Original Research

Decrease in Knee Joint Pain and Increase in Function in Patients With Medial Compartment Arthrosis: A Prospective Analysis of Valgus Bracing

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ABSTRACT

We studied a brace designed to decrease loads on the medial tibiofemoral compartment in knees with chronic pain and arthrosis to determine if pain symptoms decreased, function improved, and dynamic gait characteristics altered during walking. Eighteen patients with symptomatic medial compartment arthrosis were fitted with a commercially available brace. All were evaluated after an average of 9 weeks of brace wear, and 13 patients were evaluated after 1 year of brace wear. The Cincinnati Knee Rating System and additional pain scales were used to analyze symptoms and functional limitations. Nine subjects underwent a dynamic gait analysis and were compared with a control group of 11 normal subjects matched for age and walking speed.

The brace was worn an average of 7 hours a day, 5 days a week. Following 9 weeks of brace wear, statistically significant improvements were found for all pain parameters, and these improvements continued at the 1 year evaluation. Before brace wear, 78% had pain with activities of daily living, but after the first evaluation, only 39% continued to have such pain, and at the second evaluation, only 31% were so affected. Before brace wear, patients had a walking tolerance of 51 minutes prior to the onset of pain symptoms. At the first evaluation, patients could walk 138 minutes without pain, and after 1 year, they could walk 107 minutes without pain. Before brace wear, 78% rated their overall knee condition as fair or poor whereas at the first evaluation, only 33% continued to provide this rating. No differences were found in the dynamic gait parameters measured with and without the brace.

While this brace did not provide the dramatic improvements in symptoms, function, and patient satisfaction obtainable after high tibial osteotomy, it did help the majority of patients. If the goal of brace use is to buy a short amount of time for patients who cannot undergo or wish to avoid osteotomy or knee arthroplasty, then bracing appears to offer a reasonable alternative for short-term pain relief and improved function.

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Many patients develop medial tibiofemoral compartment knee arthrosis due to varus malalignment, prior medial meniscectomy, trauma, or other less-defined reasons. Treatment goals of such individuals are to decrease pain symptoms, allow maintenance of reasonable activities, and prolong the period until joint arthroplasty is required. In the younger active patient with varus malalignment and early symptomatic medial arthrosis, our recommendation is to perform a valgus-producing osteotomy to decrease medial compartment loads, diminish symptoms, and improve function.

In a prospective study of 41 such patients who underwent osteotomy, 88% were satisfied a mean of 58 months postoperatively and would

Fig 1: Photograph of the brace design. The brace was used according to the manufacturer's specifications.

undergo the operation again, and 78% felt their knee condition was improved by the operation.[1] We[1] and others[2] have noted that improved preoperative planning and a precise surgical technique combined with immediate postoperative motion decreased the morbidity and complication rate and increased the predictability of valgus-producing osteotomy.

A number of patients with medial compartment arthrosis and varus malalignment are not candidates for osteotomy or knee arthroplasty. These are individuals who simply may refuse these procedures from an economic standpoint, who are unwilling or unable to miss work for the operation, or who are of an advanced age desiring to buy a few years prior to these procedures. In these instances, the use of a brace designed to diminish medial compartment loads, along with appropriate anti-inflammatory or pain medication when indicated and judicious activity modification, may decrease pain and increase function. In the past few years, a number of commercial braces of various designs and construction have been introduced into the clinical treatment of patients with medial compartment arthrosis.

This study prospectively followed a consecutive group of patients who used one type of brace designed to diminish medial compartment loads and improve function. All patients were assessed after 9 weeks and 1 year of brace wear to determine symptoms, functions, and patient satisfaction. A dynamic gait analysis also was performed, recording motions of the lower extremity and ground reaction forces with and without the selected brace, to determine if abnormal or improved alterations in gait dynamics resulted.

MATERIALS AND METHODS

Subjects. Inclusion criteria for this study were persistent chronic medial tibiofemoral compartment pain that affected sports or daily activities, arthroscopic or radiographic documentation of medial compartment arthrosis, and varus osseous alignment. Over a 2-month period, 19 patients who met this criteria consented to participate. One additional patient who presented with diffuse knee pain and lateral and posterolateral ligament instability also was included in the study to determine the brace's ability to alleviate diffuse pain.

All patients were fitted with a brace according to the manufacturer's specifications (Bledsoe Brace Systems, Grand Prairie, Tex). The brace was designed to decrease the loads on the medial tibiofemoral compartment using a dual-hinged adjustable strut fixed to the brace shell at the calf and thigh (Fig 1). Patients were told to wear the brace for as many hours and for as many days of the week as they wished.

Two patients who were noncompliant with the study protocol and used the brace for only 1 hour a day for less than 2 weeks were deleted from the study. This left 18 patients (14 men and 4 women) with a mean age of 41 years (range: 21 to 78 years). All had chronic medial compartment pain ranging in duration from 8 to 396 months (mean: 137 months) prior to the initiation of this study.

All patients had undergone multiple operative procedures, including multiple arthroscopies. Twelve patients also had partial or total medial meniscectomies, three had high tibial osteotomies, three had anterior cruciate ligament reconstructions, and one had a lateral reconstruction. Nine patients had sustained the original knee injury during an industrial accident, seven during sports activities, and one during activities of daily living. One patient did not sustain a specific injury. Seven patients were completely disabled from their occupations due to arthrosis symptoms.

Evaluation. A comprehensive interview was administered before brace wear, after the initial follow-up evaluation (mean: 9 weeks), and after the final follow-up evaluation (mean: 46 weeks). Five of the 18 patients discontinued use of the brace after the first follow-up evaluation. One patient elected to undergo high tibial osteotomy even though the brace had been effective in reducing pain symptoms, one patient had a lateral and posterolateral ligament reconstruction after the brace had been ineffective in reducing pain, one patient felt that medication was more effective in pain relief than the brace, and two patients stated the brace was not effective enough to continue the study. Therefore, 13 patients completed the second follow-up evaluation. All patients completed questionnaires and were interviewed for the assessment of symptoms, sports activities, occupational activities, and functional limitations according to the Cincinnati Knee Rating System.[3,4]

To assess pain symptoms, a visual analogue scale was used in which a score of 1 indicated no pain and 10 indicated severe pain. Walking tolerance was determined by asking patients how many minutes they could walk without incurring significant pain. Pain with walking was analyzed further on a scale of 1 to 5, with 1 indicating mild pain and 5 indicating excruciating pain. Patients indicated the number that best described their pain after 30 and 60 minutes of mall shopping. The location of the pain was documented as either medial, lateral, anterior, or generalized. Finally, patients were asked if none, some, or significant pain relief was provided by only the brace, by only medication, or by both the brace and medication.

Patients completed a self-assessment of the overall condition of their knee on a 1 to 10 scale where scores of 1 and 2 indicated a poor knee; 3 and 4,

a fair knee; 5 and 6, a good knee; 7 and 8, a very good knee; and 9 and 10, a normal knee. The scale was completed at the pre-brace and both follow-up evaluations.

At the two follow-up evaluations, patients were asked to provide an average of the hours a day and days per week that the brace had been worn. They were asked if the brace helped a great deal and was used frequently, if it provided some help and was worthwhile to wear, or if it had been no help at all. Problems encountered with brace wear were documented and included slipping, pain, skin irritations, or any other complaint. All of the patients' comments were recorded by an interviewer other than the physician who prescribed the brace.

In 18 patients, the appearance of the articular cartilage was determined during a prior operative procedure performed closest in time to the initiation of brace wear according to our previously described system.[5] In six patients, the classification was accomplished within 6 months of brace wear; in four patients, between 7 and 12 months; in four patients, between 1 and 2 years; and in four patients, after 2 years.

Surface abnormalities were categorized as normal, grade I (softening), grade II (fissuring and fragmentation), or grade III (exposed bone). Each category then was divided into subtype A or B depending on whether the depth of the lesion was less than or more than one half of the depth of the surface. For this study, a lesion was classified as abnormal if it was grade IIA, IIB, or III and had an area of at least 15 mm in diameter.

Radiographs (standing anteroposterior 45°, lateral, and merchant views) taken prior to initiation of brace wear were assessed for any tibiofemoral joint space narrowing. Narrowing was classified as either none or mild, moderate (loss of less than one half of the total joint space) or severe (loss of one half or more of the total joint space). In 13 patients, radiographs were available within 6 months of brace wear; in 1 patient, between 7 and 12 months; in 3 patients, between 1 and 2 years; and in 1 patient, after 2 years.

Gait Analysis. Gait analysis tests were performed on nine of these patients at the Cincinnati Sportsmedicine and Deaconess Hospital facility using the GaitLink System (Computerized Functional Testing Corp [CFTC], Chicago, Ill). The equipment included a two-camera video-based optoelectronic digitizer for measuring motion and a multicomponent force plate (Bertec, Columbus, Ohio) for measuring ground reaction force, camouflaged under a 10-m walkway. Measurements were obtained by a micro-computer based acquisition system and remotely processed at the CFTC laboratory using techniques described previously.[6-9]

The testing protocol involved placing passive reflective markers at the superolateral most aspect of the iliac wing, the lateral most aspect of the greater trochanter, the lateral most aspect of the joint line of the knee, the lateral malleolus, and the lateral head of the fifth metatarsal of the left and then the right side of the body. Each side was marked and tested separate from the other. Limb movement and mechanical moments were calculated by computer software based on information from the three-dimensional position of these markers.

Subjects completed two tests: a pre-brace gait analysis and a post-brace gait analysis (minimum of 4 weeks after brace wear). At the post-brace test, the patient was tested both with and without the brace. Each subject was asked to walk at normal, fast, and slow walking speeds along a 10-m walkway. Data were collected during the middle stride of several strides with the measurements starting just before the foot reached the force plate and continued after the foot left the force plate to obtain a complete cycle of stance and swing phase. To control for the effect of walking speed on other gait variables, measurements were obtained over a range of walking speeds to select and compare tests of similar walking speeds.

For purposes of analysis and comparison, measurements taken at the speed closest to 1 m/sec were used.[7,10,11] Five subjects were tested both immediately after fitting the brace and after 6 weeks of wear to determine if brace wear led to any learned alterations in gait. Data from these six subjects demonstrated no apparent learned alterations in gait. Therefore, only four other subjects underwent gait analyses immediately after being fitted with the brace.

Printed data were generated in graphic form to correlate events with the gait cycle. Kinematic data in the sagittal plane and kinetic data in the sagittal, coronal, and transverse planes of the hip, knee, and ankle were available for evaluation. Peak values during stance phase were identified and recorded for each patient.[11]

The statistical means and standard deviations for all nine patients were calculated, and peak values with and without bracing were compared using a paired, two-tailed Student's *t*-test. The gait analyses of 11 unbraced control subjects with no knee injury who were matched for walking speed were used as a control group. An unpaired, two-tailed Student's *t*-test was used to compare patient values to control subjects. All moments were expressed as external moments and normalized to body weight and height (hence the use of units of % body weight (BW) × height (Ht) to allow comparison between subjects of different sizes.

Statistical Analysis. The statistical means and standard errors for all patients were calculated, and values with and without bracing were compared using a paired, two-tailed Student's *t*-test. The level of significance was $P<.05$.

RESULTS

Brace Wear. At the first follow-up, the mean (± standard deviation) number of hours patients spent wearing the brace was 6.9±4.6 hours (range: 1 to

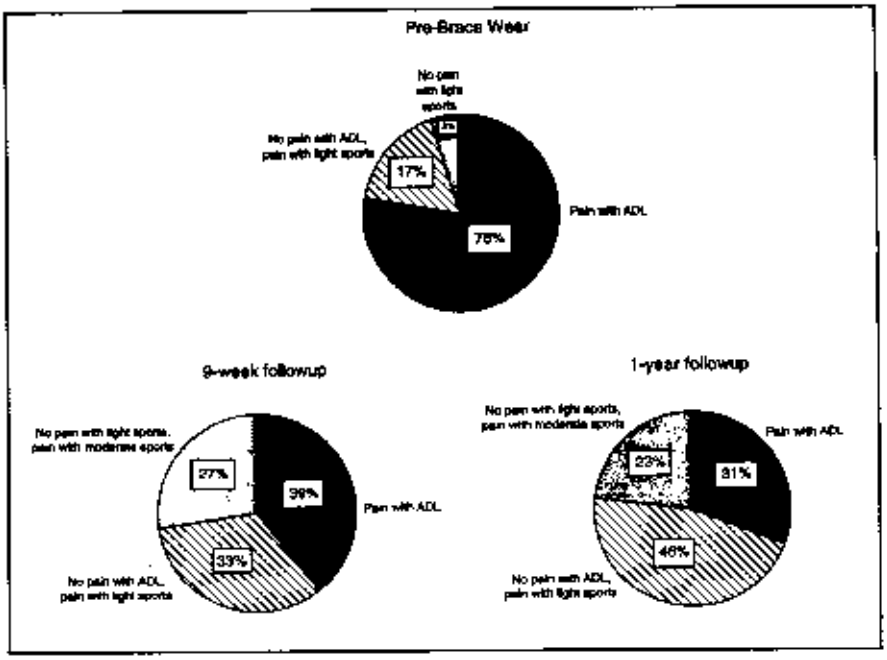

Fig 2: Results of the Cincinnati Knee Rating System pain scale before brace wear and following 9 weeks and 1 year of brace wear. The percent of patients who had pain with daily activities was significantly reduced at both follow-up evaluations ($P<.001$) compared with the pre-brace evaluation.

14 hours) and the mean number of days of brace wear was 5.2±2.1 days (range: 1 to 7 days). At the second follow-up, the mean number of hours of brace wear was 7.7±3.6 hours (range: 0 to 12 hours) and the mean number of days of brace wear was 5.1±2.1 days (range: 0 to 7 days). Between the two follow-up evaluations, 6 patients increased the hours of brace wear per day, 6 decreased, and 1 remained the same.

Articular Cartilage and Radiographic Evaluation. Abnormal articular cartilage lesions were found in the medial tibiofemoral compartment in 14 of the 18 patients during arthroscopy performed a mean of 22 months prior to the initiation of brace wear. Grade IIA lesions were found in four patients, grade IIB lesions were found in three patients, and grade IIIA lesions (subchondral bone exposure) were found in 7 patients. The lateral tibiofemoral compartment had a normal appearance in all but 6 patients who had small (<15 mm in diameter) grade IIA lesions. Abnormal articular cartilage lesions were found in the patellofemoral compartment in 13 patients. These included grade IIA lesions in 8 patients, grade IIB lesions in 2 patients, and grade IIIA lesions in 3 patients.

Moderate to severe loss of medial tibiofemoral joint space was found in 7 of the 18 patients a mean of 8 months prior to brace wear. Eleven patients had no or only a mild loss of medial tibiofemoral joint space on radiographs.

In combining the arthroscopic and radiographic data, 15 of the 18 patients exhibited a significant loss of medial tibiofemoral joint space or articular cartilage lesions in the medial tibiofemoral compartment. Two knees with mild medial compartment narrowing on radiographs had both had medial meniscectomies more than 10 years prior to our evaluation. One other patient who had normal radiographs wore the brace for lateral and posterolateral ligamentous deficiency.

Pain Analysis. Before receiving the brace, 17 of the 18 patients stated their pain was localized to the medial tibiofemoral compartment and 1 patient had diffuse pain. At the first follow-up, 16 patients had medial joint pain, 1 had lateral joint pain, and 1 had diffuse pain. At the second follow-up, 8 of the 13 patients had medial joint pain and 5 had diffuse pain.

Before receiving the brace, 10 patients were using medications for pain relief. At the first follow-up evaluation, 11 patients were using medications, and at the second follow-up, 6 patients were using pain medications. The majority of medications were nonsteroidal anti-inflammatory medications and over-the-counter pain agents.

Statistically significant differences for the Cincinnati Knee Rating pain scores were found between the pre-brace evaluation and both follow-up evaluations (Fig 2). The pre-brace mean value of 2.3±1.8 points improved to 4.0±2.2 points at the first follow-up ($P=.001$) and to 4.2±2.2 points at the second follow-up ($P=.0008$). Before wearing the brace, 14 patients (78%) had moderate to severe pain with daily activities. At the first follow-up, only 7 patients (39%) continued to have such pain, and at the second follow-up, 4 of 13 patients (31%) continued to be so affected. Compared with the pre-brace evaluation, the pain score improved in 10 patients at the first follow-up evaluation and in 9 patients at the second follow-up evaluation. There was no significant difference in the pain scores between the two follow-up evaluations.

Statistically significant differences were found between the pre-brace evaluation and both follow-up evaluations for the pain analogue scale (1 being no pain and 10 being worst pain). The pre-brace mean value of 7.3±2.3 points decreased significantly to 4.4±2.1 points ($P=.0001$) at the first follow-up, and to 4.8±2.1 points ($P=.0001$) at the second follow-up. Again, compared with the pre-brace evaluation, this pain score decreased in 17 patients at the first follow-up evaluation and in 13 patients at the second follow-up evalu-

ation. There was no significant difference in the mean values between the two follow-up evaluations.

Statistically significant improvements were found for the analysis of minutes patients could walk without experiencing pain for both follow-up evaluations compared with the pre-brace evaluation ($P<.01$ for all comparisons) (Fig 3). The use of medication had a significant effect on this variable only at the second follow-up evaluation ($P<.05$). There was no significant difference in this variable between the two follow-up evaluations.

Patients reported a decrease in the intensity of pain during mall shopping for both 30- and 60-minute evaluations (0 being no pain and 5 being excruciating pain). For 30 minutes, the pre-brace pain intensity mean of 3.7 ± 1.5 points decreased significantly to 1.9 ± 1.5 points ($P=.001$) at the first and to 2.2 ± 1.7 points ($P=.001$) at the second follow-up evaluations. For 60 minutes of mall shopping, the pre-brace pain intensity mean of 4.1 ± 1.4 points significantly decreased to 2.5 ± 1.9 points at the first and to 2.7 ± 1.9 points at the second follow-up evaluations. There was no significant difference in these scores between the two follow-up evaluations for either the 30- or 60-minute evaluation.

When asked if the brace provided any pain relief, 7 patients had significant, 10 patients had some, and 1 patient had no pain relief at the first follow-up evaluation. At the second follow-up evaluation, 3 patients had significant, 8 patients had some, and 2 patients had no pain relief with brace wear.

Functional Limitations. Statistically significant improvements were found for limitations with walking on the Cincinnati Knee Rating scale at both follow-up evaluations ($P=.01$ for both comparisons) (Fig 4). Before wearing the brace, 8 (44%) patients could not walk more than three blocks and 4 (22%) patients could not walk more than one block. At the first follow-up evaluation, only 5 (28%) patients continued to be so affected, and at the second follow-up, 3 (23%) of 13 patients had these limitations. Walking scores improved in 12 patients between the pre-brace and first follow-up evaluations, and these scores improved in 9 patients between the pre-brace and second follow-up evaluations.

There were no significant improvements in the stair climbing or squatting scores at either follow-up evaluation.

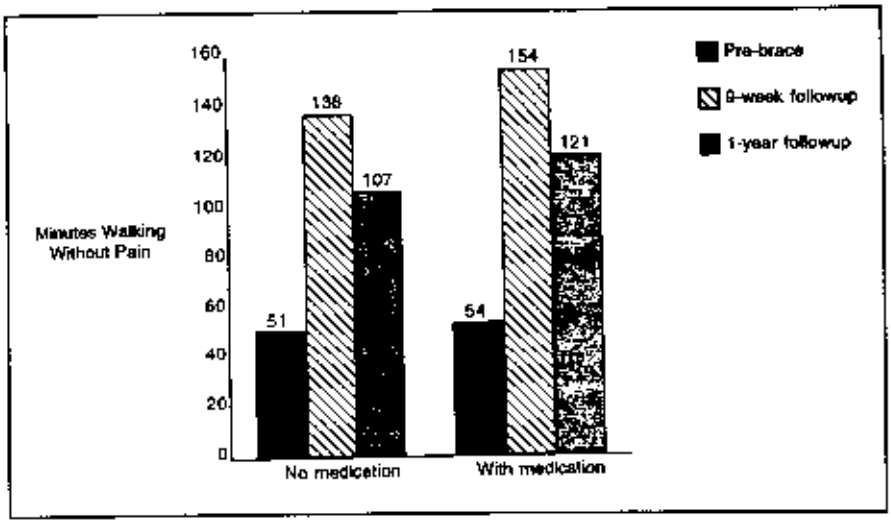

Fig 3: The mean minutes patients could walk before experiencing knee pain is shown before brace wear and after 9 weeks and 1 year of brace wear. The effect of medication intake on minutes of pain-free walking also is shown. The improvements found for both follow-up evaluations were significant ($P<.01$) compared with the pre-brace evaluation. The use of medication had a significant effect on this variable only at the second follow-up evaluation ($P<.05$).

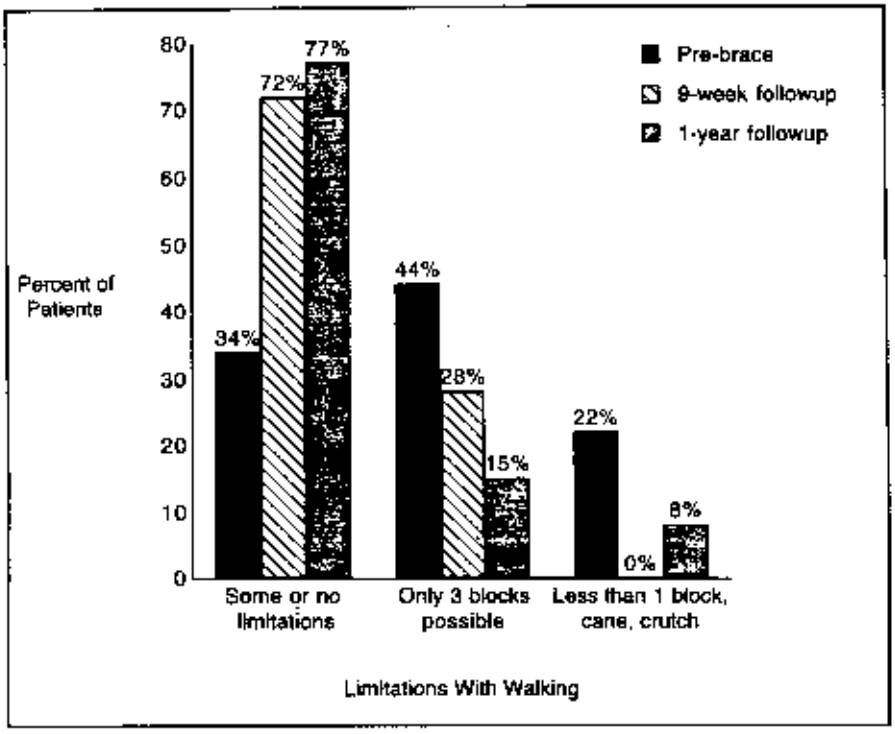

Fig 4: Functional limitations experienced by patients with normal walking, as rated on the Cincinnati Knee Rating scale, before brace wear and after 9 weeks and 1 year of brace wear. Significant improvements were found at both follow-up evaluations ($P=.01$).

TABLE 1

Participation in sports activities

Activity	Prior to Injury	Pre-Brace Wear	First Follow-Up*	Second Follow-Up†
Jumping, pivoting, cutting	13	2	2	1
Running, twisting, turning	1	0	0	0
Swimming, bicycling	4	2	4	5
No sports activity	0	14	12	7
Participating with symptoms	0	3	2	3
Participating without symptoms	18	1	4	3

*9 weeks after brace wear.
†1 year after brace wear.

TABLE 2

Occupational activities

Occupation	Pre-Brace Wear	First Follow-Up*	Second Follow-Up†
Very light/light	8	8	6
Moderate	0	0	0
Heavy/very heavy	1	1	1
Disabled due to knee condition	8	8	5
Student/houseworker	1	1	1
Working with symptoms	5	2	3
Working without symptoms	4	7	4

*9 weeks after brace wear.
†1 year after brace wear.

Additionally, no significant improvements were found in the 3 sports functions assessed (running, jumping, and twisting) at either follow-up evaluation. Only 2 patients were able to perform the 3 sports functions with no or only mild limitations. The remaining 16 patients did not even attempt these activities.

Sports and Occupational Rating. Before the original knee injury, all 18 patients were participating in sports activities (Table 1) with no symptoms or knee limitations. Prior to receiving the brace, only 4 patients continued to participate, and three of these patients had symptoms and had been advised to give up their athletic activities. At both follow-up evaluations, 6 patients were participating in swimming or bicycling activities.

Before receiving the brace, nine patients were working (five with symptoms) and eight were on full disability due to their knee condition (Table 2). Seven of the eight patients on disability received workers' compensation. At the first follow-up evaluation, no change was found in the occupational rating; however, three patients who had symptoms while working before wearing the brace reported their symptoms had decreased and no longer affected their work activities. At the second follow-up evaluation, one patient who had been on disability (not on workers' compensation) had been able to return to work without significant symptoms. Seven other patients who were evaluated were working; three had symptoms with their occupations. None of the workers' compensation patients who were disabled before wearing the brace returned to work during the follow-up evaluation period.

Patient Perception of Overall Knee Condition. During the pre-brace evaluation, the mean patient perception score (1 being poor and 10 being normal) was 3.4±1.4 points, with 14 (78%) patients rating their knee condition as poor or fair and 4 (22%) patients rating it as good. At the first follow-up evaluation, the mean score had improved significantly to 5.4±2.1 points (P=.001) with 6 (33%) patients rating their knee condition as poor or fair, 6 (33%) as good, 5 (28%) as very good, and 1 (6%) as normal. At the second follow-up evaluation, the mean score of 4.7±2.0 remained significantly improved compared with the pre-brace evaluation (P=.01). Six (46%) patients rated their knee condition as poor or fair, 5 (38%) as good, 1 (8%) as very good, and 1 (8%) as normal.

Sixteen of the 18 patients provided a higher score on the perception scale at the first follow-up evaluation compared with the pre-brace evaluation. Nine of the 13 patients evaluated at the second follow-up provided a higher score on the scale compared with that given during the pre-brace evaluation.

Gait Analysis Evaluation. After brace application, the mean value for the adduction moment did not change. Mean adduction moment without the brace measured 3.5±0.8% BW × Ht versus 3.5±0.8% BW × Ht when wearing the brace. There was no observed decrease in the adduction moment of the involved knee when wearing the brace, and there were no readily apparent gait adaptations following brace application.

Peak force during stance and gait velocity were not altered with brace wear (P<.05). There were no differences between the adduction moment at the hip, the flexion or extension moment at the knee, or the inversion-aversion moments at the ankle with brace wear (P<.05), nor were there significant differences in foot progression angle in the unbraced versus the braced condition. In addition, when multiple regression analysis was used to examine the relationship between the alteration in adduction moment with brace wear and the alteration in each of the aforementioned parameters separately and in combination, no significant correlations were found.

DISCUSSION

Of the 18 patients who completed the short-term evaluation and brace wear in this study, 15 benefited with either a reduction in pain symptoms, an increase in walking tolerance, or both. Of the 13 patients who continued to wear the brace for an average of 1 year, 10 had an improvement in pain or function compared with their pre-brace evaluation. While the use of this brace did not provide the dramatic improvements in symptoms, function, and patient satisfaction that are obtained after osteotomy,[1] it did help the majority of patients in this study.

The mean age of the patients selected for brace wear was 41 years. Osteoarthritis in patients younger than 50 years presents a difficult problem: total knee arthroplasty is not recommended due to increased activity levels, a longer expected life span, and the projected need for multiple future revisions. Arthroscopic debridement may provide temporary relief, but in cases of significant articular cartilage loss, this is generally a temporary measure at best.[12]

If the goal of a valgus-producing brace is to buy a period of time for patients who cannot undergo or wish to avoid osteotomy or knee arthroplasty, then the brace tested in this investigation appears to be a reasonable alternative for pain relief and improved function. We acknowledge the variability in the success rates of osteotomy, its high risks of complications, and the potential difficulty of eventual revision to total knee arthroplasty.[2,6,10,12] However, in our experience, osteotomy has provided more symptom relief for longer periods of time, more patient satisfaction, and more improvement in function in younger active individuals with symptomatic medial compartment arthrosis and varus malalignment than any commercially available brace that we are aware of.

Several criteria were used to assess pain during this investigation. Some of the most dramatic improvements were found in the minutes of walking patients could tolerate before the onset of pain symptoms. Wearing the brace allowed patients to more than double their walking time without pain, from 51 to 138 minutes without medication following 9 weeks of wear and to 107 minutes after 1 year of wear.

Before the investigation, 14 patients had pain with daily activities. After 9 weeks of brace wear, only 7 patients continued to have pain with daily activities and after 1 year, 4 of 13 patients continued to be so affected. Seventeen of the 18 patients felt some alleviation of pain symptoms after 9 weeks of wear, and 11 of 13 continued to feel this improvement after 1 year of wear.

The brace had little impact on returning patients to sports activities; only a few patients attempted any type of athletics, and these were typically light swimming or bicycling activities only. These individuals were advised to avoid high-impact strenuous activities involving turning, twisting, cutting, or jumping motions due to the amount of joint arthrosis and the varus malalignment present. Additionally, the brace had little effect on returning patients who were disabled back to work. However, seven of the eight individuals on full disability were supported by worker's compensation, which may have had an additional effect on motivation to return to work.

The patients tended to use the brace a mean of 7 hours each day, 5 days each week. This was a high use level, and we advised some of these patients to be careful of overusing the knee due to the underlying arthrosis. The physician and physical therapist are important components of successful brace use and the achievement of a high patient satisfaction level. The clinical team must educate the patient concerning the proper use of the brace and be ready to help with any brace problems when necessary. It is important to educate the patient concerning the issues of slippage, pinching, skin irritation, and wearing the brace under high temperature conditions.

Most patients wore the brace during high-activity periods of the day. Eight patients were able to use the brace alone to alleviate their pain symptoms, while the remaining 10 patients continued to use some level of nonsteroidal anti-inflammatory medication in addition to the brace. The combination of these two treatment modalities provided significant pain relief and functional improvement.

We have used valgus-loading braces for indications other than pain relief of medial compartment gonarthrosis and found these braces to be useful in protecting the knee from varus thrusting motions after lateral and posterolateral ligament reconstructions. These braces may function as an additional restraint that adds stability to the knee joint.[2,13,14] One patient, a 23-year-old woman, was totally disabled when she presented to our center 4 years following an industrial accident and a failed lateral reconstruction. She could walk only 5 minutes prior to the onset of pain symptoms that she described as excruciating. After 9 weeks of brace wear, she could walk for 1½ hours before the onset of pain. The brace was used successfully in conjunction with an intensive gait retraining program[15] to prepare this patient for the lateral and posterolateral reconstruction. This clinical situation offers another indication for brace wear in select patients with lateral and posterolateral ligament insufficiency, and varus recurvatum and thrust during walking activities.

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