



Study of anatomical effects of Yogasana in Osteoarthritis

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Abstract

Osteoarthritis is greatly affecting to people of this era. It is the most common form of arthritis and leading cause of disability and loss of functions in the elderly population. It can affect any joint but the knee is one of the most affected parts of the body in humans. Besides medicine, Yogasana is preventive and therapeutic measure for the problem caused by wrong lifestyle. Yogasanas are our ancient master processes needful for healthy life which also help to maintain sound state of body and mind. Osteoarthritis is the most common arthropathy and is a leading cause of pain and disability. As an example, symptomatic knee OA occurs in around 15% of adults >55 years old, with a radiographic incidence of >80% in those over 75 years old. It is a condition characterized by the progressive loss of articular cartilage and remodeling of the underlying bone. It is seen that regular practice of some yogasanas such as Marjarasana, Vrikshasana, Setubandhasana, Tikonasana, Veerbhadrasana help in improvement in joint movements, initiate healing process, achieve alignment and stability, strengthen the surrounding musculature so that osteoarthritis will be avoided and treated.

Keywords

Yogasana, Osteoarthritis, Knee joint

1. Introduction

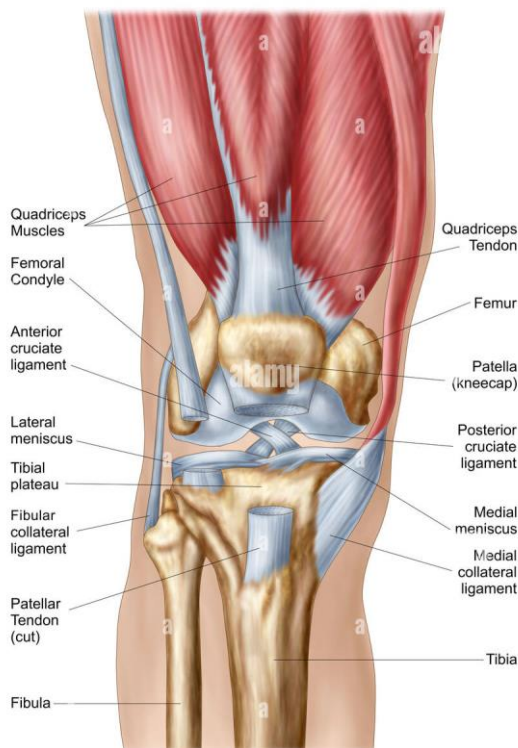
OA is the most prevalent joint disease associated with pain and disability. OA is the second most common musculoskeletal problem and it is the most frequent joint disease with a prevalence of 22% to 39% in India. OA is more common in women than men, but the prevalence increases dramatically with age. Approximately 41.1%

of males and 56.5% of females suffer from OA. Nearly 45% of women over the age of 65 years have symptoms while radiological evidence is found in 70% of those over 65 years. OA was estimated to be the 10th leading cause of nonfatal burden. Major clinical symptoms include chronic pain in joints, joint instability, stiffness and radiographic joint space narrowing, restricted range of joint movements associated with muscle weakness. Although OA primarily affects the elderly population, sports related traumatic injuries at all ages can also lead to post traumatic OA. Currently, apart from pain management and end stage surgical intervention, there are no effective therapeutic treatments for OA. Yogasana is the non pharmaceutical intervention therapy other than medicine and surgery which can initiate the healing process and strengthens the joints. Yoga is very ancient Indian science which includes yogasana which are perfect for managing the knee pain, improving flexibility, strengthen the muscles and healing alignments.

2. Aims and objectives

- 1 Study the anatomy of Knee joint
- 2 Study the pathophysiology of Osteoarthritis
- 3 Study the mechanism of Yogasana

3. Anatomy of knee joint



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The knee joint is a hinge type synovial joint, which mainly allows flexion and extension (and a small degree of medial and lateral rotation). It is formed by articulations between the patella, femur and tibia.

3.1. Articulating surfaces

The knee joint consists of two articulations- Tibio-femoral and patella-femoral. The joint surfaces are lined with hyaline cartilage and are enclosed within a single joint cavity.

Tibio-femoral- Medial and lateral condyles of the femur articulate with the corresponding tibial condyles. It is the weight bearing component of the knee joint.

Patello-femoral- Anterior aspect of the distal femur articulates with the patella. It allows the tendon of the Quadriceps femoris (knee extensor) to be inserted directly over the knee increasing the efficiency of the muscle.

As the patella is both formed and resides within the Quadriceps femoris tendon, it provides a fulcrum to increase power of the knee extensor and serves as a stabilising structure that reduces frictional forces placed on femoral condyles.

3.2. Neurovascular supply

The blood supply to the Knee joint is through the genicular anastomoses around the knee, which are supplied by the genicular branches of the femoral and popliteal arteries.

The nerve supply according to Hilton's law, is by the nerves which supply the muscles which cross the joint. These are the Femoral, Tibial and Common fibular nerves.

3.3. Menisci

The medial and lateral menisci are fibrocartilage structures in the knee that serve two functions

1. To deepen the articular surface of the tibia, thus increasing stability of the joint.
2. To act as shock absorbers by increasing surface area to further dissipate forces.

They are C shaped and attached at both ends to the intercondylar area of the tibia. In addition to the intercondylar attachment, the medial meniscus is fixed to the tibial collateral ligament and the joint capsule. Damage to the collateral ligament usually results in a medial meniscal tear. The lateral meniscus is smaller and does not have any extra attachments, rendering it fairly mobile.

3.4. Bursae

A bursa is a synovial fluid filled sac found between moving structures in a joint with the aim of reducing wear and tear on those structures. There are four bursae found in the knee joint:

1. Suprapatellar bursa- an extension of the synovial cavity of the knee located between the quadriceps femoris and the femur.
2. Prepatellar bursa- found between the apex of the patella and the skin.
3. Infrapatellar bursa- split into deep and superficial. The deep bursa lies between the tibia and the patella ligament and the skin.
4. Semimembranosus bursa- located posteriorly in the knee joint, between the semimembranosus muscle and the medial head of the gastrocnemius.

3.5.Ligaments

The major ligaments in the knee joint are

1. Patellar ligament- A continuation of the quadriceps femoris tendon distal to the patella. It is attached to the tibial tuberosity.
2. Collateral ligament- These are two strap like ligaments. They act to stabilize the hinge motion of the knee, preventing excessive medial or lateral movement.
 - a. Tibial or medial collateral ligament- wide and flat ligament, found on the medial side of the joint. Proximally, it attaches to the medial epicondyle of the femur, distally it attaches to the medial condyle of the tibia.
 - b. Fibular or Lateral collateral ligament- Thinner and rounder than the tibial collateral, this attaches proximally to the lateral epicondyle of the femur, distally it attaches to a depression on the lateral surface of the fibular head.
- C. Cruciate Ligament- These two ligaments connect the femur and the tibia. In doing so they cross each other, hence the term 'Cruciate'.(cross)
 - 1 Anterior cruciate ligament- attaches at the anterior intercondylar region of the tibia where it blends with the medial meniscus. It ascends posteriorly to attach to the femur to the intercondylar fossa. It prevents anterior dislocation of the tibia onto the femur.
 - 2 Posterior cruciate ligament- Attached at the posterior intercondylar region of the tibia and ascends anteriorly to attach to the anteromedial femoral condyle. It prevents posterior dislocation of the tibia onto the femur.

Movements-

There are four main movements that the knee joint permits

1. Extension- Produced by the Quadriceps femoris which inserts into the tibial tuberosity.
2. Flexion- Produced by the Hamstrings, Gracillis, Sartorius and Popliteus.
3. Lateral rotation- Produced by the Biceps femoris.
4. Medial rotation- Produced by five muscles ,Semimembranosus, Semitendinosus, Gracillis, Sartorius and Popliteus.

4. Pathophysiology of Osteoarthritis

The pathogenesis of OA involves a degradation of cartilage and remodeling of bone due to an active response of chondrocytes in the articular cartilage and the inflammatory cells in the surrounding tissues.

Release of enzymes from these cells, break down collagen and proteoglycans destroying the articular cartilage. The exposure of the underlying subchondral bone results in sclerosis followed by reactive remodeling changes that lead to the formation of osteophytes and subchondral bone cysts. The joint space is progressively lost over time.

5. Risk factors:

OA can be primary (with no obvious cause) or secondary (due to trauma, infiltrative disease or connective tissue diseases).

Risk factor for primary OA includes obesity, advancing age, female gender and manual labour occupations, smoking, intra-articular fractures, chondrocalcinosis, crystals in joint fluid/cartilage, prolonged immobilization, joint hypermobility, instability, peripheral neuropathy.

Clinical feature include pain and stiffness in joints, worsened with activity and relieved by rest, restricted joint movements associated with muscle weakness. Knee OA is associated with disrupted sleep, depression, increased sedentary behavior, less physical activity, obesity and decreased quality of life. Prolonged OA results in deformity and a reduced range of movements.

6. Management

6.1. Conservative

Patients should be educated about their condition and its progression, including advice on joint protection and emphasizing the importance of strengthening and exercise.

Non-pharmacological interventions such as exercise, yoga, physiotherapy etc. showed improvement in quality of life along with a reduction in pain, improved physical functions, psychological balance in patients with knee OA.

Depending on the symptoms, medicines and surgical intervention can be advised.

Exercise is one of the most important treatments for people with OA whatever your age or level of fitness. Regular exercise builds up muscles and strengthens the joints usually helps to improve symptoms.

Yogasanas are our ancient master postures needful for healthy life which also maintains sound state of body and mind.

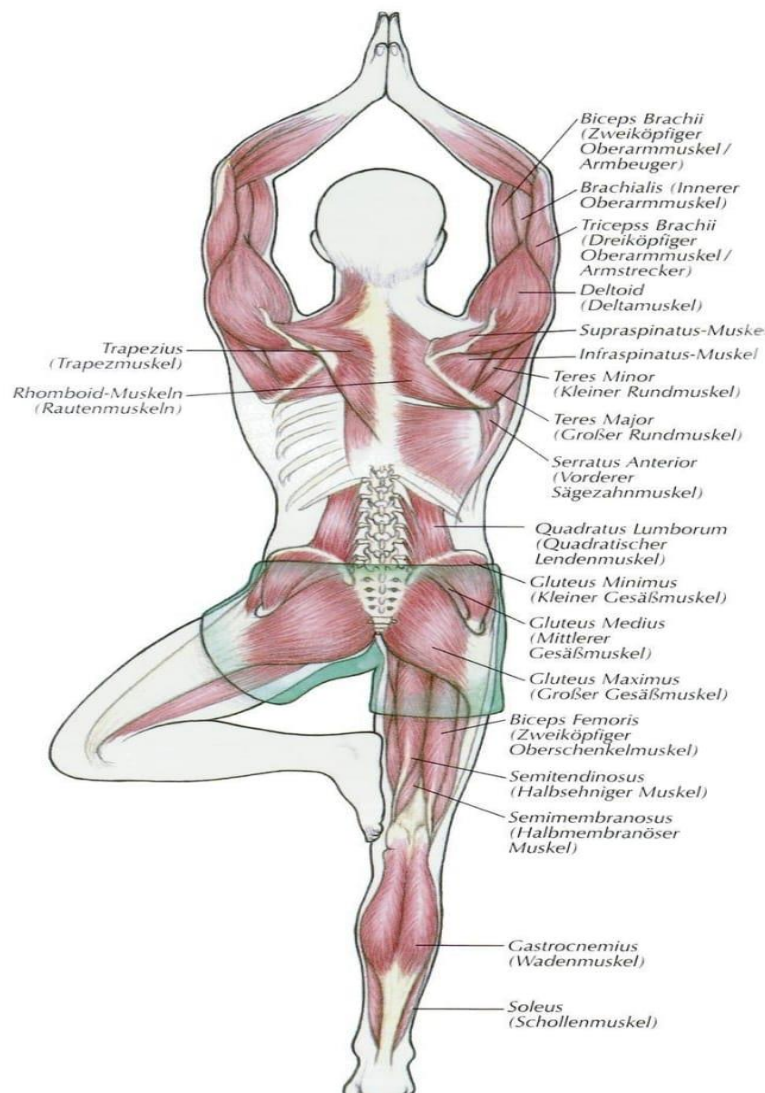
It is seen that regular use of Yogasana, helps in improvement of motions, initiate healing process, achieve alignment and stability and strengthen the muscles and makes the body more flexible so that osteoarthritis will be avoided and treated.

These yoga postures will help you to manage the symptoms of arthritis

1. Vrikshasana or tree pose
2. Veerbhadrasana or warrior pose
3. Marjarasana or cat pose
4. Setubandhasana or bridge pose
5. Tikonasana or triangle pose

Let's consider one by one.

1. **Vrikshasana**- It Is one of the standing balancing yoga posture. Vriksha means tree in Sanskrit.



Steps

1. Stand erect. Keep a distance of one foot between the legs.
2. Raise your arms up keeping the palm closer in Anjali mudra. Inner sides of the upper arms should touch the ears.
3. Raise the right leg up and place it on the left thigh.
4. Breathe normally. Keep the position as long as it is comfortable.
5. Release the right leg down. Repeat the above steps with the left leg.

Muscles involved- When you lift the arch of your foot, quadriceps and gluteus is engaged. When you pressed back the knee in a locked position, hamstring is lengthened. Engaging your core muscles mainly rectus abdominis and transverse abdominis, helps you balance in tree pose. For keeping the arm upwards, main arm adductors, latissimus dorsi, the pectoralis major and the teres major are being used.

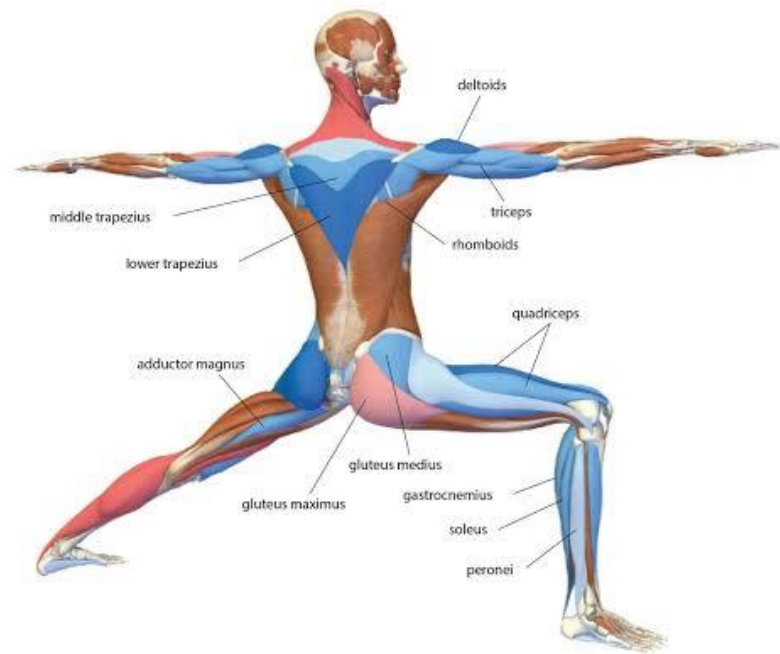
So, it benefits the following muscles -

1. Gluteus
2. Hamstrings
3. Hips
4. Hips External
5. Knees
6. Quadriceps

Benefits

1. Stretches, Strengthens, lengthens-the muscles of legs, hips, back, core, arms and shoulders.
2. This balancing pose which involves the joints of the hips, knees, ankles and shoulders are all engaged together helping in keeping the body stable. Thus, with time, the practice of this pose helps to gain better mobility in the joints and muscles involved.

2. Veerbhadrasana - Veer means warrior in Sanskrit.



3.

Steps

1. Stand in Tadasana with your hands on your waist. Move your left leg at the back. The gap between your feet should be 4.5 to 5 feet apart.
2. Inhale and while inhaling, slowly raise your arms above your head. Your arms are perpendicular to the floor.
3. Exhale and bend your right knee so that your right knee is standing on your right ankle and your right thigh is parallel to the floor.
4. Inhale, start stretching from your tailbone to your spine to your upper back to your neck and slowly drop your head at the back. You are looking at the ceiling now. Hold the posture with normal breathing for 10-20 sec
5. Slowly release the posture in reverse order and repeat with the other leg.

Muscles involved - From this pose, one can get a good stretch of both the front and rear thigh (quadriceps and hamstrings), hips and chest as well as a back extension of the erector spine muscle.

It stretches the hip flexors, calf muscles and the inner groin and strengthens the quads, glutes, shoulders and the muscles of the spine and ankles.

Benefits

1. Stretches, strengthens the gluteus maximus, the quadriceps, the hamstrings and the adductors of the inner thighs.
2. Regular practice of this pose increases flexibility in the hips and strengths and tones the legs, ankles, knees and feet.

3. **Setubandhasana** - Bridge pose as the name suggests the pose resembles a bridge.

4.



5.

Steps

1. Inhale- bend the knees, raise the hips up and bring the arms to rest on the floor.
2. Exhale- lift as high as you can grounding the feet firm on the floor. Inhale/exhale to stay for 6 breaths in bridge pose.

Muscles involved - Strengthens Hamstrings, Quadriceps, Back muscles- the erector spinae, Transverse abdominus and Rectus abdominus, Glutes , leg adductors, Latissimus dorsi, Pectoralis minor, Trapezius, Serratus anterior .

Stretches Hip flexors, especially Psoas and iliacus, Pectoralis major

Setubandhasana benefits the following muscles.

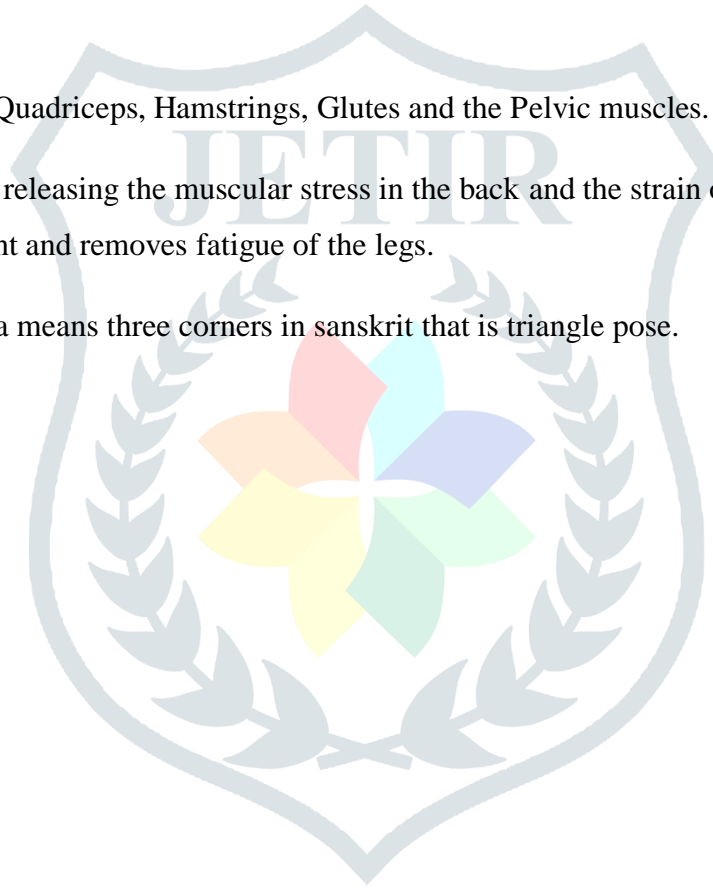
1. Lower back
2. Upper back
3. Core
4. Gluteus
5. Chest
6. Hips
7. Pelvic psoas
8. Quadriceps

Benefits

Bridge pose strengthens the Quadriceps, Hamstrings, Glutes and the Pelvic muscles.

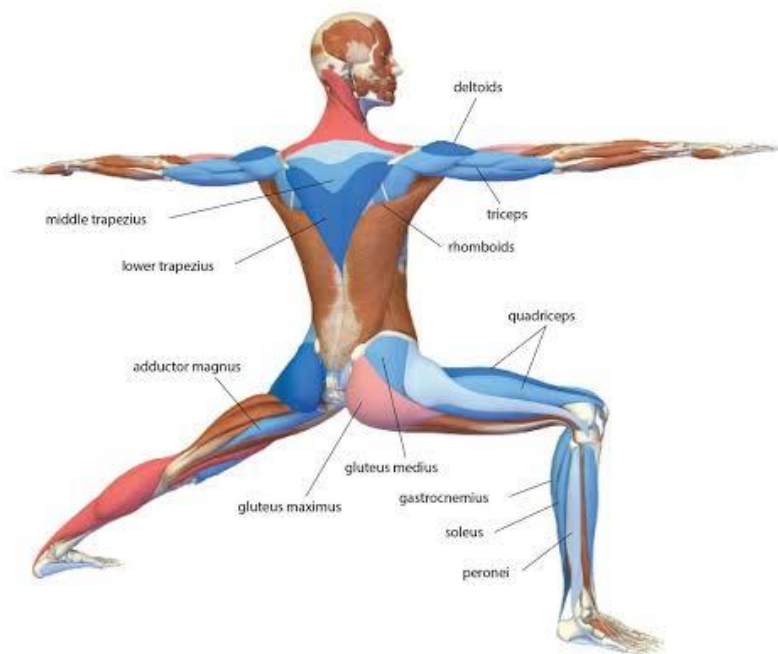
Bridge pose is energizing by releasing the muscular stress in the back and the strain on the neck. The toning of the legs strengthens the knee joint and removes fatigue of the legs.

6. **Tikonasana** – Tikona means three corners in sanskrit that is triangle pose.





7.



8.

Steps

Start by standing with your feet wide apart.

Stretch your arms out to the sides, stretch your right leg out (90 degrees) and turn your left toes (45 Degrees)

Now, place your right hand on your right ankle/ knee and lift your left arm up to the ceiling.

Look up towards your left hand and hold for 7-8 breathes

Release and switch to the opposite side.

It stretches and strengthens the thighs, knees, hips, groin hamstrings, shoulders, chest, spine and ankles. While maintaining the perfect posture largely influences the lateral spine mobility, elongates the leg muscles, and removes stiffness in the legs and hips.

It stretches the hamstrings, groins, glutes, hips and ankles. The quadriceps of the legs are active, lifting the knees and lengthening the lower hamstrings of both legs. Flexing the hip stretches the upper hamstring of the back leg and the anterior gluteus maximus muscles.

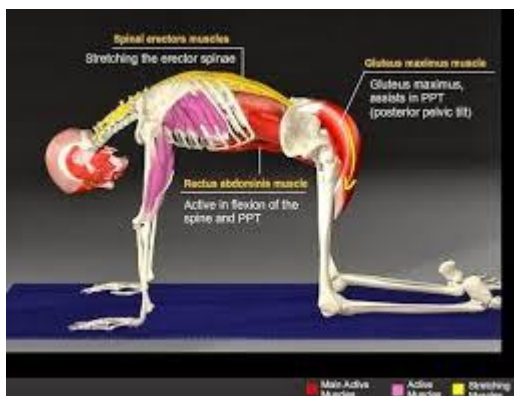
Triangle pose benefits the following muscles

1. Arms and shoulders
2. Lower back
3. Core
4. Hamstrings
5. Chest
6. Hips external
7. Psoas
8. Quadriceps

Triangle Pose Benefits

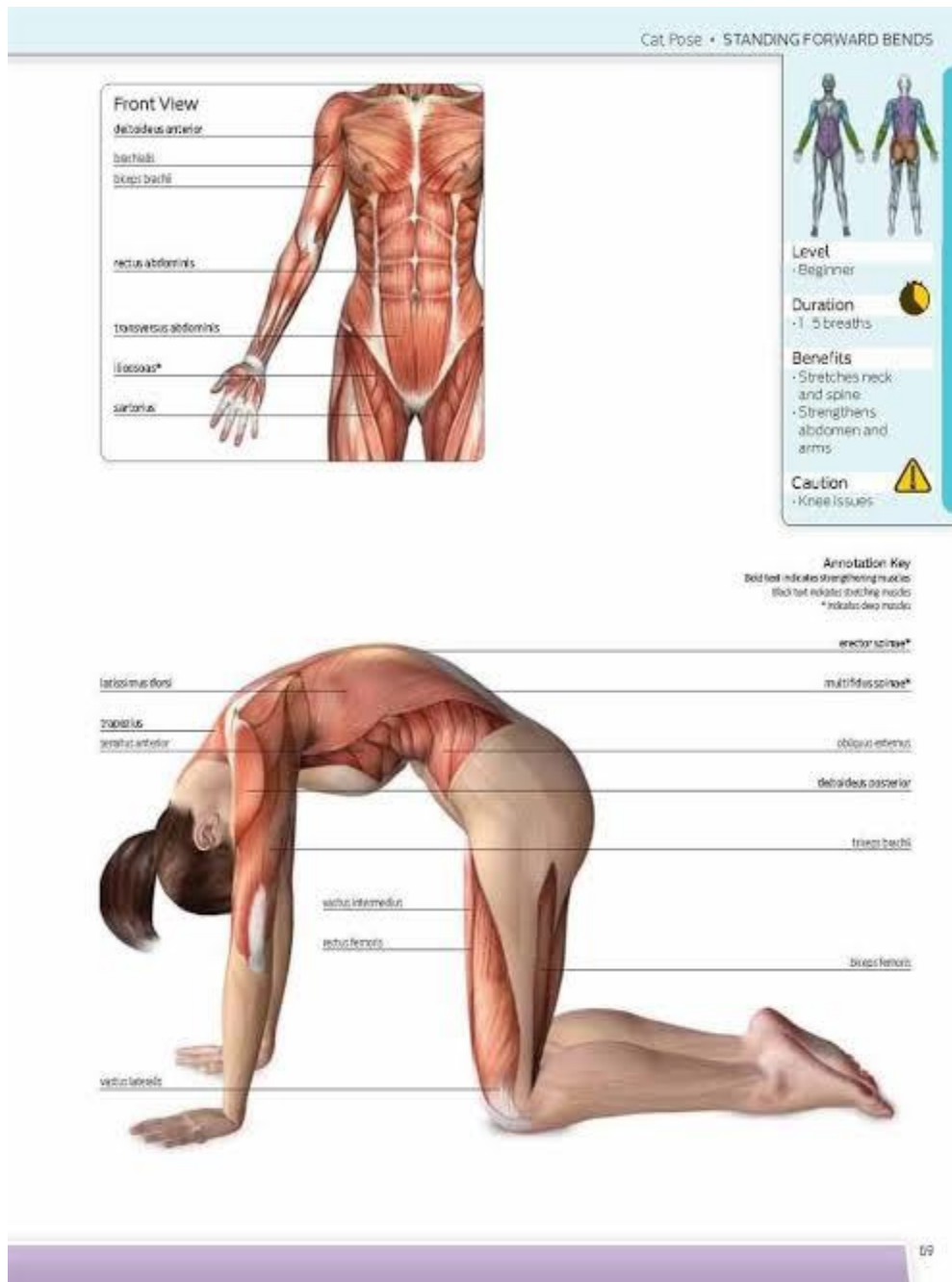
1. Stretches and strengthens the thighs, knees, hips, groin, Hamstrings ,shoulders, chest spine and ankles

9. **Marjarasana** - This name comes as the body resembles the cat, while it stretches rounding the back. Marjara means cat in Sanskrit.



10.

11.



12.

13. Steps

1. Get on all fours, like a cat. Shoulder over wrists and hips over knees, with your weight evenly distributed along with your hands and knees.
2. Start with a neutral spine. Inhale and expand the belly towards the floor. Raise your chin and tilt your head backwards toward the spine. Point the tailbone up as you stretch like a cat.
3. Then exhale and pull the belly button in, towards the spine. The chin should rest on the chest and direct your vision towards the nose. Your back should be rounded.
4. Complete as many rounds as possible.

It benefits the following muscles

1. Lower back
2. Middle back
3. Neck
4. core muscle

Benefits

1. Improves the flexibility of spine, hips, knees, shoulders and wrists.
2. Relieves the tension around the lower back, middle back, neck and shoulders
3. Strengthens the arms, shoulders and the wrists
4. Strengthens the hip joints, the knee joints and shoulder joints.
5. It engages core muscles which support the spine.
6. it stretches the back muscles, strengthens the stabilizer muscles in the spine and abdomen.

7. Discussion

Yoga is a practice that comes in many different forms and includes poses, breathing techniques and meditation. It started in ancient India and has been touted as a way to boost physical and mental health for 5000 years. In fact, yoga is proven to help people with arthritis improve many physical symptoms like pain and stiffness, and psychological issues like stress and anxiety. People with various types of arthritis who practice yoga regularly can reduce joint pain, improve joint flexibility and function and lower stress and tension to promote better sleep. Yoga also can help a person with arthritis build muscle strength and improve balance.

So Yogasanas can help in following way

1. Improve physical function- It can enhance pain management thereby improving function.
2. Improves flexibility – Stretching exercise in general help improve range of motion, so the fact that stretching in yoga will help flexibility.
3. Create a mind body connection- Yoga emphasis on pinpointing the sources of pain or anxiety and learning to relax them. It is very useful in patients with osteoarthritis.

The multifactorial approach of yoga therapy includes physical postures(asanas), breathing practices (pranayama), meditation(dhyana) may help to the amelioration of OA symptoms.

Practice of above mentioned asanas i.e. Vrikhasana, Veerbhadrāsana, Setubandhasana, Tikonasana, Marjārasana daily will benefit the OA patient in following way

1. Yoga therapy intervention may increase cartilage proteoglycan content and prevent cartilage degeneration. This is helpful for the strengthening of periarticular muscles (i.e. quads and hamstrings) that normally contract to stabilize the knee joint pain.
2. Yoga practice may prevent synovial fluid volume deterioration by stretching and strengthen different parts of the body, massaging and bringing fresh blood to the internal organs while rejuvenating the nervous system and lubricating the joints, muscles and ligaments.
3. Yoga provides the local structure strengthening to reduce physical pain by increasing joint stability.
4. It is purported to have different effects on the nervous and circulatory systems, coordination and concentration and calming effect on the body.
5. It also suggests that yoga practice helps in reducing several psychological factors such as stress, anxiety, depression and enhance self esteem and quality of life in individuals with chronic pain and arthritic conditions.

8. Conclusion

Yoga is an acceptable and safe intervention, which may result in clinically relevant improvements in pain and functional outcome in OA patients.

The mentioned asanas plays a major role in reducing the inflammation and strengthening the knee muscles and initiating the healing process so that one can prevent and easily treat the OA patients besides other medications.

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7 Yogasana

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