



MEDICAL EDITING SAMPLE 1

TITLE: KNEE OSTEOARTHRITIS

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The literature review meets dual purpose of a researcher. First thing is that it ensures the researcher gets all the relevant information about the past studies. Second one is it facilitates scope for identifying potential research questions. It helps in conceptualizing a research problem and determining specific methodology for more exploration of the problem. Various types of literature have been reviewed for the current study which also involves books, journals, and conference proceedings, published and unpublished thesis. The search was confined to the following themes: (1) Knee osteoarthritis, (2) Therapeutic exercise in knee osteoarthritis, and (3) Yoga and knee osteoarthritis.

3.1 Prevalence and Incidence of Knee Osteoarthritis

Osteoarthritis has been the prominent reason to have physical disability among the aged people; and according to the study by Felson et al., (1995) 11% of women in the age group of 60 years and above have witnessed the symptoms of knee osteoarthritis (Felson et al., 1995). Yet, another study was conducted by Szoeka, Cicuttini, Guthrie, Clark, & Dennerstein (2006) among 438 healthy middle-aged Australian women's with duration of more than 11 years in Melbourne to assess the components which are responsible for causing osteoarthritis. Out of those, 257 (59%) women were taken into account for a longitudinal study; however, about 224 women gave their consensus to take X-rays in knees and hands. The analysis reflected that out of 224 participants, 128 participants (56%) had osteoarthritis, 49 (21.6%) had knee osteoarthritis and 101 (44.5%) had hand osteoarthritis it is evident in radiology test and and It is assumed that risk factors like physical activity, BMI, and ageing were responsible for causing radiological knee osteoarthritis and alteration of these components might assist in curbing the further progress of osteoarthritis.

A comparative study was done by Kang et al., (2009) between the rural and urban Chinese population with specific reference to the occurrence of knee osteoarthritis). The study took into account of 1,030 residents (majority of them were farmers), who were more than 50 years of age. The results reflected the existence of symptomatic and radiographic knee osteoarthritis among rural men was double than that of their urban counterparts. Higher prevalence involving extreme radiographic and symptomatic knee osteoarthritis was also observed among rural women.

3.2 Pain, Physical Disability, and Psychological Well-Being in Knee Osteoarthritis

Bedson et al., (2005) executed a case-control study in North Staffordshire, where they had reviewed 146 cases and controls; out of which, 49% involves cases and 15% as controls having diagnosed knee osteoarthritis in the past. The study further reflected an estimated presence of diagnosed and identified the affected knee osteoarthritis with 12.5% of the general population in the age group of 45 years. It was identified from the study that majority of the population were prone to the risk of



getting osteoarthritis. It has been observed that people having symptomatic mild to moderate knee osteoarthritis usually complain of severe aching pain. Pain is not consistent and in maximum cases, it is related to joint use and responsible for reduced in functional activities like getting up from a sitting position, climbing up, and every day activities (Sharma et al., 2003). Thus, joint failure on perennial basis leads to pain, physical disability, and psychological distress (Gucci one et al., 1994). It becomes difficult to predict on the part of patients on the nature of pain and its frequency and locking or collapse of the joint (Gooberman-Hill, Woolhead, MacKichan, Ayis, Williams, & Dieppe, 2007). Once the majority of the cartilage gets damaged, then patients share the information of pain and disability. However, an interesting outcome in this regard is that approximately 40% of individuals having radiological damage might not have experienced pain (Kidd, 2006). In osteoarthritis, use-related pain is generic; however, there might be prevalence of rest pain, night pain, various patterns of pain right from dull ache to sharp stabbing pain (Hawker et al., 2008). Generally, the pain descriptors has its linkage with neuropathic pain (occurs due to nerve damage or dysfunction) are also taken into account. This provides the insights over presence of various types of osteoarthritis pain (Hochman, French, Bermingham, & Hawker, 2010). Hunter, Le Graverand, and Eckstein (2009) put emphasis on the significance of a non-pharmacologic method, which was relevant like a pharmacologic strategy involving the management of knee osteoarthritis.

Osteoarthritis joint damage yields pain to the affected patient; but, it has not been demonstrated over the existence of firm connection between the nature of damage of joint and severe pain. In the case of severity, symptoms from a tissue injury also get affected by extraneous factors having its origin both within and external of an individual (Kidd, 2006). The probable reasons of pain in osteoarthritis are due to more intraosseous pressure for which responsible components are vascular congestion of the subchondral bone, growth of osteophytes, synovitis and inflammation, capsular fibrosis, contracture, and weakness in muscle (Camanho, Imamura, & Arendt-Nielsen, 2011). Previous pilot study was conducted by Kulkarni et al., 2007) in United Kingdom among 12 patients with knee osteoarthritis. This study finding showed that brain is responsible for causing pain. Further arthritis pain leads to more activity in the following areas like cingulate cortex, thalamus, and amygdale, which are responsible for causing emotional aspects of pain. Some other various processes were caused by osteoarthritis pain like complex connection between of affective, sensory and cognitive to ensure integration of number of abnormal cell functionalities at levels of peripheral joints and central spinal and above the spine in the nervous signal system (Dieppe & Lohmander, 2005; Lee, Nassikas, & Clauw, 2011; Li, Lorenz, Xu, Harner, Fu, & Irrgang, 2011).

Later the study of Murphy, Lyden, Phillips, Clauw, and Williams (2011) assessed the equation among pain, severeness in radiography, and general symptoms in central nervous system. As per their results, 27% of the variance in severity of pain was due to age, radiographic severity, and centrally mediated symptoms. It was concluded that both radiographic severity and centrally mediated symptoms were having independent linkage with huge pain among women having knee osteoarthritis pain. Apart from higher radiographic features, women having severe centrally mediated symptoms such as tiredness, depression and less sleep experienced more intensity of pain. Administering treatments to women having symptoms of knee osteoarthritis could be limited by dealing with pain involving peripheral and central sources.

Whenever there is occurrence of joint damage in osteoarthritis, there are chances of osteophyte formation restricting mobility of the joint and induces pain while affecting other local joint structures. The occurrence of physiological pain mechanisms in the areas of joints like , the Dorsal Root Ganglion (DRG), and at higher process areas of brain. There are so many pro



inflammatory mediators which might involve in the osteoarthritis joint having connection with impairment that includes Nerve Growth Factor (NGF), nitric oxide and prostanoids (Fitzcharles, Almahrezi, & Shir, 2005). These inflammatory mediators are responsible for causing localized damage to tissues like synovium including activating peripheral nociceptors. At the time of chronic disease, there is a probability of the nociceptive system getting sensitized, which becomes the reason for yielding increased awareness to noxious stimuli (hyperalgesia) (Bolat & Moskowitz, 2002), and to discomfort in context to non-noxious stimuli (allodynia) (Andrew & Greenspan, 1999). From a biological dimension, activity of neuron in the pain pathway is the main cause of joint pain. In the period of inflammation, joint gets affected by chemical mediators leading to sensitization of primary afferent nerves; as a result, innocuous joint movements in normal (more physical activity, shoes having high heel, and change in weather) yields in a heavy feeling of pain. This is the neurophysiological basis of allodynia, i.e. the feeling of pain involving pain less feeling like walking. After sometime, this increased neural periphery actions might lead to neuroplasticity modifications in the central nervous system. In this scenario, second-order dorsal gray column neurons in the spinal region multiply the number of spikes as a result the transit of pain impulses to the somatosensory cortex also gets increased. This phenomenon involving central sensitization increases feeling of pain and might lead to effects of pain from body parts remotely from the inflamed joint (referred pain) (Hunter, Le Graverand, & Eckstein, 2009). Silent nociceptors of fibres in the joint, which are not usually sensitized by noxious stimulation, but become responsive with the occurrence of damage or inflammation in the joint, and might add to the pain sensation (Schaible, Schmelz, & Tegeder, 2006). The DRG in turn ensures transmission of nociceptors up, by means of the spinothalamic tract to higher cortical centres, in which processing of signals takes place to experience pain.

3.3 Physical Disability in Knee Osteoarthritis

Knee osteoarthritis has its process of complex interaction involving the disease process such as pain, comorbid conditions, loss of physical capacity, and factors related to psychological, social and environment (Ettinger et al., 1997). Van Baar, Dekker, Lemmens, Oostendorp, and Bijlsma (1998) explored a study to assess the extent to which factors like articular, kinesiological, and psychosocial are responsible for inducing pain and disability. However, researcher in order to study had controlled other factors and executed it with 200 patients having affected with osteoarthritis. Dependent variables comprise of three things; pain (visual analog scale), self-estimated impairment (questionnaire), and analyzed disability (performing regular works). Independent variables involve joint deterioration (radiographs), strength of muscle (dynamometer), range of joint movements (goniometer), pain duplicating (behavioural and cognitive strategies), and emotional well-being (depression, anxiety, cheerfulness). It was identified through multiple regression analysis that pain is associated with muscle slenderness and pain duplicating. Impairment was due to significant issues like muscle fragility, range of joint movements, pain, pain duplicating, and psychological wellness. kinesiological characteristics and pain coping were having firmly related to pain and disability. After that, Odding, Valkenburg, Algra, Vandenouwel and, Grobbee, and Hofman (1998), examined the frequency and risk factors leading to occurrence of chronic disease and disability among those persons who are more than 55 years. Here, the study was conducted in last month with sample population of Rotterdam, in which the participants' answer to the Health Assessment Questionnaire and occurrence over hip and knee pain was subjected to evaluation. It was identified from the study that 12.6% of men were having knee pain, followed by 22.3% in women. The occurrence of osteoarthritis grade 2+ of the knee was 16.3% (men) and 29.1% (women). Again, 14.1% in men and 15.9% in women were having radiological osteoarthritis grade 2+ of the hip. Progressive development of osteoarthritis is usually counted in terms of an internal physiological process. Hence, the need is to have sound



psychological well-being among osteoarthritis population so as to deal with worsening disability. There are so many psychosocial factors are also associated with people having knee osteoarthritis such as elevated anxiety and depression, poor self-efficacy, etc. Pathophysiological factors having significance to knee osteoarthritis are like obesity, poor muscle strength involving quadriceps and hamstring.

Reduced quadriceps strength becomes the past clinical findings involving those affected with knee osteoarthritis, which could be identified before realizing symptoms, and observed disability (Slemenda et al., 1997). Deficit of strength in the population group of osteoarthritis swings from 15-18 percent before the onset of disease, to 24% in persons having Kellgren/Lawrence (K/L) grade II osteoarthritis (Lewek, Rudolph, K., & Snyder-Mackler, 2004), and to 38% in those having K/L grade IV knee osteoarthritis.

Creamer, Lethbridge-Cejku, and Hochberg (2000) explored a study on self-reported disability by including 69 subjects with an aim to assess clinical and psychosocial variables and how far these are making impact on physical functions of persons having knee osteoarthritis. Assessment of pain was through the WOMAC osteoarthritis index and questionnaire related to McGill. Quality instruments were put into application to measure depression, anxiety, helplessness, poor self-efficacy, fatigue, and quality of life. Significant factors of disability were pain severity, obesity, and helplessness.

Sharma et al., (2003) recognized the factors responsible for making prediction over physical functional outcome in poor context for duration in excess of 3 years in those individuals having knee osteoarthritis. There were numerous risk factors in this respect like age, body mass index and severity of knee pain, local mechanical and neuromuscular factors, levels of activity, and psychosocial factors. These factors lead to poorer osteoarthritis index outcome of Western Ontario and McMaster Universities (WOMAC).

Bookwala, Harralson, and Parmelee (2003) explored a study on the effects of pain on functioning and well-being for which they selected 367 older adults having knee osteoarthritis. It was hypothesized over the linkage of osteoarthritis-related pain having depressive symptoms with perceived health in terms of direct and mediated by limitation of physical and social functioning. As per the results, osteoarthritis-related pain indicated about low physical and social functioning, which had a direct impact on depressive symptoms, and perceived health comprising - both direct and indirect effects.

Maly, Costigan, and Olney (2005) conducted a cross-sectional study to assess the relative contributions of variables involving psychosocial and mechanical including physical performance measures and people with knee osteoarthritis. Researcher considered fifty-four subjects (age 50–87 years) to conduct the study. Again, the assessed tasks were six-minutes' walk test, timed "Up and Go" test, and a stair-climbing. In this respect, the analyzed things are replies from psychosocial questionnaires, reflecting depression, anxiety, and low self-efficacy. Study revealed about moderate relation between self-report and performance measures while reporting over assessment of various features of mobility. Hunt, Birmingham, Skarakis-Doyle, and Vande Jamar voort (2008) reported that, the conventional way of treatment has been through emphasizing on to reduce



symptom and by slightly altering the psychosocial variables. Thus, role of psychosocial factors is key to determine the level of disability.

Hunter et al., (2009) stated that the perception of pain is subjected to modification by the prevalence of affective status of patient (e.g. level of depression, anxiety, or anger) and cognitive state (e.g. pain beliefs, expectations, memories of pain). The extent to which a patient perceives pain is influenced by factors like age, gender, socioeconomic status, racial and cultural background, skills related to pain communication, and pain experienced in past.

Smith, Purdy, Lister, Salter, Fleetcroft, and Conaghan (2014) reviewed the literature related to the realization of living with a diagnosis of hip and/or knee osteoarthritis. Thirty-two studies were taken into account to develop the meta-ethnography comprising the lived experiences of 1643 people having affected with osteoarthritis. Most of the studies reflected that people were having a negative opinion on living with osteoarthritis. There were four prominent factors responsible for influencing the attitudes with respect to the condition like: intensity of their symptoms, impact of symptoms on functional capability, attitude towards getting acquainted with the disease, and their perceptions over other people's beliefs with specific to disease.

3.5 Therapeutic Exercise in the Treatment of Knee Osteoarthritis

The advantages of exercise are familiar in context to the management of knee osteoarthritis; however, specific details over exercise prescription are subjected to change and might prove unbeneficial as well.

Ettinger et al. (1997) explored a study on the effects of structured exercise programs, where researchers selected 439 community-dwelling adults who were above 60 years of age having radiographic knee osteoarthritis, pain, and self-reported physical disability. In this study the following regimen were used like aerobic exercises, resistance exercise program, and health education program. Study outcome was; resistance exercise group receiving eight percentages each in lower score on the physical disability questionnaire and lower pain score, greater distance on the 6-minutes of walk, and faster times on lifting and carrying tasks. It was concluded from the study that older disabled persons with knee osteoarthritis, would demonstrate modest improvements in context to disability, physical performance and pain.

Hurley and Scott (1998) explored a protocol which implemented simple balance board exercises and transfer techniques in alliance with qualitative exercise therapy among 60 patients having knee osteoarthritis, as compared to a control group without resorting to the exercise. The regime was scheduled in terms of two exercise sessions for duration of 5 weeks, each one having 30 minutes. As a result, the exercise group got improvements in strength, muscle activation, joint position sense, including both physical performance and self-report measures of function, this aspect remained for over a 6-months with routine follow-up. Another meta-analysis study assessed the effectiveness of exercise treatment among those patients who were having knee osteoarthritis. A literature review was done over the medline database available in published papers from June 1966 to January 2000. After which, researcher narrowed down to twenty-three randomized controlled trials to focus on. It was observed that exercise treatment led to certain advantages, i.e. improvement in pain, positive disability outcome, etc. Overall, small to moderate benefits realized. But the analysis report was without having proven credential over the content of exercise interventions, negative effects, and long-term impact of exercise treatment. Moreover, there was inadequate information over standard outcome measures (Petrella, 2000)).



Fransen et al., (2001) made a comparison study of the treatment effectiveness involving patients having received individualized supervised physical therapy and group physical therapy. The group program was having the following exercise regimens like lower extremity strengthening, stretching exercises, and stationary cycling for endurance. There was hardly any difference between individualized program and group therapy, but there are various patients who were imparted physical agent modalities. Those patients belonging to the individualized therapy group were administered 30-minutes treatment per session, seven times over a duration of 8-weeks. Similarly, patients in group therapy were administered treatment session sixteen times, each one for 1 hour, i.e. twice in a week for 8 weeks. It was observed after the treatment sessions that both group exhibited improvement in pain and function and small impact was also seen in terms of quality of life (health). For instance a

A comparison study involving 16 weeks of isometric versus dynamic resistance training on knee pain and functioning for the patients having knee osteoarthritis. Randomization was done to select one hundred and two patients from isometric and dynamic resistance training groups or a control. The patients were administered leg strengthening exercises thrice a week for a period of 16 weeks. Whereas, dynamic group were administered exercises related to functional range of motion; isometric group was administered exercises at discrete joint angles. After completion of functional task, evaluation was done over knee pain. In order to examine assumed pain, stiffness, and functional ability, it required relying on the WOMAC osteoarthritis index. There was reduction in performance time involving four functional tasks to 16-23%, in isometric group. As far as the dynamic group was concerned, time for descending and ascending of stairs minimized by 13-17%. During the performance of functional task, it was observed that both the groups reported to have reduced knee pain by 28-58%. However, no change was noticed in the control group over the study duration (Topp, Woolley, Hornyak, Khuder, & Kahaleh, 2002). Later, the study by Bhattacharya, Pattanaik, and Parasher (2006) reviewed 30 subjects having unilateral knee osteoarthritis, where they were randomly assigned either to proprioceptive training group or conventional therapy group with duration of six weeks. Again, the followings were subjected to evaluation like knee joint proprioception, visual analog scale, and joint range of motion, WOMAC, and isometric strength of quadriceps. Subjects receiving proprioceptive training, exhibited better functional ability as compared to those received only conventional therapy.

Similarly, Lund et al., (2008) conducted a comparison study among the patients having knee osteoarthritis and controls involving efficacy of aquatic exercise and a land-based exercise program. Standing balance and strength was also evaluated after 3-months of administering treatment. Seventy-nine patients (62 women) with a mean age of 68 years (age range 40–89 years) were randomized to form three groups to impart exercise regimen in terms of aquatic exercise (n = 27), land-based exercise (n = 25), or control (n = 27). Again, aquatic and land-based exercise programs involved the following; warm up, strength training/endurance exercise, balance exercise, and stretching exercise. Duration for each session was for 50 minutes involving the following 10 minutes of warm-up, 20 minutes of resistance exercises, 10 minutes of balance and stabilizing exercises, 5 minutes of lower limb stretches, and 5 minutes of cool-down. During 3-months follow-up as per the schedule, it was observed to have subsidized pain in the case of land-based exercise group as compared to the control group.

In addition, Susko and Fitzgerald (2013) conducted a study to assess the benefits of therapeutic exercise to deal with pain related to knee osteoarthritis. The review absolutely clarified the peripheral or central mechanisms, where exercise assists in minimizing pain.



Moreover, the other comparative study by Deyle et al., (2005) revealed that home-based physical therapy program and a clinical-based physical therapy program. In this study, one hundred and thirty-four subjects having osteoarthritis of the knee were selected and randomized to assign a clinic treatment group (n = 66; 61% female, 39% male) or a home exercise group (n=68, 71% female, 29% male). It was observed that the groups exhibiting clinically improvement which was statistically significant as well involving all measured outcomes (6-minutes of walk and WOMAC) after 4 weeks.

Likewise the study by Huang et al., (2003) explored the therapeutic benefits of various muscle-strengthening exercises on the functional status of patients having knee osteoarthritis. In this study, one hundred and thirty-two patients were selected those having bilateral knee osteoarthritis. They were divided into four groups. Group I got isokinetic muscle-strengthening exercise, group II was imparted isotonic muscle-strengthening exercise, and group III received isometric muscle-strengthening exercise, and group IV was the control population. It was observed that isotonic exercise made a great impact to reduce pain; however, some patients didn't join the treatment programme as they got pain from exercise. Isokinetic exercise assisted in increasing gaining speed while minimizing the aspect of disability post treatment.

Similarly, Thorstensson, Roos, Petersson, and Ekdahl (2005) attempted a study to assess the effects of a short-term high-intensity exercise program on self-reported pain, function, and quality of life. Patients in the age group of 36–65 years having osteoarthritis K/L grade 3 were subjected to randomization either to a twice-weekly supervised 1-hour exercise intervention for 6 weeks or to a non-intervention control group. Exercise was conducted at $\geq 60\%$ of maximum heart rate. KOOS was the basic outcome measure. Follow-up of the study was done at 6 weeks and 6 months. Sixty-one subjects (mean age 56 years; 51% women, mean BMI 29.5 kg/m²) were randomly assigned to intervention (n = 30) and control groups (n = 31). However, no significant differences in KOOS sub-scales were observed during exercisers and controls. In context to the exercise group, there was a bit of improvement at 6 weeks in the KOOS sub-scale of quality-of-life, as compared to the control group at 6 months.

Fransen and McConnell (2008) stated the advantages of land-based therapeutic exercise for those having symptomatic knee osteoarthritis involving self-reported pain and reduced physical function. The author reviewed 32 studies to make an analysis involving 3616 participants having knee pain and 3719 having self-reported reduced physical function.

A thorough systematic review of randomized controlled trials was conducted to examine the effectiveness of isolated resistance training on arthritis symptoms, physical performance, and psychological function in people having knee osteoarthritis (Lange, Vanwanseele, & Singh, 2008). Meta-analysis conducted in this regard reported that that self-reported measures of pain, physical function, performance, muscle strength, maximal gait speed, chair stand time and balance assisted in improving through resistance training in 56-100% of cases, while 50-100% reporting a significant improvement in all but one performance-based physical function measure (walk time).

Reduced muscle strength is reported to be reason behind the occurrence of knee osteoarthritis. In this regard, Thorlund, Aagaard, and Roos (2010) examined reductions in various aspects of muscle strength and assessment was done on lower extremity function among the middle-aged patients, compared with controls for maximal muscle strength, rapid force capacity, distance achieved during the one-leg hop test, and the maximum number of knee bends in 30 seconds. The Knee Injury and Osteoarthritis Outcome Score (KOOS) were implemented to ascertain self-reported outcomes. It was reported that patients



got 10–26 points indicating worse for all five subscales. Thus, the study reflects that mere loss of muscle strength is not the reason for the perceived functional limitations; hence, training for developing strength could yield in lesser improvement in self-reported function.

While evaluating on the contribution of physical therapy in the management of knee osteoarthritis, Fitzgerald, Piva, Gill, Wisniewski, Oddis and Irrgang (2011) recommended over the need of techniques so as to include balance and coordination in the exercise program.

In context to subjects having knee osteoarthritis, Fitzgerald et al., (2011) evaluated the impact of agility and perturbation techniques to standard exercise therapy, as compared to the standard exercise program. One hundred and eighty-three people (122 women, 61 men) were subjected to randomization to assign either to a group which was imparted agility and perturbation training with standard exercise therapy or a group having the standard exercise program. The outcome measures were in terms of knee pain and function, knee instability, a performance-based measure of function, and global rating of change. Both groups involving intervention programme resulted in moderate improvements in self-reported outcome measures.

Vincent and Vincent (2012) reported that the advantages of resistance exercise are something more than mere relief from pain and functional improvement. Again, psychosocial well-being also involves in this regard, which specifically comprises of cognitive function, positive affect, enhanced self-efficacy and self-esteem with absence of anxiety, depression, and stress-related negative emotions. Resistance exercise might assist in minimizing anxiety, improving mood, and reducing depression among older adults (Cassilhas, Antunes, Tufik, & de Mello, 2010). It was also observed that the depressed elders receiving resistance exercise got a 46% reduction in Beck Depression Inventory scores, as compared to a 20% reduction in controls. Again, there were improvement in the following areas like quality-of-life sub-scores of emotional, social functioning, and bodily pain for which resistance exercise mattered (Singh, Clements, & Fiatarone, 1997).

Uthman et al., (2013) did also attempt to make a comparison study involving the beneficial impact of various exercise interventions in reducing pain and to bring better movement of the lower limb. In this way, this study managed to encompass 12 exercise interventions among 8218 patients. It was identified from the intervention study involving strengthening and flexibility that therapeutic exercise yielded in better result than without any exercise.

Later, Øiestad, Østeras, Frobell, Grotle, Brøgger, and Risberg (2013) analyzed the impact of two different exercise programs, involving individuals having established radiographic and symptomatic knee osteoarthritis and self-reported knee-related quality of life and knee pain. It was concluded from the study that knee osteoarthritis requires exercise therapy.

In similar manner the study by Tanaka et al., (2013) conducted a systematic review and meta-analysis of randomized controlled trials to assess the differences in efficacies involving strengthening and aerobic exercises meant for minimizing pain to those having knee osteoarthritis. The overall effect of exercise was important with a large treatment effect. The analysis revealed that non-weight-bearing strengthening exercise, weight-bearing strengthening exercise, and aerobic exercises are useful in relieving pain. Among the three types, the most sought after short-term intervention is non-weight-bearing strengthening exercise.



Though there are scores of literature on the benefits of treatment interventions for patients having knee osteoarthritis, yet the availability of studies is a matter of concern related to comparison of efficacies of various exercise interventions on pain, physical disability, and psychological well-being.

3.6 Yoga as an Intervention

This section illustrates various studies which has chosen Yoga as the intervention, in which Garfinkel, Schumacher, Husain, Levy, and Reshetar (1994) explored a study on the yoga effects on hand osteoarthritis, where adult patients were selected for the study and were imparted 8-week yoga program versus control group or no therapy. The results revealed that the yoga group induced better result than control group which could be distinguished with following features like pain during activity, finger range of motion, and tenderness. But, the need is to assess the long-term benefits of yoga to arthritis patients. Yoga has been sought after in terms of therapeutic intervention. A report in this regard indicated about the benefits of Iyengar yoga and its strengthening program on pain, stiffness, and function of people having knee osteoarthritis (Bukowski, Conway, Glentz, Kurland, & Galantino, 2006). In this study, subjects were in the age group of 50- 75 years, who had a diagnosis of knee osteoarthritis in at least one knee, through specification of clinical classification of idiopathic osteoarthritis of the knee, and were assigned to one of three groups after getting their consensus. A trained yoga instructor was assigned the task of imparting training to Iyengar yoga group (n = 4) and the strengthening group (n = 7) by physical therapist having license to practice. Each group attended the camp twice in a week for 6 weeks. The control group (n = 4) however, received no intervention. Data collection was done during 1st and 6th week for all groups. Self-reported evaluation of function contained WOMAC, a Global Self-Assessment, and a Health Care Provider Global Assessment. Two measures related to physical function were also implemented; the sit and reach test and quadriceps strength by dynamometry. It was reported that the Iyengar yoga group was having higher levels of perceived improvement involving the intervention groups (Iyengar yoga and strengthening) and the control group.

Haaz and Bartlett (2011) systematically reviewed to identify 11 studies on the importance of yoga in knee arthritis. In this review, there was no such any adverse any events and attrition was lower than typical exercise interventions. There was strong evidence in support of the reduction of disease related symptoms (pain, tender or swollen joints), disability, self-efficacy, and mental health. The study recommends that the scope for further studies must be to generate standardized protocols which are optimized to improve the mechanism of safety and adherence on long-term basis (specific poses and alterations).

Lapane, Sands, Yang, McAlindon, and Eaton (2012) conducted a qualitative study, where 2679 participants were interviewed regarding prevalent osteoarthritis treatments, which also includes Complementary and Alternative Medicine (CAM- seven alternative medical systems, mind-body interventions, manipulation and body-based methods, energy therapies, and three biologically based therapies) and traditional medications. Participants were categorized in terms of conventional medication users, CAM users, users of both, and users of neither. The percentage for CAM use was higher (47%), while 24% constitute the application of both CAM and conventional medication. KOOS-Quality of Life and Short Form 12 Physical Scale scores were having inverse relationships involving all treatments. The study identified CAM in terms of generic use to deal with joint and arthritis pain. But, the intriguing question is to what measure, these treatments are beneficial.



250 participants with knee osteoarthritis (35–80 years) were selected for the study to examine the benefits of yoga (integrated) for dealing with pain, stiffness in morning, and anxiety. They were, subjected to randomization and assigned to yoga or control group (Ebnezar et al.2012). The integrated yoga comprises of loosening and strengthening practices, performing asanas, relaxation, doing pranayama and meditation. The group involving control went through physiotherapy exercises. Both the groups underwent transcutaneous electrical stimulation and ultrasound treatment entailed with programme of intervention (40 minutes) for a period of 2 weeks entailing with a follow-up for a period of 3 months. Evaluation was done on the following day, i.e.15th (indicating post 1) and 90th day (reflecting post 2). Minimization of pain was realized in yoga group (where post 1 was having 33.6% and post 2 at 71.8%) as compared to control group (where post 1 was having 13.4% and post 2 at 37.5%). Again state of anxiety also got minimized by 35.5% (post 1), 58.4% (post 2) involving the yoga group, and for the control group; it was 15.6% (post 1) and 38.8% (post 2); similarly, trait anxiety too was noticed in terms of minimizing (where post 1 = 34.6% and post 2 = 57.10%) in yoga as compared to the control group (where post 1 = 14.12% and post 2 = 34.73%).

Cheung,Wyman, and Savik (2014) conducted a feasibility and efficacy study on a Hatha yoga exercise to deal with knee osteoarthritis-related symptoms among older women (mean age 72 years). Thirty-six participants were selected and were randomly assigned to yoga program (for 8 weeks) comprising of home-based sessions as well as group based. The basic outcome was on WOMAC that evaluated stiffness, pain, and function. The outcome in secondary comprised of physical function involving lower extremities, BMI, quality of sleep and life, which were measured through components of Short Physical Performance Battery (SPPB), the Pittsburgh Sleep Quality Index (PSQI), the Cantril Self-Anchoring Ladder, SF12v2 Health Survey, height, and weight. Data collection took place at baseline- at the following weeks 4th, 8th, and 20th. Those who were part of the treatment group got better result in pain involving WOMAC, stiffness, and SPPB (repeated chair stands) at 8th week. Again, improved treatment as well as time effects was also noticed in WOMAC pain, function, and total scores within the range of 4th to 20th weeks. Disturbance in sleep too also minimized; however, the PSQI total score declined to a large extent at 20 weeks. There was no relevance in terms of changes in BMI and quality of life. There were also no yoga-related adverse events. Even though various studies have explored the effect of Yoga as the therapy for stiffness, pain, and function, none have stated the effect for stress release.



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