Editorial

Importance of Considering Myofascial Force Transmission in Musculoskeletal Surgeries

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Introduction

Research related to the human fascia recently started to pay attention on the contribution of myofascial force transmission to the biomechanics of human movements followed by surgical conditions (1,2). Human fascia, and its effects on the myofascial force transmission have major implications on remedial surgeries for musculoskeletal disorders (2). The myofascial force transmission from the myofascial-skeletal system regulates the biomechanics of the human movement via the deep and superficial muscular fascia which serves as the element of connection between the different muscle groups in the body. In this context, when the contractile harmony in the myofascial continuity is disrupted as a result of surgical separation of muscles, movement compensations and altered motor patterns affect the normal biomechanics of the joint, ligaments and other soft tissue structures. In the long run, any such altered myofascial force distribution may lead to a pathological stress or overload to the joints and possibly may cause recurrence of joint pathologies or even affect the outcomes of the musculoskeletal surgeries. In this editorial, myofascial force transmission and its mechanical effects are presented with regard to the implications of musculoskeletal surgeries. Two schools of thoughts on the myofacial continuity such as ‘anatomy train’ and ‘integrated Myofascial-skeletal model’ is presented to relate the myofascial force transmission and its impact on surgical science and vice versa.

Myofascial force transmission

Fascia is a form of connective tissue which acts as force transmitters and regulates human posture and movements (3). Any separation of the muscle fibres and fascial continuity due to any surgical procedures may affect the myofascial force transmission and vice versa. Myofascial force transmission is the transmission of muscle force through a continuous cellular matrix of the endoymysial facial stroma of the muscle (4). Myofascial force transmission occurs via intramuscular through endomysial-perimysial network and via the epimysium pathways (4). Epimuscular myofascial force transmission occurs in two ways namely intermuscular and extramuscular pathways. Intermuscular myofascial force transmission occurs through the connective tissues at the interface between the muscle bellies of adjacent muscles. Extramuscular force transmission occurs between the epimysium of a muscle and an adjacent nonmuscular structure such as matrix supporting nerves and blood vessels, and fascia layers, which can connect the borders of the agonistic muscle to the antagonistic and synergistic fibre. Thus the myofascial force is transmitted between the target muscle and neighboring muscles and /or extramuscular tissues. In neuromusculoskeletal system regulating movements, a single muscle is enclosed by epimysium, group of muscle fibres by perimysium and each single muscle fibre is surrounded by endomysium via a continuous layering system which collectively governs the normal muscle activity and functional movements. Thus, followed by any surgical procedures, human fascia has the ability of accommodating to the creep and stress over a period of time as a result of myofascial transmission and it may influence the musculoskeletal dynamics. Thus, when the muscle fibres get separated as a result of surgical procedures, the connective tissue linkages and the myofacial force transmission get altered due to changes in the mechanotransduction and mechanosensitive system of myofascial tissues.

Mechanical effects of myofascial force transmission

The serious implications of the myofascial force transmission on the outcomes of the musculoskeletal remedial surgeries can be understood through the mechanical effects of myofascial force transmission (2). There is evidence that the myofascial force transmission from an agonist muscle can transmit to the antagonist and synergist muscles or passive tissues that cross the joint, thereby exerting major moment across the joints. The force exerted from the myofascial system can cause the movement limitation on the distal tendons of the synergistic muscles (2). For example, a proximally directed myofascial load is integrated into the force exerted at the distal tendons, but not at the proximal tendon. It is also to be noted that the distal lengthening of the muscles may particularly enhance the proximal loading of the muscles via the endomuscular and perimuscular myofascial force transmission. Thus, in some surgical conditions such as tendon repair, tendinoplasty and tendon transfer, the effects of myofascial force transmission may even determine the surgical outcomes in the longer run if the myofascial force is altered. Empirical evidence exists that the uneven myofascial load may contribute to the recurrence of the disorders in case of abnormal myofascial force transmission. However, there is paucity of research on the long-term effects of myofascial force transmission on the outcomes of the above stated surgical conditions. Any such research on the fascial contribution to the musculoskeletal surgical outcomes and musculoskeletal dynamics is most warranted.

Anatomical trains and myofascial force transmission

The knowledge obtained from the dissection of human functional anatomy leads to a new concept of "Anatomical Trains" and its contribution to human biomechanics (5). As per the concept of anatomy trains in relation to human movement science and biomechanics, the muscles from the head and toe are interconnected as one unit through the myofascial-skeletal system. Thomas Myer's myofascial train concept presents myofascial connections that cross the entire body serve as a link from the head to the toes (5). One such example of holistic myofascial continuity in the human body is the back superficial myofascial line. As per Myer, the superficial back line starts at foot from plantar fascia ascends up to the body via its fascial continuity with gastrocnemius/Achilles tendon, which further ascend up to the gluteus maximus and sacrotuberous ligament via the hamstring myofascial track. Thus, the superficial back line from lumbopelvic region, it travels up by merging fibres to the posterior layer of thoracolumbar fascia, from where fibres cross to contralateral latissimus dorsi and upper trapezius. The superficial back line ends up finally connecting galea aponeurotica via the splenius myofascial connections ending the journey from foot to head. Any disruption in this myofascial continuity may alter the myofasical force transmission and may contribute to various musculoskeletal disorders such as cervicogenic headache, thoracic outlet syndrome, low back pain, sacroiliac joint pain, hamstring strain, Achilles tendonitis or even disorders which fall on the pathway of superficial back line. Therefore, any compensation in movement patterns or any altered motor patters should be studied carefully followed by any surgical procedures involving any of the muscles in the superficial back line. Thomas Myer concept of anatomy trains can be studied further for the understanding on the other myofascial lines in our human body and their contributions to different movements in our body.

Integrated Myo-fascial-skeletal model

Stecco proposed an integrated biomechanical model that provides a logical map of body regions that are related to functional movements and describes mechanism for transmission of tension based on the myofascial sequences (6). According to this model, a single myofascial sequence is said to synchronize the movement of several segments in one direction on one place, while sequences on the same spatial plane may be considered as reciprocal antagonists (6). An interesting example for this myofascial-skeletal model is the effect of lumbopelvic disorders on the surgical outcomes of contralateral glenohumeral joint. The hip-sacroiliac-lumbar-thorax-shoulder myofascial sequence formed by the myofascial continuity between the ipsilateral hip joint and contralateral glenohumeral joint is discussed here to explain the model briefly. The hip-sacroiliac-lumbar-thorax-shoulder sequence is formed by the fibres of the gluteus maximus originating of greater trochanter of the femur which runs medially to have attachment at the sacrotuberous ligament and thoracolumbar fascia. The fibres of the gluteus maximus thus cross the mid line of the trunk together with thoracolumbar fascia and extend connectivity to the latissimus dorsi, which has its insertion on the contralateral side of the glenohumeral joint. Thus, any alteration of myofascial force transmission due to lumbopelvic disorders may possibly influence the surgical outcomes of the glenohumeral joint and vice versa. As research on facial anatomy gaining popularity, research studies that are designed to put the motor control and fascia to explore the myofascial-skeletal system linking hip-sacroiliac-lumbar-thorax-shoulder sequence are recommended.

Conclusion

In summary, this editorial relates the consequences on the human facial system from surgical perspectives and vice versa by presenting a concept of myofascial force transmission. The importance of considering the myofascial force in the post surgical rehabilitation of movement and function is emphasized. As myofascial force transmission is not considered commonly from surgical, it is hoped that this editorial adds new knowledge towards considering the concept of myofascial force transmission for the successful and rehabilitation of musculoskeletal surgeries.

References

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