood flow, coupled with increased use of energy by the active muscles, renders them far more vulnerable to damage. Finally, a suitable position when working or relaxing can help prevent repetitive pressure injury (RSI), one among several known sources of backache. Sitting upright can reduce this problem, too.

Doing this often, even for short periods of time, is much better than doing it for longer periods of time but less frequently. This procedure enables muscle tissues to loosen up. The majority of office tasks provide some opportunities to perform such actions, notably through looking at a TV screen, eating a snack, going for a brief walk and even filing or photocopying documents. Past scientific studies have confirmed that the use of an ergonomically-designed desk, a correctly adjusted seat (including the top of the seat and its height), and comfortable work space can slow the development of MSD's and reduce musculoskeletal aches. Also, short bursts of activity duringworking hours can lessen symptoms of backache, etc.[76].

CONCLUSION

To sum it up, musculoskeletal disorders, especially in the neck, shoulders and lower back constitute an ailment that plagues office workers worldwide, the main reasons being their sedentary lifestyle and absence of physical activity. Future studies, preferably large prospective cohort studies, should include data on practical treatment among office workers with regards to the severity of pain as current academic scholarship on the topic is mostly theoretical rather than practical and therefore not easy to apply in an office environment.

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