

Offprint from:  
Orthopädie Technik  
8/2005 –  
Published by  
Orthopädie Technik,  
Dortmund

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## The effect of a knee support in osteoarthritis

The aim of this study was to determine the effects produced by the application of a knee support on range of motion, pain and physical activity. The patients were also questioned about their subjective opinion on the efficiency of the support by means of a standardised questionnaire.

### Introduction

According to an estimate by the German Federal Statistical Office, around 20 percent of the German population will be affected by arthritis by the year 2010 [9]. In pathogenetic respects, osteoarthritis of the knee is a multifactorial process in which mechanical, traumatic, hormonal, genetic and molecular biological factors all play important roles.

In addition to physiotherapy and drug treatment (e.g. NSAIDs or glucocorticoids), supports are also used in the treatment of osteoarthritis of the knee [7]. Supports are particularly important because the impairment of proprioception plays an important role in the pathogenetic process. Thus, the modified gait frequently seen in osteoarthritis of the knee is,

of itself, already an indication of problems with proprioceptive performance.

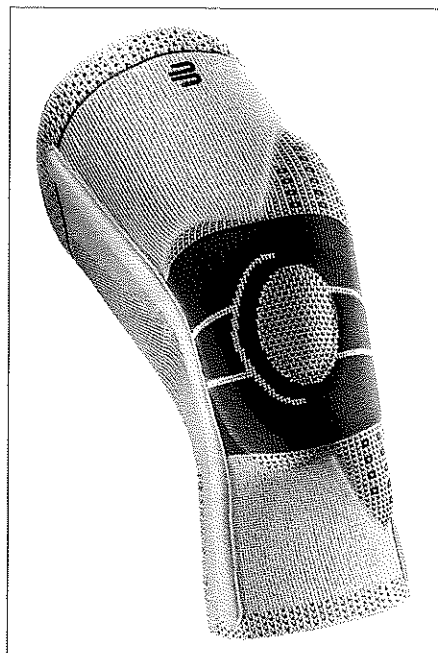
Experimental studies have shown that the loss of deep sensation caused by restricted proprioception leads to degenerative changes in the articular chondrocytes [3]. This, in turn, promotes the development of osteoarthritis of the knee. Kirkley et al. have investigated the effect of knee supports in 119 patients with osteoarthritis of the knee over an observation period of six months.

Using standardised questionnaires [WOMAC (Western Ontario and McMaster University Osteoarthritis Index) and MACTAR (McMaster-Toronto Arthritis Patient Preference Disability Questionnaire)] and walking and stair-climbing tests, they found a statistically significant reduction in pain and an improvement in the function of the arthritically damaged knee [4].

In another study by Jerosch et al. [5], 17 patients with osteoarthritis of the knee were investigated by means of an angle reproduction test. The knee support produced a significant improvement in angle reproducibility [6]. Sell et al. likewise reported an improvement in proprioceptive performance in 48 patients with chronic rheumatoid arthritis [8]. A study by Berry et al. showed that the wearing of a knee support by 170 patients produced a marked reduction in pain [2].

### Material and methods

A total of 39 patients with symptomatic osteoarthritis of the knee, grades 1-3 (in the radiological classification according to Kellgren), and with an average age



*GenuTrain® A3 – The active support for complex treatment of knee pain.*

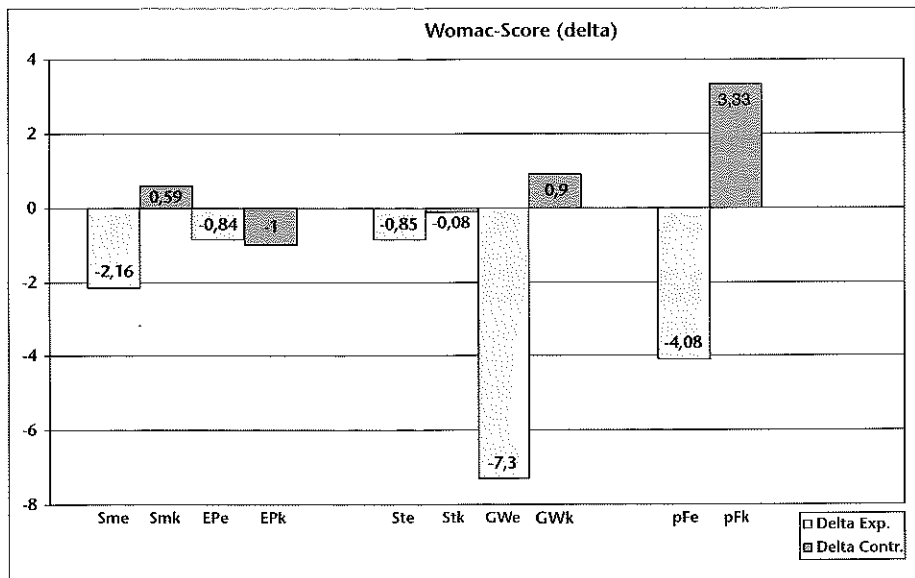


Fig. 1 Comparison of differences in the Womac score for „pain“ (Sm), „serious problems“ (EP), „stiffness“ (St), „overall Womac score“ (GW) and „physical function“ (pF) between the initial and final examinations in the experimental group (e) and control group (k) during the six-week observation period.

of 62 years took part in this study. One group (n = 19 subjects) was fitted with the GenuTrain A3 active support manufactured by the company Bauerfeind (Zeulenroda, Germany) over the six-week observation period, while the other group (n = 20 subjects) did not wear a support and served as the control group.

## Study procedure

In the pre-post study design, the clinical knee examination findings, pain-free walking distance (by

means of a patient questionnaire), subjective pain and, using a variety of standardised questionnaires, numerous knee-related parameters were determined before and after a six-week therapeutic intervention in both the experimental (with support) and control (without support) groups.

A pain diary was used to determine rest pain, nocturnal pain and exertion pain. The subjective pain score at rest, at night and during exertion was assessed at weekly intervals using a visual analog scale (VAS).

The standardised questionnaires included the Womac index, the SF-36 questionnaire and a questionnaire rating the performance of the support on a scale from 1 = very good to 6 = very poor.

## Results

A marked improvement was observed for the pain-free walking distance between the initial and final examination in the experimental group (Exp) compared to the control group (Con) (657.7 vs. 271.4 metres).

### Womac score

The comparison of the differences between the initial and final examinations over the course of the six-week observation period showed a better result in the support wearers for the parameters of pain, stiffness, overall Womac score and physical function (the higher the score for the individual parameters, the more pronounced the osteoarthritis of the knee) compared to the test situation without a support. The results for the parameter of „serious problems“ were roughly in the same range (Fig. 1).

### SF-36 score

The comparison of the differences between the initial and final examinations over the course of the six-week observation period showed better scores (a higher score indicates a better health-related quality of life) for all parameters of the SF-36 score (social functioning, physical functioning, vitality, mental health, general health perception, general medical health, pain, emotional limitation and comparison with the previous year) compared to the test situation without a support (Fig. 2).

### Pain diary

The comparison of the differences between the initial and final examinations over the course of the six-week observation period showed a better result for the support wearers in the evaluation of nocturnal pain, resting pain and exertion pain compared to the test situation without a support (Fig. 3).

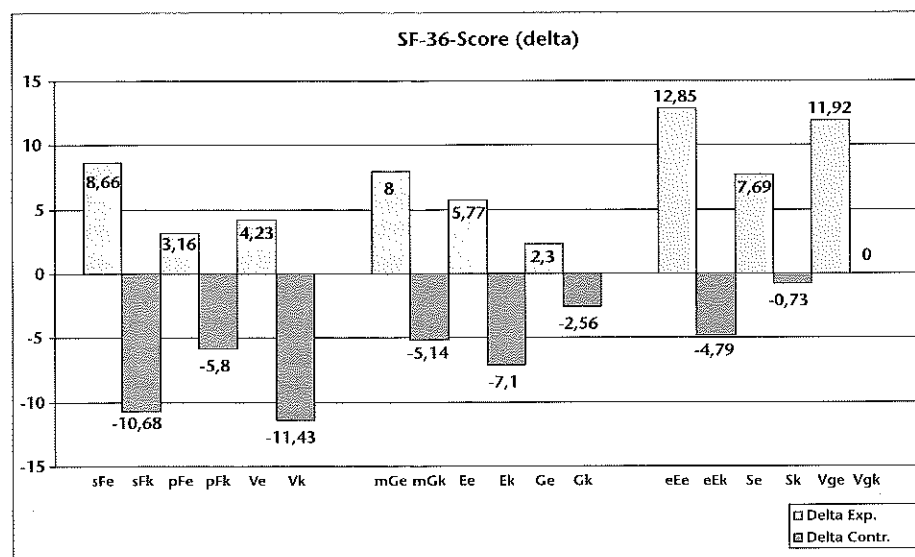


Fig. 2 Comparison of the differences in the SF-36 score for „social functioning“ (SF), „physical functioning“ (pF), „vitality“ (V), „mental health“ (mG), „general health perception“ (E), „general medical health“ (G), „emotional limitation“ (eE), „pain“ (S) and „comparison with the previous year“ (Vg) between the initial and final examinations in the experimental (e) and control (k) groups during the six-week observation period.

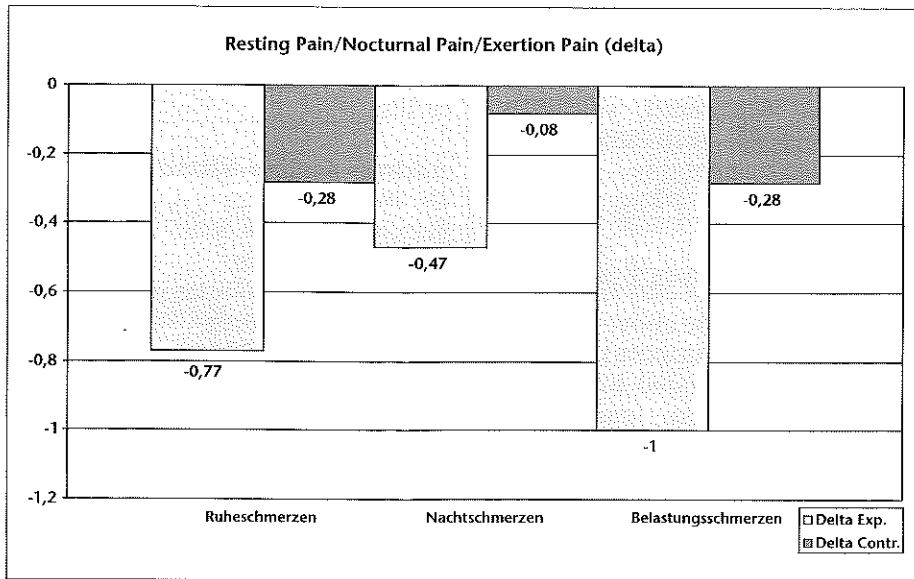


Fig. 3 Comparison of the differences in the categories of „resting pain“, „nocturnal pain“ and „exertion pain“ between the initial and final examinations in the experimental and control groups during the six-week observation period

## Gait, swelling, knee effusion and tenderness

The categories of flowing and limping were used as parameters for evaluating the gait. Overall, the gait remained almost identical in both the experimental and control groups over the six-week observation period (Exp/Con: improvement 7.7 / 7.1 percent, constant 92.3 / 85.8 percent, deterioration 0 / 7.1 percent).

The circumference measured over the centre of the patella was used as the parameter for evaluating swelling of the knee. Overall, better results were obtained with application of the support compared to the test

situation without a support. An improvement was observed in over half of the patients wearing the support and no deterioration occurred in any subject in this group. In the control group, on the other hand, an improvement was noted in roughly a quarter of cases, but a deterioration was also noted in a similar proportion.

The palpation of a ballotable patella is used as a parameter for evaluating knee effusion. Overall, the test situation with the support produced much better results. In the group with the support, improvement was noted in almost two-thirds of cases and no patient suffered a deterioration. In the control group, on the other hand, the results remained roughly

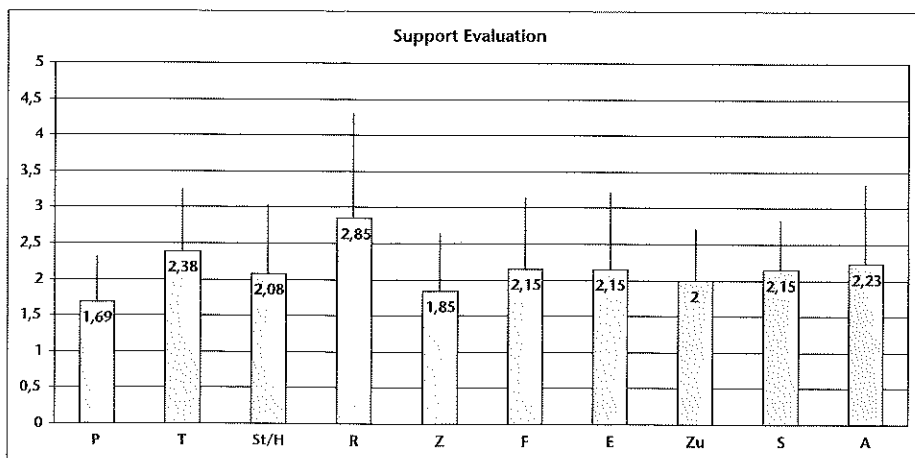


Fig. 4 Evaluation of the support by test subject with respect to fit (P), wear comfort (T), support effect (St), slipping sensation (R), skin condition (Z), functional fulfilment (F), suitability for movement (E), satisfaction (Zu), pain (S) and everyday suitability (A) at the initial examination on the basis of a standardised questionnaire.

constant throughout the six-week observation period. Approx. 15 percent of subjects improved, while 15 percent deteriorated.

Tenderness in the area of the medial joint space was used as the parameter for evaluating tenderness. Overall, the test situation with the support showed better results. An improvement occurred in approx. 31 percent of cases in the group with the support, although a deterioration was also noted in approx. 15 percent of subjects in this group. By contrast, only 14 percent of the group without a support showed an improvement, while 28 percent deteriorated.

## Questionnaire on the functional efficiency of the support

The support was rated highly by the patients for fit (average: 1.7), wear comfort (average: 2.4), and support effect (average: 2.0). The support also received good scores for the categories of skin condition (average: 1.9), functional fulfilment (average: 2.2), suitability for movement (average: 2.2), general satisfaction (average: 2.0), improvement in pain symptoms (average: 2.2) and everyday suitability (average: 2.2). The slipping sensation, with an average score 2.9, was within the usual and acceptable range for supports. Details are shown in Figure 4.

## Discussion

In this study, the GenuTrain A3 active support distributed by the company Bauerfeind was tested for its suitability in the context of the clinical condition of osteoarthritis of the knee. In addition, variables associated directly with the osteoarthritis of the knee, including clinical knee findings, knee pain, and also its effects on general physical and mental health were also investigated.

As has also been reported by Hess [4], clinical examination revealed a reduction in swelling and effusions. This study also revealed a much greater improvement in the pain-free walking distance with the support compared to the control group. This contrasts somewhat

with the findings of a study by Kirkley et al. [6] in which no difference was found for the pain-free distance after a treatment period of six months between a group fitted with supports and a control group. These differing results may be explained by the specific properties of the investigated support and the much longer observation period, with a possible reduction in the acceptability of wearing the support on a daily basis.

The improved results in the Womac score, as also described by Berry et al. [2], are an indication of the subjectively better assessment of efficacy for treatment with the support. Patients were accordingly asked specifically about pain and problems during certain physical activities and everyday situations, particularly subjective well-being in the context of osteoarthritis of the knee.

While the Womac score is designed to assess arthritis specifically, the SF-36 score evaluates the general perception of health. Since the test subjects with the support reported better results for the SF-36 score, it may be assumed that individuals with osteoarthritis of the knee also feel healthier generally as a result of wearing the support, which translates into an improvement in general quality of life. The study also showed that the active support is potentially a more cost-effective alternative to drug treatment of osteoarthritis of the knee [2].

A study by Berry et al. [2] with 166 subjects documented a significantly greater reduction in pain at rest, pain on exertion and pain at night over a six-week investigation period with the use of the GenuTrain support. The average reduction of approx. 11 percent was much lower in numerical terms than the reduction of approx. 25 percent in this study. This may be attributable to the fact that the support used in this study was designed more specifically for the diagnosis of osteoarthritis of the knee.

The stabilizing performance and functional efficiency of the support were confirmed by means of another questionnaire. The support was rated positively in parameters that are crucial for the use of the

support, including fit, wear comfort, support effect, slipping sensation, skin condition, functional fulfilment, suitability for movement, pain, satisfaction and everyday suitability.

## Conclusion

In summary, it may be concluded from the above data that the tested active support is suitable for use in its intended indications of knee irritation, particularly osteoarthritis, and for the prevention and treatment of anterior knee pain. Its suitability was demonstrated in specific test results showing, for example, an increase in pain-free walking distance, better results in specific questionnaires (Womac score) and a reduction in resting pain, nocturnal pain and exertion pain. As a supplementary effect, the use

of the support also resulted in an improvement in the perception of general physical and mental quality of life.

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