

THE BIOMECHANICS OF ŚĪRṢĀSANA

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Anyone who has done *śīrṣāsana* will know that the area of the greatest strain is the neck. For in this posture, the neck takes on the load of the body which is many times more than its normal load—the head. This load is the greatest when one is getting into the posture. To stay still when in *śīrṣāsana* without sway or movement requires perfect balance. When this is not possible the effort made to stay in balance causes considerable strain to the neck.

We have taken the help of one who is at home, both with yoga and with biomedical engineering to discuss the biomechanics of *śīrṣāsana* with special focus on the role of the neck.

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A lot has been written and debated about *śīrṣāsana* and it is surprising that it continues to fascinate and offer itself for exploration. One of the most interesting things about this *āsana* is that it seems so simple; just standing on one's head! Yet it is called the King of *āsana*-s and epitomises the idea of yoga itself. In *dhyāna* one turns one's self inside out and in *śīrṣāsana* one goes upside down!

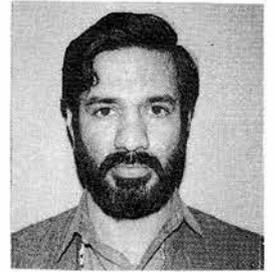
The body is composed of bones, soft internal tissue and muscle. The bones provide the structure to the body. But this is not a rigid monoblock. There are a number of bones linked through joints. Muscles attached to the bones (on either side of the bones) connect the bones together and create the ability of the parts of the body to flex and extend. Ligaments give the joints stability. A posture is maintained through the dynamic balance between many opposing groups of muscles.

When a person stands straight, he does not stand still! He actually sways forward and back very slightly! This is because the muscles that flex and extend the legs, ankles, back, head and neck are in dynamic balance. This

balance is finely tuned across a number of joints.

The backbone in particular is composed of several small bones. The person standing is, therefore, like a chain held straight by a set of symmetrical, well balanced rubber bands which are strapped diametrically across it. Good posture is developed over many years of practice. If over the years there is, due to wrong techniques, an asymmetrical development of these muscles, it shows up as bad posture. Also to achieve this erect posture and the considerably effortful activities of walking, running and jumping, the muscles of the legs and torso need to be very strong. The backbones of the lumbar area are very thick, and the lower back is strongly muscled. The neck however, is designed only to hold the head. Therefore it is much less strongly muscled than the other parts of the body.

The entire effort of balancing on one's head therefore requires a lot of re-learning by the muscles of the body. The legs which carry the body and provide stability, are up in the air and the neck and shoulders take the strain of carrying the much heavier torso and legs.



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The two factors—the blood rushing to the head (not the brain) and the practice of getting the neck and shoulders to balance the body, need preparation. To stay in *śīrṣāsana* is easier than getting into the posture and out of it. Both these processes, put a great strain on the neck and shoulder. Within a few seconds the body and legs must be lifted off the ground, swung into position and stabilised. For this period of time, the effort on the neck and shoulder muscles is very great, particularly because the head is not a flat clear base like the feet.

Though this movement is small, the biomechanical effort required is very great. Considering only the weight of the legs, this movement implies 720 Kg-cms of moment to be balanced and overcome by the neck and shoulders.

'Moment' refers to the force required to rotate an object about an axis. As can be seen from the illustration, the legs have to be rotated about the hip and the effort to achieve this has to be made from the hip.

This force will be transmitted all along the torso with the neck bearing a significant portion of the effort.

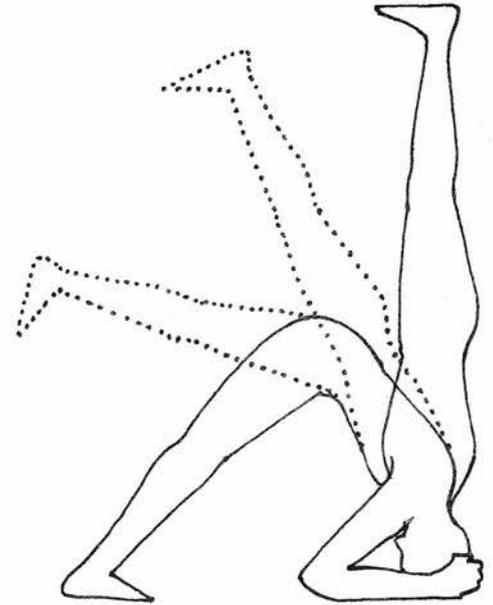
[The figure of 720 kg-cm of moment is arrived at using specifications relating to a standard individual as is normally done in biomedical engineering calculations. The weight of the person was assumed to be 65 kgs.]

The neck normally carries the head balanced exactly over its neck bones—i.e. head movements normally imply overcoming a very small inertial resistance.

The difference between the two efforts required is considerable. Therefore, the way the neck and shoulder are prepared becomes crucial to the success of the posture.

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the stage of *śīrṣāsana* where there is the greatest strain on the neck

To summarise, three major changes occur in the body when *śīrṣāsana* is performed—inversion of blood flow patterns, new dynamics of balance and the great load on the neck when putting the body into (and helping it out of) the posture.

It is vitally important that a person should be tested for his ability to undergo these changes and the corresponding strain and is led to the practice of *śīrṣāsana* through careful preparation.

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