Anatomy and Physiology of Injury and Recovery

How does SIJ injury impact on a students' Yoga Practice? What asana should be avoided and why?

The skeleton is a kinetic chain held together by ligaments and held erect by muscles. Correct skeletal alignment is dependent on muscle tone and elasticity. When muscle tension becomes unbalanced, the joints are compromised. Misalignment of one joint can impact other joints in the body by shifting the centre of gravity, forcing the body to compensate to achieve balance. For example, when the Sacroiliac joints become misaligned, body alignment shifts to compensate and can be the cause pain of anywhere from the head to the feet. The sacroiliac is one of the joints in the pelvis, formed by two bones, the sacrum and the ilium. "While there is a small amount of movement allowed at the S-I joint, its major function is stability, which is necessary to transfer the downward weight of standing and walking into the lower extremities. Held together by strong yet pliable ligaments, it is designed to lock in place when we stand; the sacrum bone wedges down into the pelvic joints due to the weight of the trunk, similar to the way a padlock closes. This tight sacrum-pelvis connection creates a firm base for the entire spinal column."[1] This dysfunction refers to either hypo or hyper mobility (low or high respectively). In other words, the joint can become 'locked' or be too mobile. This can then lead to problems with surrounding structures such as ligaments (e.g. Iliolumbar ligament) and muscles, which mean SIJ problems can cause a wide range of symptoms throughout the lower back and buttocks, or even the thigh or groin.

SI joint strain will be irritated by forward bends, these muscular symptoms may be relieved by gentle, flexion-based stretches. Forward bends or lumbo-sacral flexion makes the SI joints more vulnerable to injury because there is less joint congruency, in other words less stability. In a flexed posture or with the tailbone 'tucked', the stability of the joint is entirely dependent on the ligaments around it. Combining lumbo-sacral flexion with rotation, as in Seated Twist such as Marichyasana III, may force the sacrum out of alignment, especially if the ligaments are lax, either due to genetic predisposition. Once an injury occurs, forward bends are most likely to aggravate the symptoms.

Sitting in and of itself "unlocks" the sacrum and the ilium. If additional stress is then placed on the joint, discomfort and/or injury could occur. Janu Sirsasana and Paschimotanasana can aggravate the pain by stretching the muscles at the back of the leg putting additional pressure on the joint. " Both Baddha Konasana and Upavistha Konasana unlock the sacroiliac joint and potentially strain the transverse ligaments of the sacrum, particularly if we bend forward. When we sit in Upavistha Konasana, there is little to support and/or stabilize the sacroiliac joint, and bending forward only adds to this instability."2

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[1] http://www.yogajournal.com/health/562?page=4

[2] http://www.yogajournal.com/health/562?page=4

The piriformis muscles, strong external rotators of the thigh, attach to the sacrum and the femur. Any wide legged pose, twisting, forward bends which stretching these muscles can increase S-I joint instability. For instance, in Prasarita Padatonasana/ Wide legged forward bend pose if the adductors are tight or hypertonic, the piriformis of the same hip may be inhibited, leading to pain and dysfunction of the hip, sacroiliac joint or low back. Prasarita is a effective way to simultaneously stretch and strengthen the legs and torso and to address these muscle imbalances. The other example is Gate Pose/Parighasana, student with very tight adductors may not be able to kneel in this posture without tilting the pelvis up on the extended side. This will likely cause too much compression in the lumbar spine and possibly stress the SI joints.

Supported Seated Forward Fold may be tolerable for those with chronic conditions worsened by spinal flexion (HNP, osteoporosis, SI joint instability) if approached slowly and modified to limit the degree of spinal flexion. Paschimotanasana can be practised with the knees raised using a bolster or rolled up blankets or a bolster under the torso. If it is still painful supported janu sirsasana or Balasana with trunk supported on a bolster can be performed. Over time forward bends may become easier and more beneficial.

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When reclining, the erector spinae muscles are relaxed. In standing forward bends, they may be relaxed or moderately active. But in sitting forward bends, unless the hamstrings are very loose, the erector spinae muscles must contract very strongly to tilt the pelvis forward. This adds a very strong compressive force to the joint as well as the disks.

What protocol would you follow for a student who has come to Yoga to manage an injury and why?

The most important thing from point of my view is to work with a diagnosed injury. Because, undiagnosed injury may be one of the symptoms of serious problems such as prolapsed discs, sacroiliac joint dysfunction, rotator cuff injury or may be derived from a poor postural alignment. If a students practice with undiagnosed injury , it is likely to result in crucial injuries. Therefore, if a student has an undiagnosed injury it is essential to refer the student to a GP or other health care practitioner. Recognizing the student's limits in a professional manner, knowing the source of the injury, getting an approval from health practitioner such as X-ray and having a adequate knowledge about the injury are keys to help the student properly. Diagnosed injury

also helps a yoga teacher to understand which phase students in such as acute or chronic. Because, "Students are encourage not to practice yogasana during the acute phases of any injury and are advised to practice any of the other 8 limbs of Yoga or to work privately with YT's to determine a safe, therapeutic individual practice under the guidance of an experience Yoga Teacher/Therapist (Palmer 2010)".3

As a Yoga teacher I also would follow these protocols;

- not diagnose any diseases and referring to a GP or any other health practitioner when necessary

- approaching students from a holistic point of view, working with whole person not just their symptoms

- understanding a student's individual differences and limitations
  having knowledge about injuries or doing a pre-research

- using a comprehensive Health Assessment Form to have a full overview of any previous injuries, current, medication that may affect their practice e.g. side effects, any recent procedures, current occupation, practice history, other physical activities being undertaken, any respiratory complaints that may be exacerbated by heat, pre or existing cancers/treatment, whether they are undergoing IVF or natural fertility, treatment, blood pressure concerns etc.4
  encouraging students to communicate with me for the duration of their practice any changes to their health

- encouraging body awareness and to teach students to listen to their body
  giving individual variations, modifications for poses, using props

- working with students according to their individual needs

- teaching yamas and niyamas in a class atmosphere which I believe it is one of the most significant aspects of yoga to prevent any injury. For instance, ahimsa (non violence); in asana practice helping students increase their body awareness and differentiate between sensation and pain and the cultivation of gentle thoughts towards oneself especially when illness and diseases lead the students to feel betrayed by their body are more powerful aspects of ahimsa.

[3] MOKAP004 (P 5)
[4] MOKAP006 (P 2)

What asana should be avoided for the following injuries and why? Name 3 asana or types of asana for each;

- Rotator Cuff injuries; Students are initially advised to rest the affected shoulder, avoiding any movements which cause the shoulder to be painful. Then to begin gentle movements as soon as possible in order to prevent stiffness in the shoulder. The most important aspect of this injury is to allow the body to re-learn proper alignment and postural balance slowly. Therefore, starting practice at wall first rather than on the floor especially for weight bearing asanas enable to work gradually into full arm balances. For example, plank, chaturanga dandasana and downward facing dog poses require bearing the weight of the whole body on the arms therefore wall plank, wall chaturanga, wall downward dog and wall push-ups (puppy-dog pose) help to establish correct alignment in the shoulder without putting weight on the arms and strengthen the upper arms and shoulder girdle area.

- Sciatica/Lumbar spine injuries; Any irritation of sciatic nerve can cause mild or excruciating pain that starts in the lower back and runs down the legs. Herniated disks in the Lumbar area or tight muscles such as the Piriformis can cause irritation. Standing or sitting forward bend such as can Paschimottanasana, Janu Sirsasana , Parsvottanasana (Intense Side Stretch Pose) aggravate the pain by stretching the muscles at the back of the leg putting additional pressure on the lumbar area as well as sciatic nerve ; forward bends tend to stretch the sciatic nerve.

- Soft tissue injuries; During the first 1 to 3 weeks after the injury, immobilization of the injured tissue areas allows healing without extensive scarring. When soft-tissue regeneration begins, controlled mobilization and stretching of muscle and tendons stimulate healing. At 6 to 8 weeks post injury, the rehabilitative goal is full return to pre-injury level of activity. 5 The degree of damage and location of the injury determines what level of care is required to support healing. Some yogasanas such as Chaturanga Dandasana, Adho Mukha Svanasana which is executed many times in a vinyasa practice and resulting in repetitive movement triggers injuries of the wrist, elbow and shoulder. Furthermore, Vrksasana or Virabhadrasana I-II-III put too much pressure on the knee joint as well as ankle joint. The main questions to ask with regard to injury are how much weight is the body bearing and how many times is it being asked to do the same motion relative to its own comfort zone.

  These suggestions should be followed during the acute phase, when the injury is still painful and inflamed (red, swollen, and hot), which may last a few days with a mild condition or a few weeks or even months with a more serious injury. 6

[5] MOKAP006 (P 9)
[6] http://www.yogajournal.com/for_teachers/2626?page=2

1. Avoid painful activities and positions. While the body is trying to repair and "stitch up" the torn tissues, pain indicates that the healing process is being disturbed and the new repairs are being torn up. At best, it will take even longer for the injury to heal; at worst, the tissues could be injured more severely.
2. Avoid the position and activity that caused the injury. This will minimize disturbance of the healing process. For example, if the lower-back muscles were strained while bending over to pick up the lawn mower, forward bending in yoga could reinjure that area. If an ankle sprain occurred when the foot slipped off the outer edge of a clog, grounding the outer edge of the back foot in a standing pose such as Virabhadrasana II (Warrior Pose II) reproduces the position of injury.
3. Know when to encourage immobilization. Mild muscle strains, including stiffness and soreness from overworking in a new activity, shouldn't be immobilized: Don't spend 48 hours lying on the couch with back muscle soreness after the first gardening day in spring. In fact, some gentle movement helps circulate the blood through the injured tissues, facilitating healing. However, with more serious injuries, such as a sprained ankle or knee ligaments that are swollen and painful, immobilizing the area with an Ace bandage or brace allows the body to go about stitching up the tissues without repeated disturbance.
4. Gradually rebuild activities. Encourage your students to practice gentle movement and very gentle stretching of the injured area as the pain subsides. Depending on the severity of injury, it takes time to rebuild the strength and flexibility of the injured area. If your student returns to full activities after a week or more of rest-and-repair time, chances are good that the de-conditioned tissues will be re-injured.

- Prolapsed disc: when we bend forward in Pashimottanasana, much of the flexion comes from the lumbar spine and it can strain the ligaments that surround the vertebral bodies and also exacerbate bulging of the intervertebral disks. Moreover, most of standing twist such as Parivrtta Trikonasana or Parivrtta Parsvakonasana are performed with lateral flexion and forward flexion of spine which allow excessive rotation for posterior vertebral ligament. If this forward flexion comes from lower back rather than hip joint it is likely to trigger injury. In backbends such as ustrasana (camel pose) or urdhva mukha svanâsana (upward-facing dog pose) injury to the lumbar area often occurs because the thoracic spine does not bend, forcing the lumbar spine into overextension. When reclining, the erector spinae muscles are relaxed. In standing forward bends, they may be relaxed or moderately active. But in sitting forward bends, unless the hamstrings are very loose, the erector spinae muscles must contract very strongly to tilt the pelvis forward. This adds a very strong compressive force to the joint as well as the disks. Combined with the force of gravity and the effects of leverage, this puts enormous pressure on the lower lumbar disks in seated forward bends.

- Neck Injuries; The cervical spine is the most vulnerable part of the spine because it is the most mobile. The two types of poses in which the most care is needed to protect the neck are backbends and inversions. In backbending, vertebral compression and nerve impingement occurs when a Yoga student is too aggressive, thrusting the head and neck back in bhujangasana, urdhva mukha svanasana or ustrasana. In ustrasana gravity will play a part in taking the head back.7 The prominent process on C7 is at the most risk in shoulder-stands such as Salamba Savangasana (supported shoulder stand), Halasana (Plow Pose), and Setu Bandha Sarvangasana (Bridge Pose), which is why it is important to use blankets and props where appropriate to avoid grinding the cervical vertebrae into the floor.8

- SIJ Injuries; The piriformis muscles, strong external rotators of the thigh, attach to the sacrum and the femur. Any wide legged pose such as Upavista Konasana, twisting such as Parivrtta Ardha Chandrasana, forward bends such as Prasarita Padatonasana which stretching these muscles can increase S-I joint instability. For instance, in Prasarita Padatonasana/ Wide legged forward bend pose If the adductors are tight or hypertonic, the piriformis of the same hip may be inhibited, leading to pain and dysfunction of the hip, sacroiliac joint or low back.

What Yoga practices would be suitable for a student who has chronic pain and associated depression and why?

Pain, especially chronic pain, is an emotional condition as well as a physical sensation. It is a complex experience that affects thought, mood, and behaviour and can lead to isolation, immobility, and drug dependence. In those ways, it resembles depression, and the relationship is intimate. Pain is depressing, and depression causes and intensifies pain. People with chronic pain have three times the average risk of developing psychiatric symptoms — usually mood or anxiety disorders — and depressed patients have three times the average risk of developing chronic pain.9

Brain pathways10

The convergence of depression and pain is reflected in the circuitry of the nervous system. In the experience of pain, communication between body and brain goes both ways. Normally, the brain diverts signals of physical discomfort so that we can concentrate on the external world. When this shutoff mechanism is impaired, physical sensations, including pain, are more likely to become the centre of attention. Brain pathways that handle the reception of pain signals, including the seat of emotions in the limbic region, use some of the same neurotransmitters involved in the regulation

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[7] American Academy of Orthpaedic Surgeons. Tips to prevent yoga injuries. http://orthoinfo.aaos.org/topic.cfm?topic=A00063, March 14, 2007.
[8] MOKAP004 (P 8)
[9] http://www.health.harvard.edu/newsweek/Depression_and_pain.htm
[10] http://www.health.harvard.edu/newsweek/Depression_and_pain.htm

of mood, especially serotonin and norepinephrine. When regulation fails, pain is intensified along with sadness, hopelessness, and anxiety. And chronic pain, like chronic depression, can alter the functioning of the nervous system and perpetuate itself.

The mysterious disorder known as fibromyalgia may illustrate these biological links between pain and depression. Its symptoms include widespread muscle pain and tenderness at certain pressure points, with no evidence of tissue damage. Brain scans of people with fibromyalgia show highly active pain centers, and the disorder is more closely associated with depression than most other medical conditions. Fibromyalgia could be caused by a brain malfunction that heightens sensitivity to both physical discomfort and mood changes.

Yoga practice includes the use of postures or asanas, breathing techniques, Yoga Nidra and meditation to make the body more powerful and immune to the outer environment. Consistent meditation practice provides significantly decrease high levels of these stress hormones in the blood. Meditation training affects activity in stress-relevant brain areas such as anterior cingulate and amygdala and increase production of neurotransmitters, which are responsible for the all-encompassing sense of happiness such as endorphins and serotonin. In addition, levels of the neurotransmitters GABA "(gamma aminobutyric acid) that is one of the major inhibitory neurotransmitters in the central nervous system"11 and DHEA (dehydroepiandrosterone) that stabilize mood disorders are increased by practicing meditation.

Pranayama has a powerful effect on the body and mind such as Brahmari Pranayama – The Humming Bee Breath. This pranayama relieves stress and mental tension and reduce anger, anxiety and insomnia.12 "By focusing on breathing, the control of breathing shifts from brain stem / medulla oblongata to cerebral cortex. The thoughts and emotions are by passed and mind can experience focus, emotional stress, random thoughts are removed."13 Awareness of breath helps manage these emotional disturbances and makes the prana flowing.

Yogasanas such as forward bends relaxes the nervous system, stimulate parasympathetic nervous system activity and therefore therapeutic for those with experiencing anxiety. Standing forward bends activate the pineal gland that releases melatonin and therefore regulates and rebalances the circadian rhythms, particularly sleeping cycles.

[11] MOKTTP005 P-13
[12] MOKTTPO16 P-12
[13] http://www.Yogapoint.com/articles/Breath_Yoga.htm

From a Yoga Teacher perspective, what are the key injury prevention techniques that you would apply in your Yoga Class?

I firmly believe that as a yoga teacher " having an adequate anatomy and physiology knowledge" and also having ability to apply this knowledge into a yoga class as well as self-education play a crucial role to prevent injuries.

- Feeling confidence as a yoga teacher and making feel student that also helps students to practice safely
- Asking their permission before adjustments also helps students to protect their body. Because a student may not be grounded during a pose therefore a little movement for adjustment cause a fall. After adjustments a yoga teacher should move slowly and ask students whether or not they can hold posture after adjustments
- Improve students awareness of their limitations
- Apply bandhas and breathing techniques
- Encourage students to use the breath during practice
- Create a proper sequence for poses
- Applying the principles of vinyasa krama with precise alignment in a yoga practice can reduce the risk of injury
- Warm up and limbering body is also significant because cold muscles, tendons and ligaments are vulnerable to injury
- Encourage students to wear appropriate clothing that allows for proper movement
- New students to Yoga are encouraged to attend a Beginners Yoga Course
- Referring students to a Yoga class according to their needs such as prenatal class or gentle class
- Gentle variations, props and modifications should be apply during practice
- Each new students must fill the health history form before practice
- Students should not be encouraged to push their body for poses and a yoga teacher should never create a competitive atmosphere in the class.
- A yoga teacher should has ability to observe students individually for proper adjustment during practice
- Verbal instructions must be so clear (not hesitation) and if a yoga teacher wants to demonstrate a pose he/she should be in a correct alignment for poses. Because, what students see is more affective than what they listen (mirror image)
- First aid is also important to step in for any emergency situation in a class atmosphere
- Encouraging students not to practice with full stomach and also hydrated well before practice
- Encourage body awareness and to teach students to listen to their body. If a student is experiencing pain or exhaustion while participating in yoga, they should move into Balasana to take a break. If pain during asana persists with cause they should encouraged to seek the advice health practitioner.[14]
- Before practicing inversions a gentle variation must be offered to the students

[14] MOKAP006 (P 12)

such as viparita karani, Moreover, observing students face, verbal instructions carry significant role as well as proper adjustments during inversions. For instance, a student's face indicates that whether or not this inversion is so difficult for her/him and if the student's face looks so painful, he/she should practice a gentle variation. Furthermore, space between students is also so important to practice inversions safely. Because, any sudden movements such as falling are likely to occur during inversions and other students may be injured. Therefore, enough space between students not only prevents any injury and also provides a safe atmosphere for teachers to adjust students properly.

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