

The subject carries out this test without having visual control over it. When the positioning has been checked, the spring is put under tension with the lever and deflected to the right or the left by a tester. On each side, the ball is moved twice in each direction, always beginning with the dominant side. The order in which deflection takes place is decided by the person supervising the test. The data are recorded using the Next View programme.

The test needs to be carried out by two persons, as one is required to operate the computer while the other operates the lever for deflection. To ensure that the subject cannot prepare for the moment at which the deflection takes place, it is essential that the two testers communicate the point at which the lever is moved by using hand signals.

Description and implementation of the pulley test

The pulley test is to establish, how well subjects are able to dose their strength during a sequence of movements.

In this test design, the subject stands with his back to the pulley. Feet are placed in a parallel position at hip width on the floor markings. The 150 cm high box allows the weight distribution to be the same for the preliminary and follow-up tests in that the subject lightly touches the box with the dorsal vertebrae.

The subject's weight should not be carried by the box. The wheels were set at the highest level as all subjects were tall and could consequently reach this height. The pulley used for this investigation has a six-fold transmission. The sensor, turning potentiometer, is mounted on the upper wheel, as this point marks the longest distance of rope. The potentiometer is operated at 5V and the data were recorded on the Next View programme.



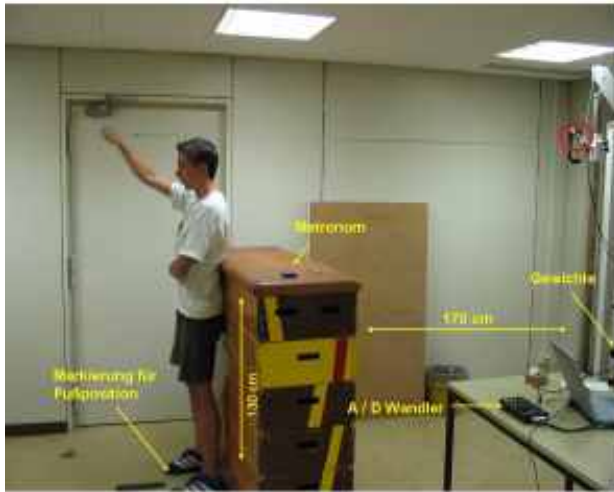


Figure 11: Set-up for pulley test

The weight, which is added in the course of the movement is attached to the basic weight with loops of 20cm length. The basic weight is 15kg, to which additional weights of 10kg or 15kg are added. This is implemented by placing the loops on the pole with the threading mechanism.



Figure 12: Mechanism with loops for adding weights

The movement begins at an elevation of 180° and ends at an elevation of 90° . This movement is to be carried out at a constant pace. A metronome, playing at 48 beats per minute, was used to ensure a regular pace. Once the subject is in the starting position, three trial runs are carried out so that he or she can keep the rhythm and the exact range of movement can be maintained. Once the subject

moves to the rhythm of the metronome, a weight is added. Depending on the decision of the tester, this happens after a minimum of 5 and a maximum of 10 repetitions. The dominant arm is tested first. Before any weights are added, the tester must make sure that the subject maintains the rhythms throughout the experiment and completes the full range of movements. The experiment was carried out in an environment where the subject could concentrate fully on the rhythm and on moving as directed.



Figure 13: Starting and finishing positions during the experiment

Description and implementation of punching mask test

This test, designed specifically for this study, uses a punching mask to research the sense of position.

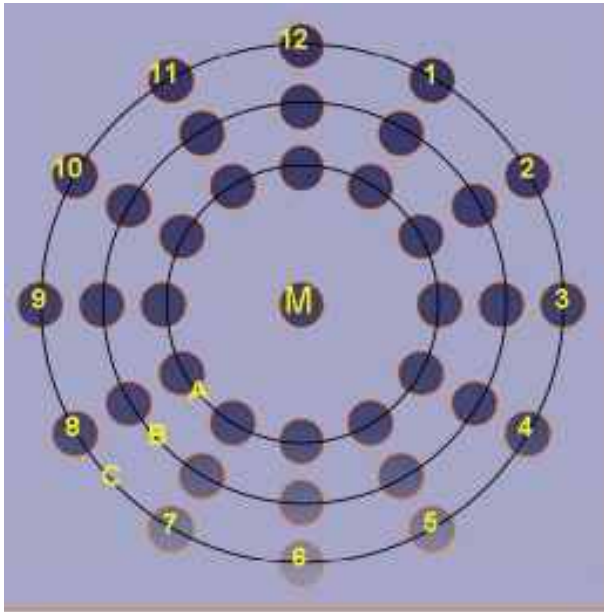


Figure 14: Diagram of the punching mask

The holes in the mask are arranged like the numbers on the dial of a watch. In order to achieve different levels of difficulty, three circles with different diameters were embossed on the material. The inner circle has a radius of 9cm, the middle one 13cm and the outer one 17 cm. The punching mask is mounted on a stand, the height of which is easily adjustable.

The subject's arm length is measured, in order to establish the angle in the shoulder joint for the individual positions.

The subject's shoulder axis is in perpendicular position to the punching mask. The mask is positioned in such a way as to allow the subject to touch the centre of the circles with a stretched arm at an angle of 90° to the torso. When positioning the subject, it is important to ensure that the arm which is being tested is able to carry out a deflective movement. The subject needs to stand in a firm position throughout the duration of the experiment. In order to reconstruct the subject's position for follow-up tests, the height of the centre of the punching mask and the distance of the foot from the stand are noted. Prior to running the experiment, the subject is given a pair of glasses to avoid any visual control.



Figure 15: Starting position for punching mask experiment

Massband = measuring tape

The subject's arm is moved along the three concentric circles and he or she is told in where on the circle the pointer finger is to give some orientation help for the test to follow.

During the experiment, the subject's arm is moved and a finger placed on one of the holes. He or she must then describe the position of the hole as it would related to a clock face and describe on which of the three circles this lies. The tester must ensure that the subject is not asked to point to holes which are above or next to each other. The subject needs to maintain the starting position, especially the position of the shoulder axis to the mask. Five trials are run for each arm. Neither during nor after these is any information provided as to the accuracy of the subject's movements.

Description and implementation of the isokinetic test

The strength diagnosis was carried out with the training apparatus Cybex Norm. The data required for the parameters tested were recorded with the dynamometer. The different parameters, for example the torque or the average attainment can then be represented and documented.



Figure 16: Isokinet apparatus

As advised by the manufacturer, the test was carried out with a starting position of 90° deflection and the elbow flexed at 90° . The range of movement was limited to 50° internal rotation and 50° external rotation. (see (Wang, Macarlande, Cochrane, 2000)). This range allows for optimal use of force.

The test was carried out at a speed of $60^\circ/\text{sec}$ and $180^\circ/\text{sec}$, the speed being set and directed via the recording mechanism. The movement started with a 50° external rotation and the repetitions also ended in this position.



Figure 17: Range of movement on Isokinet

After getting into the correct position, the subjects were able to warm up at the apparatus (set at $120^\circ/\text{sec}$) and familiarize themselves with its characteristics. The test was run immediately after the warm-up. At 60° , five repetitions were run, at $180^\circ/\text{sec}$ there were 20.

The test began at a speed $60^\circ/\text{sec}$. Internal and external rotations were measured within the same sequence of movement. After a break of 90 seconds, the test was continued at $180^\circ/\text{sec}$. The dominant side was tested first; before the non-dominant side was investigated, the apparatus needed to be rearranged. The test was always carried out by the same person