Open Access Research Journal of
Medical and Clinical Case Reports
Journals home page: https://oarjpublication/journals/oarjmccr/
ISSN: 2783-0284 (Online)

(RESEARCH ARTICLE)

Ubiquity of repetitive stress injury disorders in the OPD of Karachi, Pakistan

Muhammad Atayyab Talha Irfan [1], Khadija shakeel [1], Hira Zehra [1], Usman Khalid [1], Faizan Saeed Syed [2], Nida Rizvi [3,*], and Kashif Bashir [3]

[1] *Department of Physiotherapy, Dow University of Health Sciences, Karachi, Pakistan.*
[2] *New York, United States of America.*
[3] *Department of Physiotherapy, Aga khan University Hospital, Karachi, Pakistan.*

Open Access Research Journal of Medical and Clinical Case Reports, 2021, 01(01), 001–010

Publication history: Received on 18 February 2021; revised on 20 March 2021; accepted on 23 March 2021

Article DOI: https://doi.org/10.53022/oarjmccr.2021.1.1.0026

Abstract

Background: A musculoskeletal disorder is the pain or injury in the joints, muscle, tendon, ligament, and its associated structures that support head, neck, upper and lower limb. These disorders can be trigger from repetitive exposure to awkward posture and due to psychological, social and occupational factors. Musculoskeletal disorders are the second leading cause of disability globally. The frequency of musculoskeletal disorders in physiotherapy OPDs of Karachi, Pakistan has not been reported yet, so this study investigated the frequency of musculoskeletal disorders in physiotherapy OPD of Karachi, Pakistan.

Objective: The purpose of this study was to find out the frequency of musculoskeletal disorder in patients visiting physiotherapy outpatient department of various tertiary care hospitals situated in Karachi, Pakistan.

Material and Method: A cross sectional survey study was carried out by using a self-constructed questionnaire to observe the frequency of MSD in physiotherapy. Data collection was done under the supervision of senior physical therapist.

Results: 403 patients were included in this study from various physiotherapy OPDs. to evaluate the frequency of MSK disorders in which 166 were males and 237 were females. The minimum and maximum ages of the candidates who participated in the study were 8 and 69 years respectively.

The results showed that 72.5% of patients in OPD had MSD in relevance to 28% of the patients suffering from neurological disorders [Table 3, 4].

Conclusion: Muscular-skeletal disorders are common among patients visiting in physiotherapy OPDs of Karachi, Pakistan. The most influenced region observed were the low back and shoulder due to overuse and also the knee which was persistent in elderly patients. Female patients were seen to have higher rate of MSK disorders which affects their daily activity than man. Suitable preventive and proper management methods are suggested to lessen MSK disorders.

Keywords: Ubiquity; Repetitive Stress Injury; OPD; Pakistan.

1. Introduction

1.1. Background of the Research/Project

From past decades, around worldwide Musculoskeletal disorders have become progressively prevalent [1].Musculoskeletal disorders exemplify as the most flagrant and quotidian cause of severe long term pain and physical

* Corresponding author: Nida Rizvi
Department Of Physiotherapy, Aga Khan University Hospital, Karachi, Pakistan.

impairment or disability that influence 100 million individual across the world [2]. Musculoskeletal disorders are the monotonous cause for admission to the health care system and self-medication [3].

Musculoskeletal disorders encircle a variety of degenerative and inflammatory conditions that affects peripheral nerves, joint, muscle, ligament, tendon and supporting blood vessels resulting in pain, ache and discomfort. [4] It encompasses clinical syndromes such as osteoarthritis, nerve compression disorder (sciatica, carpal tunnel syndrome) , tendon inflammations and related conditions (epicondylitis, tenosynovitis, bursitis) ,and also the less standardized conditions such as low back pain, myalgia and other regional syndrome not ascribable to known pathology. Low back, neck, shoulder, forearm, hand are the most commonly affected regions of the body [5].

Predominantly Musculoskeletal disorder are caused by jerking movements, trauma [to joints, muscle, bone, tendon ,nerve, ligament] ,falls, sprains, fracture, direct blow to muscle and the dislocation. The symptoms related with musculoskeletal disorder are generalized and localized pain that can intensify with movement, fatigue, muscle pull, sleep disruption, muscle spasm and burning sensation[6] [7].

Musculoskeletal symptoms are commonly seen in adult community. In 1995 general household survey was conducted in which Musculoskeletal disorder were the most frequently self-reported illness, with a rate of 143 per 1000 adult men and 159 per 1000 adult women [8].

In 2002-2003 greater than 50% of the 2,685 male and female were arbitrarily incorporated in a survey, felt musculoskeletal symptoms during the former 12 months and nearly 30% incorporated them in the past week. The incidence of MSD amplified with age and speckled extensively across economic sectors and occupation. Rotator cuff syndrome supervene by carpel tunnel syndrome and lateral epicondylitis, is the most frequent musculoskeletal disorder. About 13% of workers experienced at least 1 musculoskeletal disorders which shows that incidence I was high of clinically diagnosed MSDs. Greater than half of the workers open to at least 2 MSDs risk factors. Corresponding to industrial activity and occupation, exposure varied. Conferring to the norms document, a elevated percentage of MSD cases can be categorized as possibly work related (95% in male and 89% in female age <50, and 87% in male and 69% in female age >50)[9].

Today frequency of MD is 6% of the people in the age cluster of 20–75 years about 2,565,500 in Iran; keenness is growing and is projected to extent 5,114,900 in 2025. The conjoint source of disability in diabetes patient is due to the higher prevalence of musculoskeletal disease has been acknowledged. It principally distresses the upper limbs, mainly the hands and shoulders [10].

In the 18th century musculoskeletal disorders (MSDs) are recognize as workrelated diseases since the time of Ramazzini who portray establish cases of such injuries in his book [11].

In the past 12 months 95% of workers show up MSD in at least single body structure. The OWAS result states that, 83% of the analyzed work postures need instant curative measure for work safety. In which the most detrimental posture was carrying a profound load on overhead. Carrying greater than 120kg augment the risk of neck pain and low back pain by 4.555 and 4.527, respectively [12].

Another survey was conducted among Iranian female worker in which wrist/hands, shoulder and lower back complaint were vastly dominant. WMSDs were associated with job, daily working hour, Age, working schedule, marital status, tenure, and type of activity [13].

Musculoskeletal disease prevalence increase with age and are affected by the habits and lifestyle. Global population changing lifestyle and aging significantly increases the incidence and prevalence of musculoskeletal disease. The world health organization and united nation affirmed 2000-2010 as a" bone and joint decade" as a result [14].

Using a questionnaire survey the prevalence of musculoskeletal disease is estimated which reported that prevalence of osteoarthritis (3.2%) , spondyloarthropathy (0.3%) , herniated disc (1.1%) , rheumatoid arthritis (1.6%) , osteoporosis (0.8%) and gouty arthritis (0.1%) [15] [16].

It has been documented by population based survey that musculoskeletal disorders play a significant role as a source of disability. The mini Finland survey reported that musculoskeletal disorders were the main source of disability in 20% of people aged 30 year or more. In a whole life span according to Hogg-Johnson 50%-80% of population, has ever had back pain [17].

Musculoskeletal pain related to work is most frequent in healthcare professionals, including dentist. A study was conducted in April 2016 in teaching hospital of Karachi which comprised of 230 dentist to evaluate the prevalence of Musculoskeletal disorder. The prevalence of musculoskeletal disorder was 138(75.9%) . The most common cause for Musculoskeletal disorder was the static posture for greater than half an hour procedure 38(27.5%) and lack of rest 21(15.2%) [18].

The patient commonly approach complementary therapy for musculoskeletal complaints. 40% and 60 % of patients going orthodox rheumatology outpatient clinics have receive such treatments in Canada and Australia [19].

The presence of a single musculoskeletal disease can make a significant contribution in entire treatments that individual possibly receiving. The objective of musculoskeletal disorder management is to enhance quality of life by deflating stiffness and joint pain, preventing growth of joint damage and restoring and maintaining functional stability, but achieving this can demand utilization of a variety of interventions, which encompasses non-drug intervention, example physical therapy, cold/heat, physical exercises. Furthermore musculoskeletal disorder drug intervention includes oral and topical medication to relieve joint stiffness and pain and decrease inflammation. Surgery may be requisite for the critically affected patient who deals with persistent stiffness and pain from arthritis example, osteoarthritis is accountable for above 90% of initial knee and hip joint replacements [20]. Most of the people in their entire life will experience pain that is rarely a symptom of serious disease which is stated in the systemic reviews of musculoskeletal disorders like low back and neck pain. Later reappearances are predictable, patients can profit from a plan for dealing with eruptions .As health care system will offers symptomatic assuagement but hardly cures. Since treatment of musculoskeletal problems is need to be based on better incorporation of perspectives, specially the patient perspective [21]. The purpose of this research study was to rule out the frequency of patients with a musculoskeletal disorder coming to physiotherapy OPD of tertiary care hospitals situated in Karachi, Pakistan. Nowadays the most common reason that a patient seeks medical attention is for musculoskeletal disorders. This study will rule out the frequency of the patient who are visiting with complaint of any disorder related to our musculoskeletal system. According to the previous studies based on musculoskeletal disorders, the high prevalence of sedentary lifestyle, workload, daily stress among general population leads to pain, discomfort and sometimes disability. From the help of our study we will help to promote healthy lifestyle along with recommendation of physical exercise to combat the difficulties related to musculoskeletal.

2. Methodology

The research strategy was centered on a cross sectional study design, in which we gathered the date on a single point time. The target of our study was to discover the frequency of musculoskeletal disorder in the physiotherapy OPD of Karachi, Pakistan. which was achieved with the help of self -designed questionnaire in a quantitative approach. “403” sample size is achieved through this study.

Our targeted population was the patients who were visiting physiotherapy OPD with complain of musculoskeletal disease or disorder of every age and gender. The institutional review board approval was allotted by the HOD of the physiotherapy campuses which was allowing us to collect the data from the patients coming to physiotherapy OPD. Informed consent was signed by the disposed participants and the discernment of the data was also affirmed to the participants. Our target population was the patient visiting with musculoskeletal disorder in physiotherapy OPD Karachi, Pakistan. The cross sectional study evaluated the variable of interest amongst the patient with musculoskeletal disorder through a self-designed survey questionnaire. The research analysis was carried out in the physiotherapy OPD Karachi. The survey was prosecuted on 403 patients, by using self-designed questionnaire via non probability convenience sampling technique. Self-constructed questionnaire was used to rule the frequency of musculoskeletal disorder in the patients who are visiting physiotherapy OPDS, the questionnaire contained total 16 questions. The first four questions were related to the pain history, area and the nature of the pain and pain cycle except 3rd question and the remaining 12 question was exploring the functional impact at work ,any other diseases, vaccines, smoking history, sleep hours etc, the 3rd question was about the body map which contain 9 regions of body neck, shoulders, upper back, elbows, low back, wrist/hands, hips/thighs, knees and ankles/feet and we ask the Respondents if they have had any musculoskeletal trouble in the last 12 months and last 7 days which has prevented normal activity.

3. Results

Data was analyzed by using SPSS version 16.0. Frequencies and percentages were determined for subjective factors through tables, pie diagrams; histograms i.e. gender orientation, marital status, MSK disorders, neurological disorders, causes, diagnosis, and other medical problems and usual posture. Mean and standard deviation was computed for

quantitative variable i.e. age which is also represented through histogram. Chi square test was applied to see the association of MSD with neurological diseases. P value of less than 0.05 was considered significant.

403 patients were included in this study from physiotherapy OPD to evaluate the frequency of MSK disorders in which 166 were males and 237 were females. The minimum and maximum ages of the candidates who participated in the study were 8 and 69 years respectively.

The results showed that 72.5% of patients in OPD had MSD in relevance to 28% of the patients suffering from neurological disorders (table 3, 4). MSD with reference to causes, the most common cause turned out to be overuse injuries followed by pathophysiological disorders while the congenital issues contributed the least to MSD.The most common disorder was found to be Low back pain (20.8%) followed by Knee OA (15.4%) and Adhesive Capsulitis (9.4%). The disorders such as Achillies tendonitis, Weak rhomboids, Multiple sclerosis, Deltoid injury, Trapezius weakness, Lateral epicondylitis, Heel spur, Poliomyelitis, Spinal spondylosis, Scoliosis, Knee bursitis, paresthesis, Myesthenia gravis, Encephalitis, Myelomalacia, Multiple myeloma were the least common to be found in Physiotherapy OPD i.e. 0.2% (Table 5). Low back was the most common region to be painful proceeded by Knees (85 patients) and Shoulder (67 patients) while upper back and hip, thigh were the least common regions to be painful. Face was the only region not to be falling into MSD category. MSD arising due to stoop posture was the most common (45.91%) while only 37.47% patients were found to be having normal posture.

Table 1 Distribution according to age

	N	Minimum	Maximum	Mean	Std. Deviation
Age	403	8	69	36.93	11.192
Valid N [listwise]	403	8	69	36.93	11.192

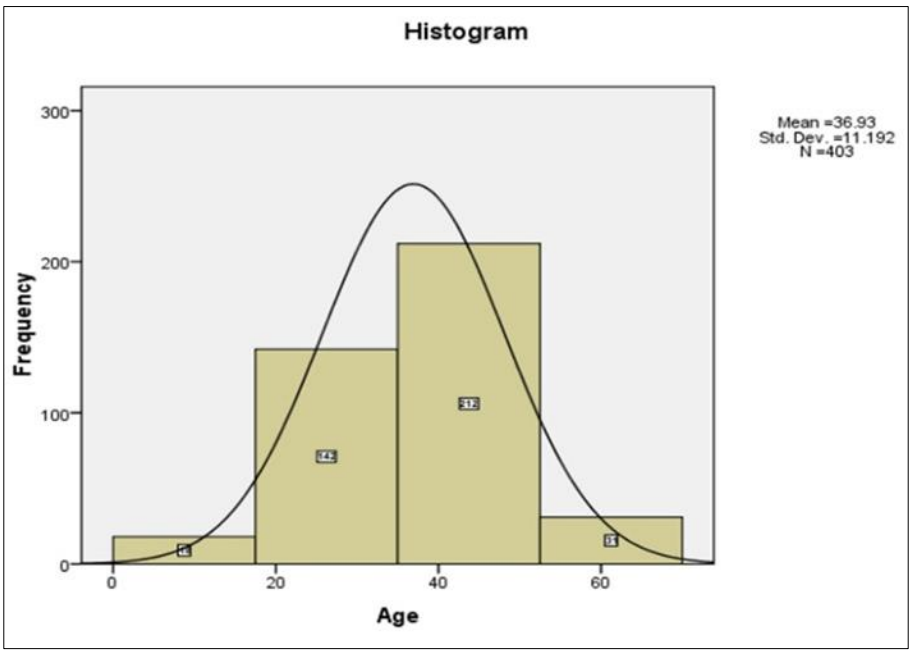

Figure 1 Distribution according to age

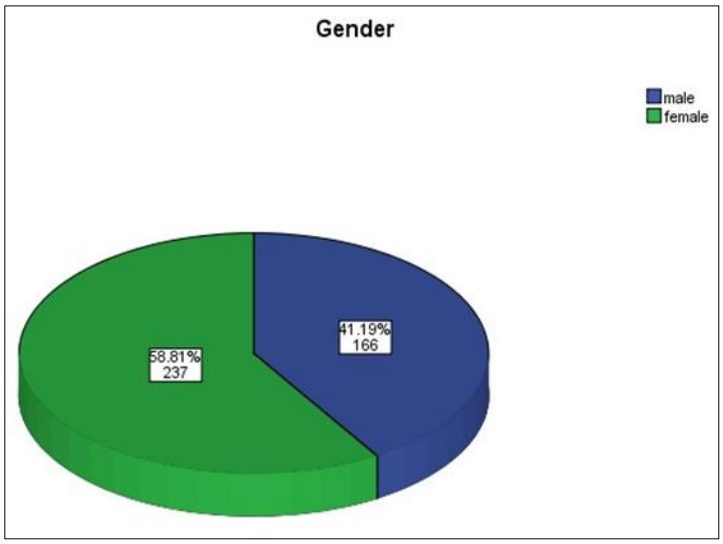

Figure 2 Distribution according to gender

Table 2 Distribution according to gender

		MSD		**Total**	
		Yes	no		P-value
Gender male female	Count	111	55	166	
	% within MSD	38.0%	49.5%	41.2%	
	Count	181	56	237	
	% within MSD	62.0%	50.5%	58.8%	
Total	Count	292	111	403	0.024*
	% within MSD	100.0%	100.0%	100.0%	

Table 3 Distribution according to MSK disorders

		Frequency	**%**
Valid	yes no	292	72.5
		111	27.5
	Total	403	100.0

Table 4 Distribution according to Neurological disorders

		Frequency	**%**
Valid	Yes	113	28.0
	No	290	72.0
	Total	403	100.0

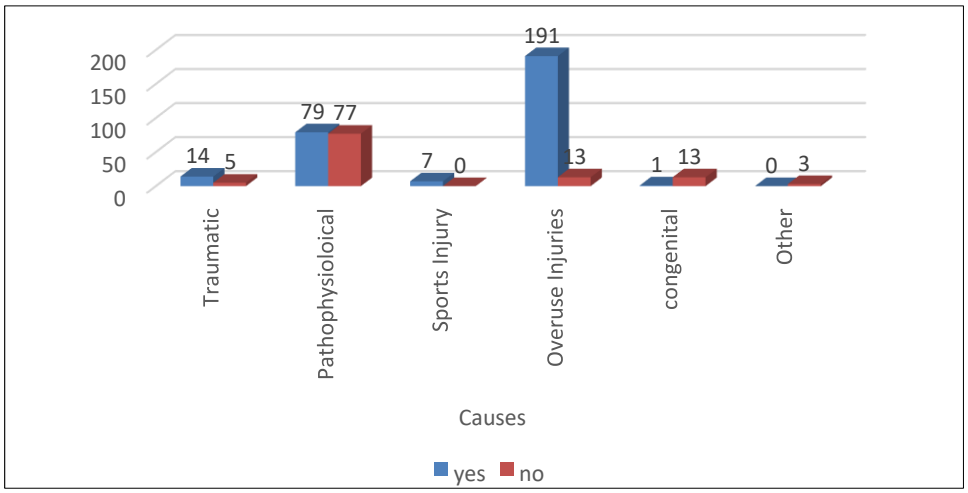

Figure 3 Distribution according to causes

Table 5 Distribution according to diagnosis

	Frequency	%		Frequency	%		Frequency	%
Low back pain	84	20.8	Mayopathy	4	1	Achillies tendonitis	1	0.2
Knee OA	62	15.4	Supraspinat us impinge-Ment	3	0.7	Weak rhomboids	1	0.2
Adhesive capsulitis	38	9.4	Anterior cruciate ligament injury	3	0.7	Deltoid injury	1	0.2
Stroke	29	7.2	Cervical radiculopath y	3	0.7	Trapezius weakness	1	0.2
Cervical spasm	20	5	Lumber spasm	3	0.7	Lateral epicondyliti s	1	0.2
Cervical pain	18	4.5	Facial palsy	3	0.7	Heel spur	1	0.2
Cerebral palsy	18	4.5	Propalse intervertebr al disc	3	0.7	Poliomyeliti s	1	0.2
Bell's palsy	13	3.2	Planter fasciitis	3	0.7	Spinal spondylosis	1	0.2
Fracture	13	3.2	Traumatic brain injury	3	0.7	Scoliosis	1	0.2
Cervical spondylo sis	9	2.2	Rhematoid arthritis	2	0.5	Knee bursitis	1	0.2
Shoulder pain	8	2	Cervical spondylolist hesis	2	0.5	Meralgia paresthesis	1	0.2
Rotator cuff syndrome	7	1.7	Piriformis syndrome	2	0.5	Myesthenia gravis	1	0.2

Knee pain	6	1.5	Disc buldge	2	0.5	Encephalitis	1	0.2
Sciatica	5	1.2	Spinal stenosis	2	0.5	Myelomalac ia	1	0.2
Fibromya lgia	5	1.2	Spinal cord injury	2	0.5	Multiple sclerosis	1	0.2
Lumber radiculop athy	4	1	Ankle sprain	2	0.5	Multiple myeloma	1	0.2
Carpel tunnel syndrome	4	1	Patellar tendonitis	1	0.2	Total	403	100.00

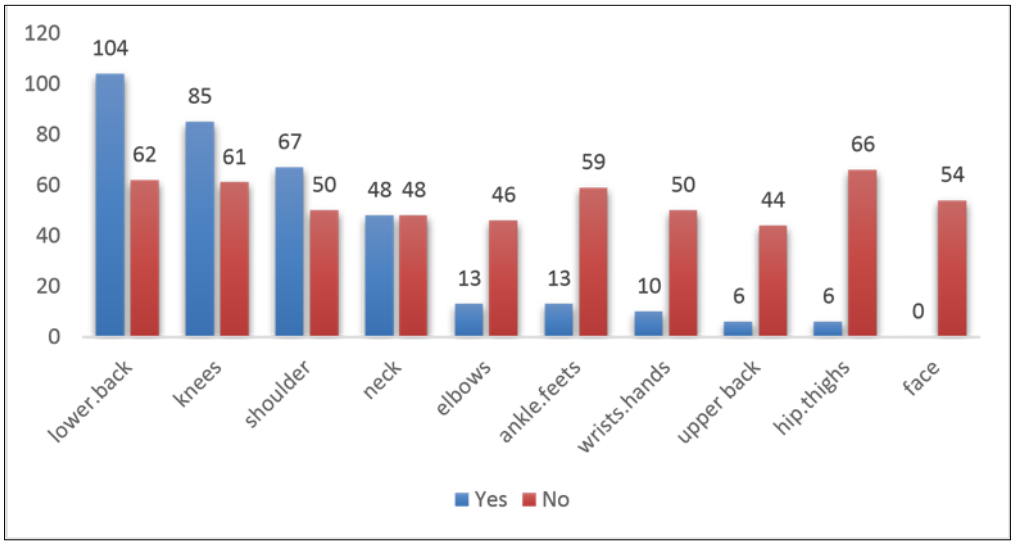

Figure 4 Distribution according to body region

Table 6 Distribution according to usual posture

			MSD		Total	
			yes	no		P-value
How would you describe your usual posture?	normal	Count	140	11 9.9%	151	
		% within MSD	47.9%		37.5%	
	forward head posture	Count	20	10 9.0%	30	
		% within MSD	6.8%		7.4%	
	scoliosis	Count	2	2 1.8%	4	
		% within MSD	.7%		1.0%	
	stoop posture	Count	127	58 52.3%	185	
		% within MSD	43.5%		45.9%	
	abnormal	Count	3		33	

		% within MSD	1.0%	30 27.0%	8.2%	
Total		Count	292	111 100.0%	403	0.001*
		% within MSD	100.0%		100.0%	

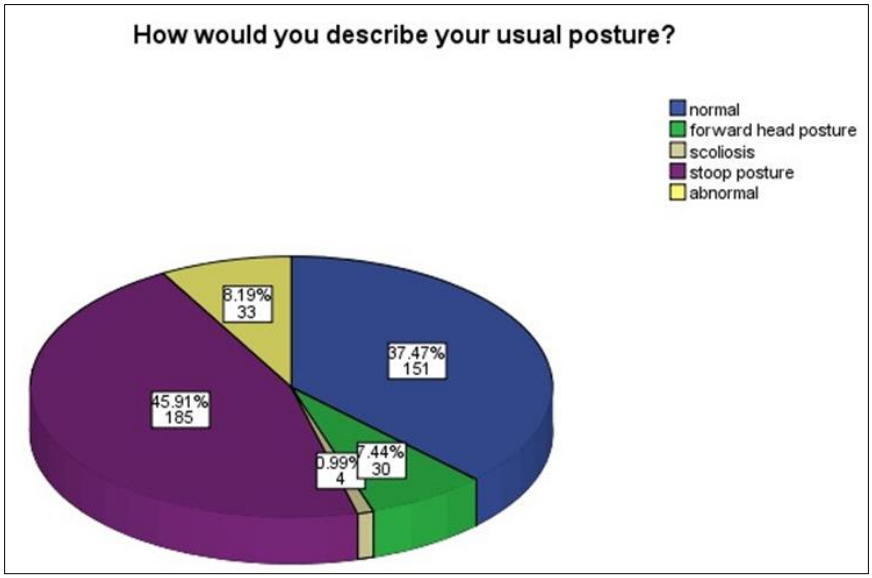

Figure 5 Distribution according to usual posture

4. Discussion

403 patients were included in this study from physiotherapy OPD to evaluate the frequency of MSK disorders in which 166 were males and 237 were females. Female patients reported with a significantly higher prevalence of MSK disorders because of everyday household with the percentage of 58.8% while only 41.2% of the patients were males; which are contrary to the results which found prevalence of self-reported chronic back problems is 14.5% for men and 12.5% for women. Men had a 6.6% prevalence of restricted activity due to musculoskeletal disorders, whereas the corresponding figure for women was 5.3% [17].

4.7% of the patients had a traumatic injury, 38% of the patients were enduring due to pathophysiological changes which is second most noteworthy, 1.7% of patients had sports injury, 50.6% of the patients had overuse injuries, 3.5% of the patients had congenital disorders.

The most frequent diagnosis was low back pain with the percentage of 20.8%, which occurs in the MSD due to overuse injuries; which is parallel to the results that the low back was the most common site of disorders (69.8%) [2].

The second noted diagnosis was knee osteoarthritis with a percentage of 15.4%, which was persistent in elderly patients. 9.4% of the patients were observed to have adhesive capsulitis because of overuse injuries that take place in MSD [23].

45.91%, which is an excessive number, of patients were noted with stoop posture due to bad ergonomics with the frequency of 185. 37.47% of patients were distinguished with prime anatomy picture with the frequency of 151. 8.19% of patients were reported with abnormal postural strain with the frequency of 33. 7.44% of patients were surveyed with forward head anatomy with the frequency of 30.

5. Conclusion

Musculoskeletal disorders are common among patients visiting in physiotherapy OPD. The most influenced region observed were the low back and shoulder due to overuse and also the knee which was persistent in elderly patients. Female patients were seen to have higher rate of MSK disorders which affects their daily activity than man. Suitable preventive and proper management methods are suggested to lessen MSK disorders.

Recommendations

The observation from our study concluded that Musculoskeletal issue have turned into a pandemic healthcare issue, these disarranges can be counteract by recognizing the common risk factors causing MSD i.e uncoordinated, deviated, inactive or stoop posture, extraordinary work and extremely repititive work. Making ergonomic improvement to the work and house surroundings will enhance the wellbeing and health of workers as well as lessen the productivity or quality concern. Diminish static loading, carrying, manual material taking care of, movement that provoke the problem or prolong pressure on the nerves and lessen work done over the shoulder level. While lifting, utilize correct lifting and moving strategies and get help if an object is too substantial or a cumbersome size or shape. Utilize appropriate positioning throughout the activity to counteract reoccurrence. The regular and follow up meetings can hold the patients within proper limits, adjust and better comprehend approaches to cope up to the issues they are confronting, and for documenting significant inquiries concerning the nature and reasons for good and poor kind of MSD.

This research can be done in different hospitals in Pakistan to find out the frequency of MSDs in our city. Since we've included all type of patients in OPD, in our future research we can observe MSD in particular age groups for example adolescence and geriatric population only. In our research we only found out the frequency of Musculoskeletal disorders in OPD. However, in the future other researchers can observe different cases that will include other field such as sports related problems, neurological disorders or gynecological related difficulties. In future, researchers can observe work-related MSD in physiotherapists and general physicians working in OPD. Further researches can be done specifically targeting female population and their problem factors related to MSK disorders. And through the future research on this aspect, other researchers can educate and emphasize on lifestyle to reduce the risk factors of musculoskeletal disorders in female. Lastly, when future researches will be conducted researchers would bring awareness on the topic of physical therapy management to spread knowledge amongst people on this issue.

Compliance with ethical standards

Acknowledgments

We are really thankful to Irfan Ali Bozdar for his consistent support throughout this research journey.

Disclosure of conflict of interest

No Conflict of Interest reported.

Statement of ethical approval

Institutional Review Board Approval was taken before commencement of this study.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Evangelos C, Alexopolos, Ioanna-Christina Stathi, Fotini Charizani. Prevalance of musculoskeletal disorder in dentist.BMC Musculoskeletal disorder. 2004; 5: 6.

[2] Babatunde OA Adegoke, Ashiyat K Akodou, Adewale L Oyeyemi. Work Related Musculoskeletal disorders among Nigerian Physiotherapists. BMC Musculoskeletal disorder. 2008; 9: 112.

[3] Maria EH Larsson, lena A nordholm. ingbrittohrn. Patients' views on responsibility for the management of musculoskeletal disorders – A qualitative study. BMC Musculoskeletal Disorders. 2009; 10: 103.

[4] Bolanle MS Tinubu, Chidoziie E Mbada, Adewale L Oyeyemi. Work Related Musculoskeletal disorders among Nurses in Ibadan, Southwest Nigeria: a cross-sectional survey. BMC Musculoskeletal disorder. 2010; 11: 12.

[5] Laura punnett, David H.Wegman .Work Related Musculoskeletal disorders: the epidemiologic evidence and the debate.journal of electromyography and kinesiology. 2004; 14: 13-23.

[6] Wolfe F, Clauw DJ, Fitzcharles MA. The American College of Rheumatology preliminary diagnostic criteria for fibromyalgia and measurement of symptom severity. Arthritis Care Res [Hoboken] . 2010 May; 62[5] : 600-10.

[7] Babar-Craig H, Banfield G, Knight J. Prevalence of back and neck pain amongst ENT consultants: national survey, J Laryngol Otol. Dec 2003; 117[12] : 979-82.

[8] Michelle Urwin, Deborah Symmons, Timothy Allison. Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at diVerent anatomical sites, and the relation to social deprivation. Ann Rheum Dis. 1998; 57: 649– 655.

[9] Roquelaure Y, Ha C, Leclerc A, Touranchet A. Epidemiologic surveillance of upper-extremity musculoskeletal disorders in the working population. Arthritis Rheum. 15 Oct 2006; 55[5] : 765-78.

[10] Zahra haeri kermani, seyed mojtaba mousavi bazzaz, seyed kazem farahmand. The comparison of frequency of the upper limb musculoskeletal disorders among patients with diabetes type II with normal cases. Nov 2017; 9[11] : 5848–5853.

[11] john C Rosecrance, Thomas M Cook. Upper Extremity Musculoskeletal Disorders: Occupational Association and a Model for Prevention. CEJOEM. 1998; 4[3] : 214-231.

[12] Krishnendu sarkar, samrat Lev, Tamal Das. International journal of occupation and environmental health. 2016; 22[2] .

[13] Alireza Choobineh, Hadi Daneshmandi, Seyed Hamidreza Tabatabaee. The Prevalence Rate of Work-Related Musculoskeletal Disorders Among Iranian Female Workers. Women's Health Bulletin: October 2015; 2[4] : e27334.

[14] Woolf AD, Pfleger B. Burden of major musculoskeletal conditions. Bull World Health Organ. 2003; 81: 646-656.

[15] Choi HJ, Han WJ, Im JS, Baek HJ. The prevalence and clinical features of musculoskeletal diseases in Incheon: results from chronic disease management surveys. J Korean Rheum Assoc. 2009; 16: 281-290.

[16] Bae SC. The current status of surveys on prevalence of rheumatic diseases in Korea. J Korean Rheum Assoc. 2010; 17: 1-3.

[17] DC Cole, SA Ibrahim, HS Shannon, F Scott, J Eyles. Work correlates of back problems and activity restriction due to musculoskeletal disorders in the Canadian national population health survey [NPHS] 1994–5 data. Occup Environ Med. 2001; 58: 728–734.

[18] Hameed MH, Ghafoor R, Khan FR. Prevalence of musculoskeletal disorders among dentists in teaching hospitals in Karachi, Pakistan, J Pak Med Assoc. 2016 Oct; 66[Suppl 3] [10] : S36-S38.

[19] A Chandola MD MRCP, Y Young MSc MFPHM, J McAlister BSc FRCOphth. Use of complementary therapies by patients attending musculoskeletal clinics. J R Soc Med. 1999; 92: 13-16.

[20] Stephen J. Duffield, Benjamin M. Ellis, Nicola Goodson. The contribution of musculoskeletal disorders in multimorbidity: Implications for practice and policy. April 2017; 31[2] :129-144.

[21] Maria EH Larsson, lena A nordholm. Responsibility for managing musculoskeletal disorders – A cross-sectional postal survey of attitudes.BMC Musculoskeletal Disorders. 2008; 9: 110.

[22] E+ Education,The Definition and causes of musculoskeletal disorders. Ergonomics plus.

[23] Sayed A Tantawy, Asma Abdul Rahman, Maryam Abdul Ameer. The relationship between the development of musculoskeletal disorders, body mass index, and academic stress in Bahraini University students. Korean J Pain. 2017 Apr; 30[2] : 126–133.