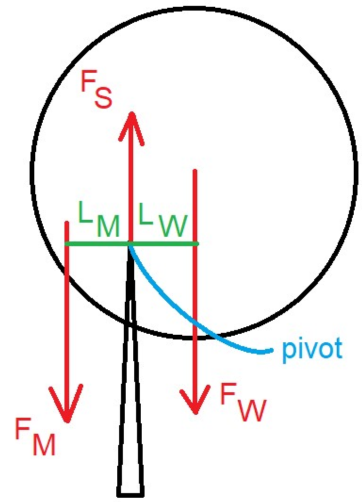
9-32)

Since the head is motionless, we need to meet the conditions for equilibrium, and in this case, it looks like the torque condition is sufficient. If it's not, we'll find out. In a case like this one, we can choose the pivot for convenience, since the torque must be zero about any pivot. I choose the point of support at the top of the spine (S), mostly because I neither know nor want to know the force applied there. As usual, we'll make some assumptions, such as that the neck muscles (M) in the back pull straight downward and that the other muscles are relaxed and exert no forces. A weight (W) of 50 N is about average for adults.



Then,

$$\sum_n \tau_n = +r_M F_M \sin(\varphi) + (0) F_S \sin(?) - r_W F_W \sin(\theta) = 0.$$

Now, we don't know either the distance from the pivot to the center of mass of the head or the angle theta. We do however know the lever arm for that force, 2.50 cm, which is the product of r_W and $\sin(\theta)$. The same goes for the muscle force. Now we have that

$$+l_M F_M (1) - l_W F_W = 0.$$

PID

$$l_M F_M = l_W F_W$$

$$F_M = \frac{l_W F_W}{l_M} = \frac{0.025 \times 50}{0.05} = 25\ \mathrm{N}\ .$$