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Flexibility Highways

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In my experiences, many of the dysfunctions, pains and musculoskeletal symptoms people possess result from muscle and joint tightness. These range of motion limitations lead to a chain reaction of compensations that cause overuse of muscle tissue and lack of use of the primary movers. Significant improvements occur after a series of thoughtful stretching.

Perhaps the most controversial component of fitness is flexibility. By definition, flexibility is the range of motion over a joint or series of joints. Yet, the primal thought of that definition neglects the effects of muscle tightness upon other muscular structures, and that flexibility takes on a new paradigm when joints and muscles move in three planes of motion. Therefore, our industry must think out of the box when approaching stretching programs and incorporate three-dimensional stretching of muscles through the sagittal, frontal, and transverse planes. Additionally, when stretching, a chain link relationship must exist from one muscle group to an adjacent muscle group when performing a biomechanically sound stretching program.

Tradition has reinforced flexibility of muscles to be usually single joint and single plane actions. A more functional approach is to incorporate multiple joints and planes into the Flexibility Highway stretch, as this is more conducive to human motion. For example, to functionally stretch the abdominals, it is important that the hip flexors be included into the stretch, as hip flexor flexibility will add to the motion of the abdominals and torso extension in the sagittal plane. When dynamic extension actions occur in the sagittal plane, the abdominals and hip flexors must be able to accommodate adequate excursion of these muscles to perform optimally in human motion. Interestingly, the chain reactions of adjacent extremities affect joints above and below the muscles desiring to be stretched. In this case, when the abdominals and hip flexors are being stretched from the standing position, it is important to have the same side heel on the ground and good range of motion in the same side calf group, because in gait and function, the Soleus and Gastrocnemius work synergistically to extend the knee in the sagittal plane and control rotation of the knee in the transverse plane respectively. The interplay of these adjacent muscles is just a minute example of the integrated relationship muscles have in human motion. Likewise, muscles responsible for the control of transverse plane actions should be stretch concurrently, as these muscles work synergistically to control the rotational action. If these muscles are stretched together, the stretching of the muscles and stimulation of the muscles' proprioceptors are enhanced through motions that are reminiscent of the action.

Additionally, when stretching the upper extremity (i.e., the shoulder joint), it is critical to understand what plane of motion the person is trying to increase in the shoulder. From a functional motion perspective, the hips play an integral part in shoulder action, thus need to be incorporated into the stretch as well. For example, when stretching the shoulder in the sagittal plane, it is important to stretch the same side hip in the sagittal plane. When the shoulder flexes, sufficient hip extension on the same side must accompany that movement to prevent overuse of the shoulder musculature. In the frontal plane, the hip abductors and adductors must have enough flexibility to enhance shoulder girdle and shoulder joint adduction/abduction. In the transverse plane, optimal shoulder external rotation is dependent upon the opposite hip internal rotators to be flexible as well as the same side hip external rotators. And with all shoulder motions, there must be adequate flexibility in the scapular action and parascapular muscles to allow movement of the scapula on the thoracic cage.

The Four Flexibility Highways

To expand upon the above concepts, I categorize flexibility programming into four "highways": the anterior, posterior, lateral, and 'cross-town'. The logic behind this is utilizing the chain reaction premise that muscles and joints are influenced by adjacent muscles and joints. In this sense, to improve range of motion, one must work from the ground up and integrate the musculature relationship along the respective highway. When thinking about the anatomy of each highway, consider the Myofascial attachments of one muscle and the adjacent muscles as interchanges on an interstate highway. When one muscle or "street" ends, it conjoins or "interchanges" with the next muscle or "street".

Anterior Flexibility Highway - The anterior flexibility highway runs from the south to the north or along the sagittal plane with flexion/extension movements occurring on this highway. The muscles of this highway begin at the dorsal surface of the foot with the toe extensors, interchange with the anterior compartment of the ankle and tibia. The next interchange north is the patellar tendon and quadriceps attachment northward to the hip flexors. To enhance function of both the quadriceps and hip flexors, it is important to lengthen both together. The hip flexors intersect with the abdominals that travel to the ribs, sternum and the sternochondral fascia and venture into the pectorals, anterior shoulder, and the sternocleidomastoid. From there, an angular detour takes our journey to the mastoid process of the skull and into the northernmost destination, the scalp fascia. To integrate a flexibility program, the client must allow the associated muscles along the anterior superhighway to extend. Following this concept, a case can be made that the range of motion in the southern section of the highway can affect the northern section. Further study of human motion enlightens us to analyze and understand the relationships that occur through chain reaction processes. Figure 1 below demonstrates the integrated stretching to enhance range of motion along the anterior aspect of the body.

Figure 1 - Anterior Flexibility Highway

Posterior Flexibility Highway - The posterior flexibility highway runs from the south to the north or along the sagittal plane with flexion/extension movements occurring on this highway. The muscles of this highway begin at the plantar surface of the foot from the toe flexors through the posterior compartment of the ankle meeting at the Achilles tendon. Through the posterior calf group (Gastrocnemius, Soleus, and posterior tibialis) northward, the knee interchange meets the hamstrings. Taking the "hamstring expressway" to the ischial tuberosity, the gluteals and hamstrings create a multi-directional exchange north-by-northwest (or northeast depending upon which "leg" of the highway you travel) to the sacrolumbar junction. Here the gluteals meet the erector spinae, in 'lumbar fascia junction', and head straight northward with many oblique interchanges of the spinal rotators along the way. It is important to note that the union of the gluteals and the erector spinae musculature should be stretched in an integrated fashion, as any functional lumbar movement pattern includes the gluteals and the relationship of these structures should be developed together. If the client wants to take a slight diversion through the rear shoulder group, a slight change of position and arm placement will include this area as well. Refer to Figure 2b below for this alternative route. The final posterior journey terminates at the scalp fascia. Figure 2a demonstrates the integrated stretching to enhance range of motion along the posterior aspect of the body.

Figure 2a - Posterior Flexibility Highway

Figure 2b - Posterior Flexibility Highway

Lateral Flexibility Highway - Commonly overlooked in function is the lateral highway or column. The lateral flexibility highway runs from the south to the north along the frontal plane with abduction/adduction movements occurring on this highway. Running from the lateral ankle and the peroneal group the lateral highway goes north to the lateral tibial condoyle and the iliotibial band. Moving upward from this taut structure, the ITB merges with the tensor fascia lata, the gluteus medius and minimus, and meeting with the gluteus maximus. When analyzing the multi-directional fibrous "routes" of the gluteals complex, a point can be made to include these sections of the highways with all superhighway stretching. The gluteals are the "command central" of our center of gravity, balance, and power. They are utilized in all functional movement patterns, thus are the "hub" of tri-plane movement patterns. Along the lateral flexibility highway, the lateral gluteals are adjacent to the quadratus lumborum and then the obliques. The obliques merge with the external and internal intercostals toward the anterior aspect and the latissimus dorsi in the posterior aspect. From this point north, the lats will meet up with the posterior rotator cuff. A bypass occurs at the junction of the latissimus dorsi and the trapezius group, whereby the journey northbound excursions through the trapezius group to the sternocleidomastoid. As Figure 3 demonstrates, stretching the lateral highway is necessary for enhancement of frontal plane movement patterns. For the optimal lateral stretch, think from the bottom up and let the hip move laterally as far as it can without undue strain.

Figure 3 - Lateral Flexibility Highway

Cross-town Flexibility Highway - The cross-town flexibility highway runs from the south to the north along the transverse plane with rotational movements occurring on this highway. This highway produces the most power, is the most functional in movements and essentially affects the other three highways. The Cross-town is the most complex of the highway system because all routes can junction off from each other. When analyzing movement patterns, nothing is truly in only one plane of motion. There is influence from one plane into the other two, yet often one plane is predominant. The interesting phenomenon of the cross-town highway system is at each joint a junction to one of the other highways occurs. In describing this section, I will venture into the main junctions (i.e., the pelvic, abdominal, and shoulder intersections).

From the navicular, cuneiform, and 2-4 metatarsals of plantar surface of the foot, the posterior tibialis enters upon the posterior compartment of the tibia. Also, the peroneus longus circles its wagons from the first metatarsal and medial cuneiform to the lateral fibular condyle and meets up with the biceps femoris. Additionally, the anterior tibialis from the first metatarsal comes around the bend to the lateral upper 2/3 of the tibia. Upward along the posterior tibia to the knee, the biceps femoris travels to the ischial tuberosity. The gluteals emanate in a tri-plane fashion and circle laterally to the gluteus medius and minimus and also the tensor fascia lata (TFL). Here the iliotibial band conjoins with the TFL. Interestingly, the peroneals meet the iliotibial band at the knee and create a distance relationship with the lateral hip complex (gluteals and TFL). From an opposite hip along the latissimus dorsi to the same side shoulder, the cross-town highway is heavily a factor in functional movements.

On the anterior aspect, emanating from the gluteus medius, minimus and TFL, the cross-town highway travels along the obliques, abdominals, and pectorals to the opposite shoulder. This relationship must be established to enhance motions for throwing athletes as they “come over the top” in the throwing motion, and golfers upon the post-contact phase and follow-through in the golf swing. In these examples, the abdominals lengthen to decelerate relative spinal extension of the torso in relation to the hip. To reduce risk of injury, these muscle structures should be integrated together in a functional stretch. Additionally, the abdominals are the conduit between the hips and shoulder in the anterior flexibility highway. From the clavicular aspect of the pectorals and shoulder, the sternocleidomastoid then ends the journey as it conjoins with the mastoid process of the skull.

Within the cross-town flexibility highway are smaller units of flexibility highways. The key routes are from the hips to the opposite shoulder on the anterior and posterior flexibility highways. Also, the gluteals and the opposite latissimus dorsi form a smaller unit of the cross-town flexibility highway. We must not forget the impact the lower extremities have upon the hips, back, and shoulders when integrating the flexibility highway stretches. It is very important to create the stretching relationship with these muscles groups to ensure the best and most functional highway connection for optimal performance.

Figure 4a - Cross-town Flexibility Highway

Figure 4b - Cross-town Flexibility Highway

X-Factor: *When the anatomy and fiber alignment of the gluteals is viewed, it is interesting to note the near parallel and continuous fiber highway of the opposite latissimus dorsi and gluteus maximus. I call this the posterior X-factor, and for this reason try to stretch these muscle groups together. For instance, when a right handed thrower decelerates the throwing motion, the left hip and gluteus maximus lengthen as well as the right latissimus dorsi and posterior shoulder. Another example is when a golfer takes their backswing; the opposite latissimus dorsi lengthens as well as the opposite gluteals. These muscles work in tandem to slow motion and therefore require to be stretched together in the cross-town highway, forming the X-Factor. For the anterior X-factor, I stretch the opposite hip flexor through the abdominals and obliques to the opposite shoulder. Therefore, I integrate those structures as these will be an enhancement for deceleration of functional movement patterns in the cross-town flexibility highway.*

The Hip Complex: *One of the main junctions of the highway system is the hip complex due to the many muscles that converge in this region. As the above discussion states, there has been mergers from the anterior, posterior, and lateral highways in and around the hip. When looking at human motion, one can identify one highway that takes a bypass or junction and becomes motion and a necessitated stretch on the cross-town highway. The hip complex is one of those major junctions that must be stretched in all three planes of motion.*

Putting It All Together

When joints become immobile and the accompanying musculature becomes shortened and tight, the proprioceptors become de-sensitized and dysfunction can ensue. Joints become limited in motion, other structures will compensate to achieve the desired action. Studying human motion develops a deep appreciation for the myriad of intricacies that result from the relationship joints and muscles have upon each other. The three-dimensional interaction that occurs from the ground up through the body has tremendous impact upon optimal health and performance.

Based upon the principles from the above discussion, controlled dynamic range of motion is useful for nearly all populations. The sedentary and deconditioned populations will benefit by movement patterns that will gradually lengthen muscle tissue through eccentric loading and simultaneously gaining strength. The client should move through the patterns gradually and increase range of motion with each repetition. By performing in this method, the person uses gravity, their body weight, body angles, moves in three planes of motion, and is able to improve activities of daily living. It is important to note none of these techniques are ballistic stretches, rather motions integrated into patterns that are task specific.

A formula for effective range of motion improvement starts with gross movement patterns, such as 5-10 minutes of low level walking, jogging, cycling, or other activities the client enjoys and can tolerate. This is followed by tri-planar movement patterns that are task specific, starting with abbreviated motions that resemble the desired activity and gradually increase in depth of the range of motion. This will allow the lengthening of muscles, sensitize the proprioceptors, and enhance a greater range of motion.

For the athletic population, the warm-up session should be task oriented to enhance tri-planar motions. With various movement patterns incorporating forward/backward, diagonal, rotational movements, lunges, jumps, and hops, a myriad of functional actions can enhance flexibility and not only increase range of motion, but prepare the athlete for participation and reduce risk of injury.

After the workout session or event, it is advisable to then work on flexibility to lengthen muscles back to their resting state. I suggest holding the static stretch for 20-30 seconds and do each stretch twice. When doing static stretching, it should be multi-joint, multi-planar, utilizing multiple muscle groups. With this approach, the individual readies themselves for multi-dimensional motions for a lifetime.

The excitement of studying the integrated motions and the relationship of joints to one another can provide the health and fitness professional an entirely new perspective on effective exercise programs. Just as important is the need for integrated flexibility programs to enhance the quality of life for all.

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