

Flexi-Bar part 3

Description of the clinical investigation

In order to gain a thorough picture of the clinical state of the subject's shoulder, a physiotherapist carried out six manual tests. The physiotherapist completed the same procedure during the preliminary and follow-up tests.

The following tests were carried out:

- Infrapinatus/Teres minor test



- Lift-off test



- Jergason-test (long biceps tendon)



- Painful arc



- Stability test



- Apprehension test



Design of the questionnaire

The design of the questionnaire was based on that developed by Professor Immhoff (see appendix). The first part deals with antropometric data, such as body size and weight, while the second part addresses training age, frequency of training, availability of a balance sport and other regularly practised sports. The questions are open-ended. The third section of the questionnaire deals with any form of pain and how this may influence the training, or whether they may be exacerbated by training. The questionnaire covers the subjective opinion on changes brought about in the shoulder area after training. The subjects choose from a range of pre-formulated answers, as this allows for easier evaluation. Results from the questionnaire are included in the test outcomes in order to check whether the objective results obtained through the measuring processes described above agree with the statements made by the subjects.

Evaluation of results

As mentioned earlier, the three tests were developed specifically for this investigation. It was important to find a way of analysing the data which had been generated in a rapid and meaningful way. The evaluation of the ball test and the pulley test was carried out with a Matlab 6.1 programmed script. For evaluating the punching mask test, Microsoft Excel 2003 was used. Following on from this, statistical analysis was completed applying the programme SP33 12.0. The data for the ball test, pulley test, punching mask and isokinet were calculated with the Wilcoxon test. Results with $p \leq 0.05$ were considered significant.

Evaluation of the ball test

The data for this revealed two parameters; on the one hand note was taken of the time required to regulate the deflection of the ball. On the other hand, the difference in angles between the starting and final position was recorded.

Data recorded were evaluated as follows: the maximum possible deflection of 32 °was set at 100%. The start of the deflection was set at 70%, i.e. 22.4°. The offset was calculated for the values in order to present them graphically.

The regularisation of the deflection is considered complete, once 500 of the current measurements are below the threshold of 20% at a scanning rate of 1000Hz. Within 0.5 seconds the sensor should not register any movement larger than 6.4 ° (equivalent to 20%) By analysing these data, it is possible to establish precisely how rapidly the subject reacts to an interference in the position. As the regularisation cannot take place to the value of one degree exactly, the threshold is set at 20%.

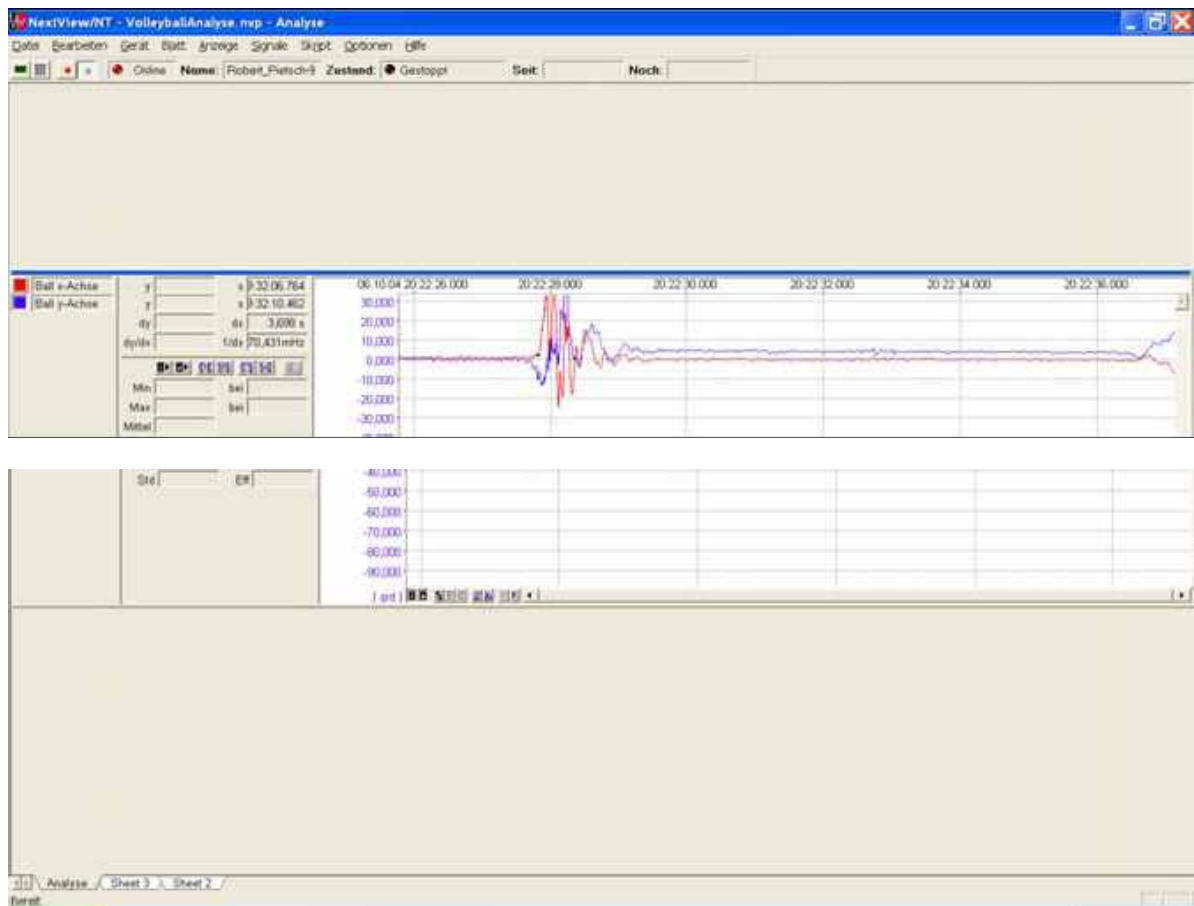


Figure 18: Screenshot balltest Next View

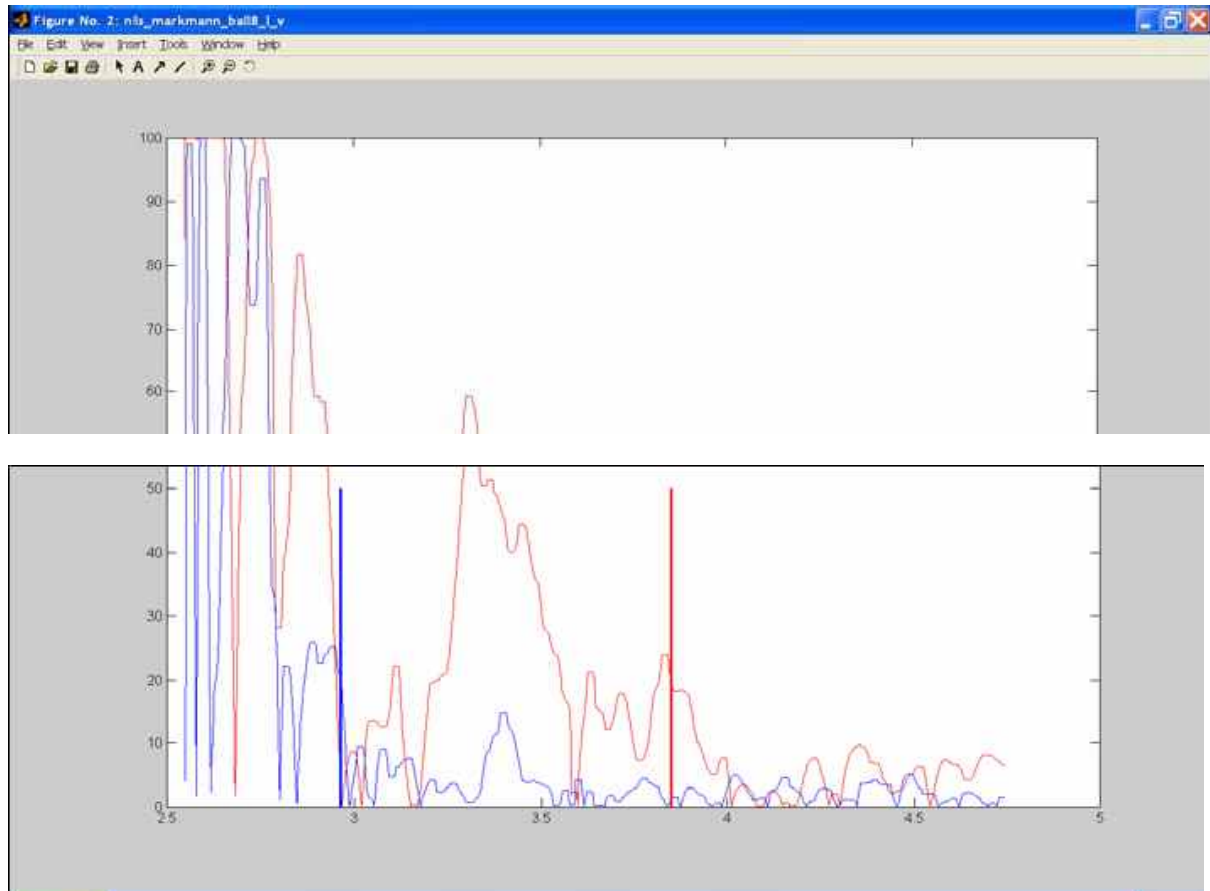


Figure 19: Screenshot evaluation of balltest, Matlab

By creating the offset, it is possible to reconstruct to what extent the end position of the subject differs from the initial position. These data needed to be further scrutinize in Excel in order to define the distance between the subject's position to the centre of the joint on the test apparatus. As this point does not move on one level, but along a semi-circle, the results in Excel were calculated with the formula $\phi d = \arcsin \sqrt{\sin^2 \phi x + \sin^2 \phi y}$. This angle provides information as to the subject's ability to find his or her original position after a disruption

Results of the ball test

In the case of the flexi-bar group the results of this test do not allow us to draw statistical inferences, as data from preliminary and follow-up tests are only available for five subjects. Therefore a descriptive method and analysis of single cases is used for following up the flexi-bar group.

Two of three groups showed improved results. The group which had trained with the thera-band showed a minor deterioration. This is only at 2.6% and not to be regarded as significant ($p=0.594$).

The group which underwent normal preparation, time taken to regularize the deflection went down by 11.6%. Despite this improvement, the difference in results is not significant ($p=0.173$)

The results of the flexi-bar group, as represented graphically show an improvement of merely 5%. However, it is not really possible to compare these results with those of the other test groups, as only six subjects were tested initially and nine attended the follow-up test.

There are only five subjects for whom results of all three tests are available. At the initial test, these players took, on average 1.0103 seconds \pm 0.236 to regularize the deflection, during the follow-up the results were, on average only 0.7159 seconds \pm 0.246 at $N=5$. This would represent an improvement of 29.1%. With a total of 20 tests carried out on the dominant side of the five subjects, only one attempt on the dominant side showed a decline. The greatest improvement, after calculating an average result of the four tests for one person (dominant side), lies at 0.34 seconds for subject number 27.

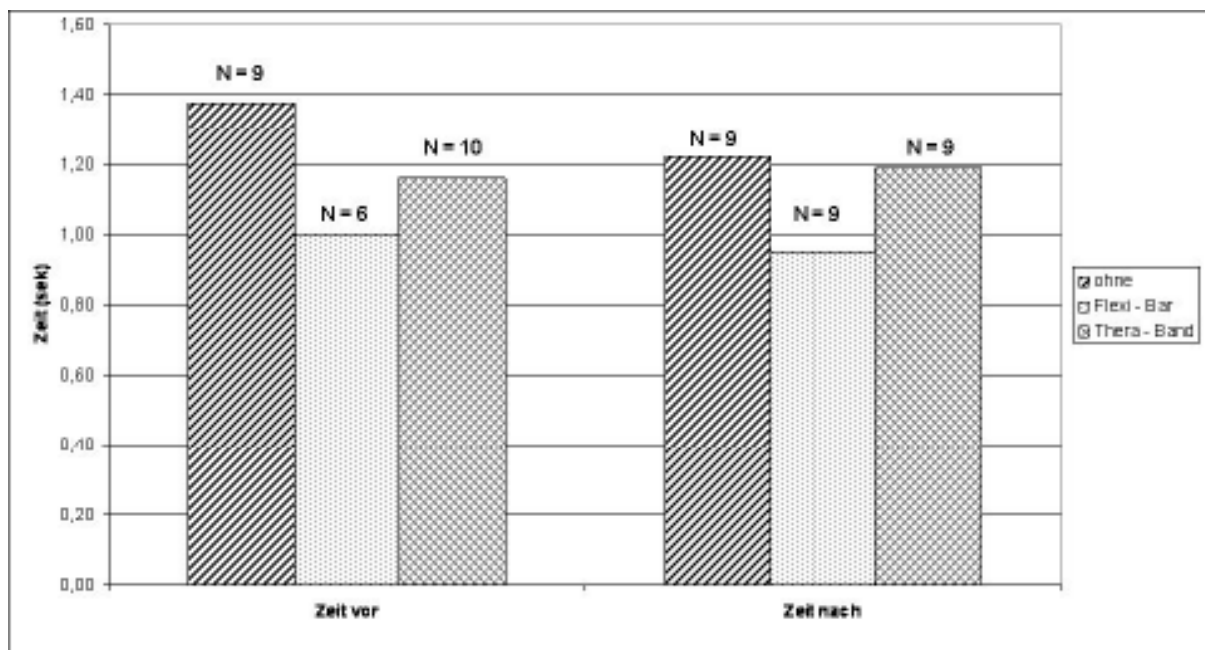


Figure 20: Average values for regulatory time, dominant side

Zeit = time

vor = before

nach = after

ohne = without

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Figure 21: Individual cases of regulatory time on dominant side

On the non-dominant side, results are similar to those on the dominant side. Improvements for the group which trained normally amount to 10.7%; again, this is not a significant difference ($p=0.173$). The thera-band group showed a deterioration of 27.4%, but this, too, cannot be considered significant ($p=0.767$). For the flexi-bar group (with varying numbers of subjects) an improvement of 15.2% was noted.

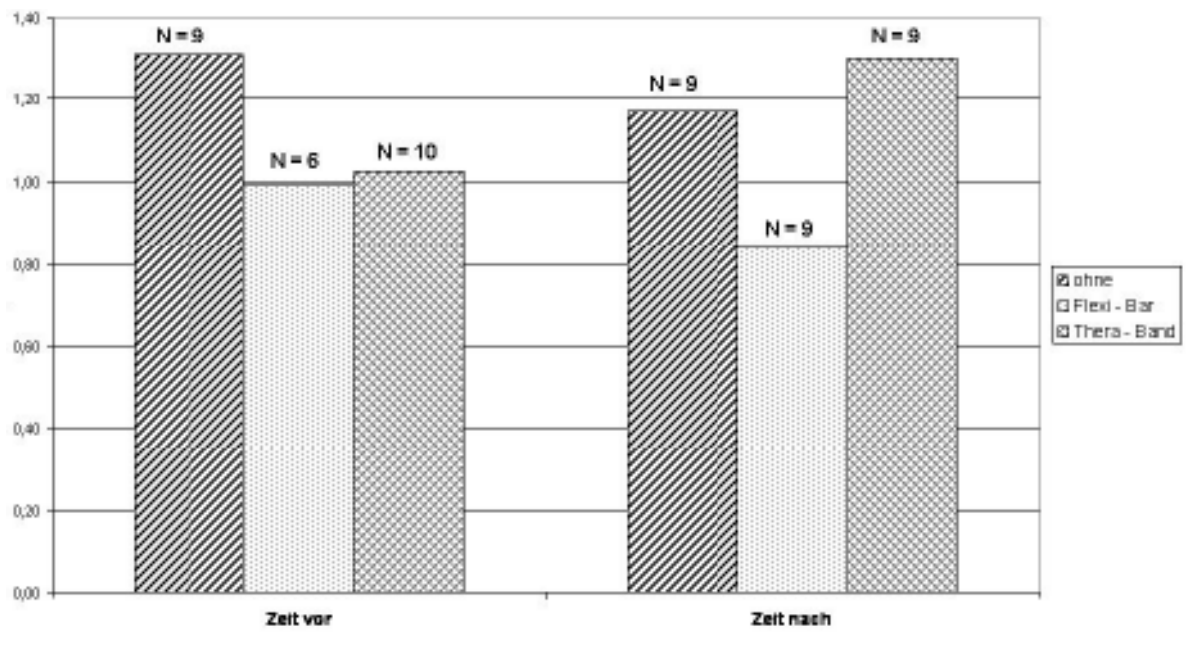


Figure 22: Average values for regulatory time, non-dominant side

Zeit = time

vor = before

nach = after

ohne = without

Looking at the five players, for whom all the results are available, an improvement of 23.6% is apparent.

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Figure 23: Regulatory time on non-dominant side

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