Efficacy of Custom Foot Orthotics in Improving Pain and Functional Status in Children with Juvenile Idiopathic Arthritis: A Randomized Trial

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ABSTRACT. ***Objective***. To compare the clinical efficacy of custom foot orthotics, prefabricated "off-the-shelf" shoe inserts, and supportive athletic shoes worn alone, on reducing pain and improving function for children with juvenile idiopathic arthritis (JIA).

Methods. Children with JIA and foot pain (n = 40) were randomized to one of 3 groups receiving: (1) custom-made semirigid foot orthotics with shock absorbing posts (n = 15), (2) off-the-shelf flat neoprene shoe inserts (n = 12), or (3) supportive athletic shoes with a medial longitudinal arch support and shock absorbing soles worn alone (n = 13). Foot pain and functional limitations were measured using the Pediatric Pain Questionnaire–visual analog scale (VAS), Timed Walking, Foot Function Index (FFI), and the Physical Functioning Subscale of the Pediatric Quality of Life Inventory™ (PedsQL™). Measures were administered by personnel blinded to group status at baseline (before wearing the assigned intervention) and at 3 months' followup.

Results. Children in the orthotics group showed significantly greater improvements in overall pain ($p = 0.009$), speed of ambulation ($p = 0.013$), activity limitations ($p = 0.002$), foot pain ($p = 0.019$), and level of disability ($p = 0.024$) when compared with the other 2 groups. Both children and parents in the orthotics group reported clinically meaningful improvement in child health-related quality of life, although the group by time interaction did not show statistical significance. Except for a reduction in pain for supportive athletic shoes (paired t test, $p = 0.011$), neither the off-the-shelf shoe inserts nor the supportive athletic shoes worn alone showed significant effect on any of the evaluation measures.

Conclusion. In children with JIA, custom-made semirigid foot orthotics with shock-absorbing posts significantly improve pain, speed of ambulation, and self-rated activity and functional ability levels compared with prefabricated off-the-shelf shoe inserts or supportive athletic shoes worn alone. (J Rheumatol 2005;32:943–50)

Key Indexing Terms:
CHILDREN FOOT PAIN JUVENILE IDIOPATHIC ARTHRITIS ORTHOTICS

Children with juvenile idiopathic arthritis (JIA) frequently experience foot and ankle pain[1,2]. In addition to antiinflammatory treatment, joint injections, surgical interventions, and physical therapy, current recommendations include the use of supportive athletic shoes, prefabricated "off-the-shelf" shoe inserts, or custom foot orthotics[3-6]. However, there is no evidence that any of these modalities help children, even though most experts recommend their use[7]. Investigations to date have focused mainly on adults with foot pain and orthopedic conditions such as metatarsalgia[8], patellofemoral pain syndrome[9,10], plantar fasciitis[11], overuse injuries in runners[12], or low back pain[13,14]. Orthotics with varying posting methods for controlling the forefoot and/or hindfoot position, particularly in athletes[15], have been shown to be effective. Importantly, the use of insole foot pressure measuring systems has documented the benefits of custom orthotics for the management of excess plantar pressure and ulcers in patients with diabetes[16,17].

Several studies address the use of orthotics in the management of foot pain and their effect on gait variables in adults with rheumatoid arthritis (RA), suggesting clinical benefit of orthotics, splints, and/or shoe inserts[18-21]. The focus of these studies, however, has been on delaying future orthopedic interventions through correct alignment and shock absorption[22-24], rather than improved function and quality of life. To date, there are no studies evaluating the effect of these interventions on children with JIA and foot pain.

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This prospective, randomized, single-blinded study was conducted to evaluate the efficacy of custom-made semirigid foot orthotics with shock absorbing posts with regard to foot pain, speed of ambulation, functional abilities, level of disability, and health-related quality of life in children with JIA affecting the feet and ankles. We hypothesized that the custom-made foot orthotics would have a significant positive effect on the outcome measures and that this positive effect would be significantly greater than that associated with either off-the-shelf shoe inserts or athletic shoes worn alone.

MATERIALS AND METHODS

Patients. Forty-eight children consecutively evaluated in 3 pediatric rheumatology clinics at 3 Southern California children's hospitals, with a diagnosis of JIA according to ILAR criteria[25], who had persistent pain in the joints of the lower extremities (ankle, subtalar, hindfoot, and/or metatarsal joints), and who met the inclusion criteria were enrolled. Global disease activity was assessed by the pediatric rheumatologist at the time of recruitment using a 100 mm continuous Likert scale. Of the 48 children invited into the study, one refused to participate and 7 were lost to followup and so did not complete the followup assessment.

Forty children (Table 1), 30 girls and 10 boys, ages 5–19 years (mean 12 years, 7 months, SD 3.7), completed the study. More than half the patients (51.4%) were Caucasian, with 35.1% Hispanic, 5.4% each African-American and Asian/Pacific Islander, and 2.7% other. Eleven patients had enthesitis related arthritis, 21 had polyarthritis, 6 had oligoarthritis, and 2 had systemic arthritis. The hospitals' internal review boards approved the study, all parents signed informed consent, and patients over 7 years of age signed a child's assent prior to participation in the study. The children were assessed by a pediatric rheumatologist to ensure that inclusion and exclusion criteria were met, as follows:

1. Diagnosed with JIA
2. At least 5 years of age
3. The presence of active disease of the ankle, subtalar, hindfoot, and/or metatarsal joints as determined by the tender and swollen foot joint count
4. History of persistent foot/ankle pain for more than 1 month but less than 2 years
5. No foot osseous anomaly noted during the physical evaluation and no history of foot/ankle surgery
6. Stable medication(s) for one month prior to entry and during the course of the study
7. No joint injections for at least 6 months prior to entry and during the course of the study
8. No previous use of shoe inserts or foot orthotics
9. Ability to walk a minimum of 50 feet without assistive devices

Procedures. Once accepted into the study, each subject was randomly placed by opening a sealed envelope containing a predetermined numbered placement card into one of the 3 intervention groups: (1) Custom-made semirigid orthotics made of metal particle-reinforced polyolefin with shock absorbing functional posts; (2) prefabricated off-the-shelf shoe inserts made of 1/8" flat neoprene; or (3) new supportive athletic shoes with a medial longitudinal arch support and shock absorbing soles (cross-training type shoes) worn alone. All children, regardless of intervention, received new athletic shoes at the beginning of the study. The study was single-blinded (the patients knew their assignments, while the examiners did not). There were no statistically significant differences between study groups in any demographic, disease characteristics, or medications.

Each subject had 3 visits. At visit one, each child was randomized to an intervention group and educated about the recommended supportive athletic shoes to be worn during the course of the study by a physical therapist (PT 1). Children in the orthotic group were evaluated using the orthotic manufacturer's prescription form and underwent non-weight-bearing casting in a subtalar neutral position by PT 1. At visit 2 (time = 0), another physical therapist (PT 2), blinded to the patient's intervention group, took baseline measures while the participants wore their everyday shoes.

Table 1. Demographic and disease characteristics by intervention group.

	Custom Orthotics, n = 15		Shoe Inserts, n = 12		Supportive Shoes, n = 13	
	N	%	N	%	N	%
Age, yrs, mean (SD)	12.14	(3.32)	12.17	(3.04)	13.77	(4.55)
Male/female	2/13	13.3/86.7	4/8	33.3/66.7	4/9	30.8/69.2
Ethnicity						
African-American	1	7.7	1	9.1	0	0.0
Asian/Pacific Islander	0	0.0	1	9.1	1	7.7
Hispanic	5	38.5	3	27.3	5	38.5
Caucasian/non-Hispanic	7	53.8	6	54.5	6	46.2
Other	0	0.0	0	0.0	1	7.7
Mother's education						
Less than highschool	4	30.8	1	10.0	3	23.1
Highschool or some college	4	30.8	4	40.0	3	23.1
College degree or beyond	5	38.5	5	50.0	7	53.8
Diagnosis						
Enthesitis related arthritis	3	20.0	3	25.0	5	38.5
Polyarthritis	11	73.3	6	50.0	4	30.8
Oligoarthritis	1	6.7	2	16.7	3	23.1
Systemic arthritis	0	0.0	1	8.3	1	7.7
MD global disease activity						
Quiescent	1	6.7	2	16.7	2	15.4
Mild	5	33.3	4	33.3	4	30.8
Moderate	5	33.3	3	25.0	5	38.5
Severe	4	26.7	3	25.0	2	15.4

Immediately after this assessment, all children began to wear their new supportive athletic shoes and their assigned interventions. The fit of the interventions and any adjustments that needed to be made were done by PT 1. At visit 3 (3 months after wearing the intervention footwear), PT 2, still blinded to the child's intervention, performed followup measurements while the children wore their supportive athletic shoes.

Measures. At baseline and at 3 month followup visit, each child was evaluated using the following measures:

1. The Pediatric Pain Questionnaire–visual analog scale (VAS) is a standardized VAS for pain validated for children[26]. The VAS measures current pain intensity and worst pain intensity during the previous week as perceived by the child. A score of 0–10 is noted; lower scores indicate less pain.
2. The Timed Walking evaluation consists of instructing the patient to ambulate across a marked 50-foot distance as quickly as possible[27]. Using a stopwatch, 3 attempts are timed and an average speed of ambulation is documented.
3. The Foot Function Index (FFI) is a self-administered index developed for adults with arthritis who have foot pain. It consists of 23 questions divided into 3 subscales: (1) Activity Limitation (5 items), (2) Foot Pain (9 items), and (3) Disability (9 items)[28]. The activity limitation subscale addresses how often and to what extent activities were limited due to foot problems. The pain subscale measures the level of foot pain in a variety of situations, and the disability subscale describes the amount of difficulty experienced while performing various activities due to foot problems. The FFI is designed to measure the influence of foot pain on a patient's current function during the past week, and changes in status over time. Similar to the VAS, each FFI item consists of a 10 cm line with descriptor anchors placed at each end. After the child places a mark on the line, PT 2 scores the item. A score is attained for each item by dividing the horizontal line into 10 equal segments. To obtain a subscale score, the item scores for each question are totaled and then divided by the maximum total possible for all of the items in the subscale. The subscale scores range from 0 to 100, with the lower scores indicating better function. Although this tool has been validated for an adult population, it appears applicable to children because of its simple language and the use of a VAS.
4. The Physical Functioning Subscale of the Pediatric Quality of Life Inventory™ 4.0 Generic Core Scales (PedsQL) is a brief (23 items), practical, reliable, and valid measure of child health-related quality of life (HRQOL)[29-32]. Other PedsQL 4.0 Generic Core Scales encompass: Emotional Functioning (5 items), Social Functioning (5 items), and School Functioning (5 items). The PedsQL 4.0 comprises parallel child self-report and parent proxy-report formats. Scores near 0 indicate poorer physical functioning and scores near 100 indicate better physical functioning. Because the intervention used here was primarily physical, as opposed to psychosocial, the child self-report and parent proxy-report physical functioning subscales were the only subscales used for this study.

Statistical analysis. The primary outcome variable was the FFI scales. We used an intention-to-treat analysis: all participants who underwent random allocation were analyzed according to group assignment. No participant with a followup assessment was excluded from the analysis. To compare the 3 intervention groups, we examined relative change over time across the 3 intervention groups using repeated-measures analysis of variance (ANOVA). In this case, a significant group by time interaction indicates that one group improves more than the others. We examined within-group change over time using paired-sample t tests. Statistical significance level was set at $p < 0.05$. Because of the relatively small sample size, no correction was made for family-wise error rate. Analyses were performed using SPSS Version 8.0[33].

RESULTS

Forty children with arthritis affecting the foot and/or ankle completed the study: 15 patients received custom-made semirigid foot orthotics with shock absorbing posts, 12 children received an off-the-shelf flat neoprene shoe insert, and 13 were given new supportive athletic shoes to be worn alone. There was no relationship between completing the trial and intervention group (chi-square (2) = 0.76, p = 0.682), and no child withdrew from the study because of discomfort or lack of efficacy. Seven children failed to complete the study; 2 received foot orthotics; 2 children received the flat neoprene shoe inserts; and 3 were given the new shoes worn alone. They did not differ from those who completed the study with respect to parental education level, family income, race/ethnicity, or child's age, gender, or type of arthritis.

Using the Pediatric Pain Questionnaire-VAS, children who received custom orthotics had a significantly greater reduction in pain intensity than the other 2 groups (Figure 1A). On a scale from 0 to 10, these children reported a change from an average of 5/10 to almost no pain, while the other groups had almost no change in pain over time. The repeated measures ANOVA showed a statistically significant group by time interaction for the Pain-VAS intensity rating ($F(2, 37) = 5.40$, $p = 0.009$, observed power = 0.813) (Table 2). Paired t tests showed a reduction in pain for the orthotic group ($t(14) = 5.1$, $p = 0.001$) and the shoe-only group ($t(12) = 3.0$, $p = 0.011$). There was also a significant main effect for time ($F(1, 37) = 27.33$, $p = 0.001$), such that the combined sample, overall, reported less pain over time.

Evaluation of Timed Walking also showed that the orthotic group fared better; these patients walked almost three-quarters of a second faster over 50 feet ($t(14) = 2.7$, $p = 0.017$) compared with the other groups, resulting in a statistically significant group by time interaction ($F(2,37) = 4.93$, $p = 0.013$, observed power = 0.775) (Table 2, Figure 1B). It should be noted that children in the group wearing shoes alone walked about a quarter of a second faster after 3 months of intervention when compared to baseline, while the neoprene shoe insert group walked almost two-thirds of a second slower when compared to baseline.

In all 3 subscales of the FFI, improvement was larger in the orthotic group than changes documented for the other 2 groups (Figure 1C). Again, there were statistically significant group by time interactions for all 3 subscales of the FFI (activity limitations $F(2,37) = 7.77$, $p = 0.002$, observed power = 0.933; foot pain $F(2,37) = 4.41$, $p = 0.019$, observed power = 0.725; disability $F(2,37) = 4.14$, $p = 0.024$, observed power = 0.696; Table 2). For these 3 subscales, the orthotic group was the only group to show significant improvement ($t(14) = 5.4$, $p = 0.001$ for activity limitations; $t(14) = 3.7$, $p = 0.002$ for foot pain; and $t(14) = 3.8$, $p = 0.002$ for disability). There was a significant main effect of time for foot pain ($F(1, 37) = 8.25$, $p = 0.007$) and for foot disability ($F(1, 37) = 6.15$, $p = 0.018$).

We found no statistical difference in reported HRQOL even though there were trends toward a significant group by time interaction for both the child self-report and the parent

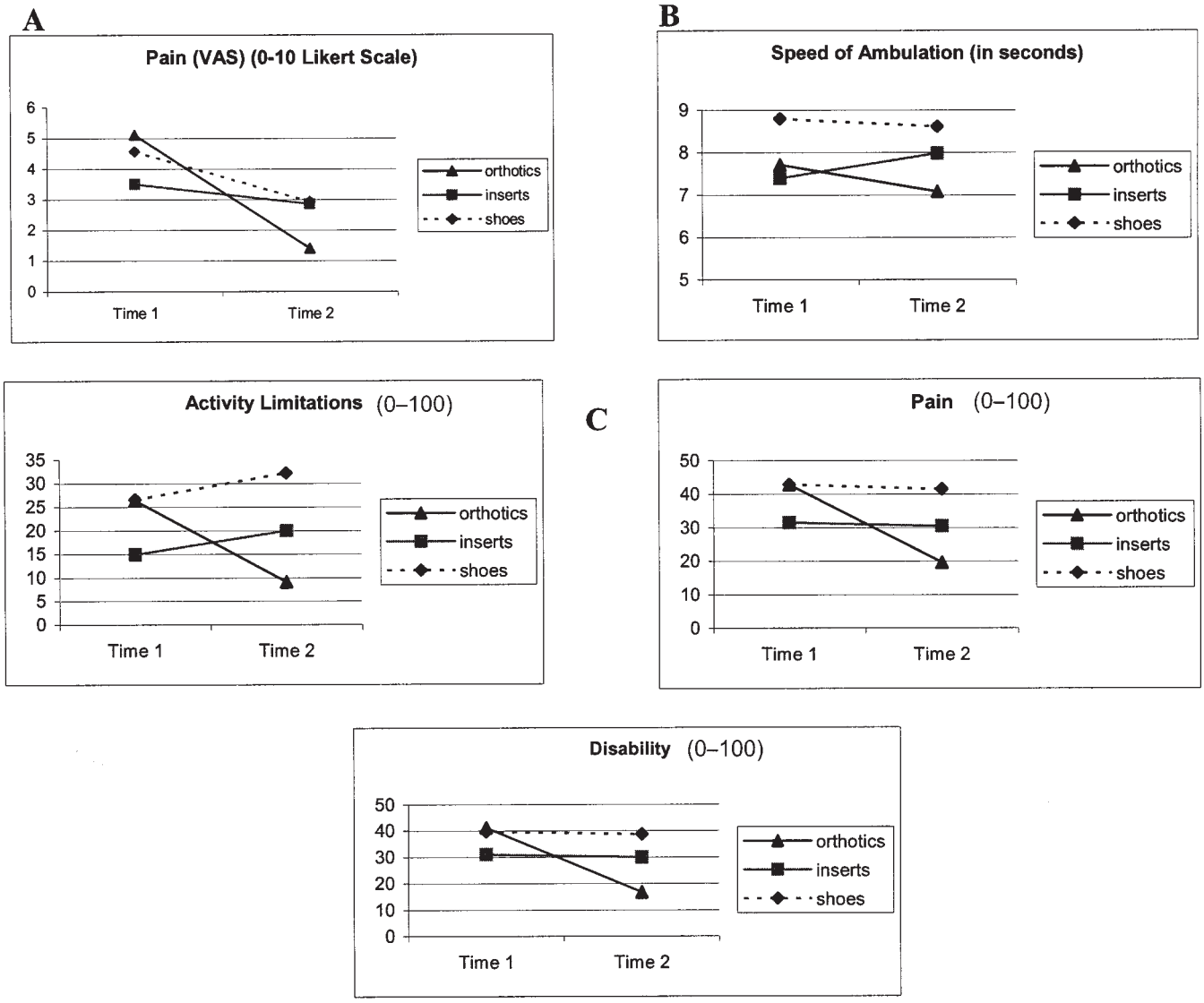

Figure 1. Change over time according to (A) pain visual analog scale (VAS), (B) Timed Walking, and (C) Foot Function Index, using group means at baseline and 3 month followup visit.

proxy-report PedsQL 4.0 Physical Functioning Summary Scale (self-report $F(2,33) = 3.01$, $p = 0.063$, observed power = 0.393; proxy-report $F(2,32) = 2.07$, $p = 0.143$, observed power = 0.545) (Table 2). In both cases, the overall sample improved [significant main effect of time for self-report ($F(1, 32) = 9.81$, $p = 0.004$, and for proxy-report ($F(1, 33) = 6.67$, $p = 0.014$]. Moreover, the orthotic group was the only group to show significant improvement in paired t tests ($t(12) = 3.1$, $p = 0.008$ for self-report and $t(13) = 3.9$, $p = 0.002$ for proxy-report) (Figure 2). It is further worthwhile to note that in both cases the increase in the orthotic group was more than twice the 5 points considered to be the minimally clinically important difference for the PedsQL 4.0[29]. The correlation between the child self-report and parent proxy-report was positive and significant at baseline and at followup ($r = 0.45$, $p = 0.006$ at baseline; $r = 0.69$, $p = 0.001$ at followup).

No objective changes were documented in the tender and swollen foot joint count from the baseline measures to the 3 month followup examination. The children still had active arthritis and no discernible differences were noted between the groups even though clinical changes were noted.

There were no significant group main effects for any dependent variable.

DISCUSSION

Our study was designed to determine the most effective intervention for persistent foot and/or ankle pain in children with arthritis whose medications had been stable for one month or more. Effectiveness in reducing symptoms as well

Table 2. Repeated measures ANOVA for outcome measures at baseline and 3-month followup.

	N	Baseline Mean (SD)	Followup Mean (SD)	Group-by-time interaction F test	df	p
Pain						
Orthotics	15	5.23 (2.01)	1.32 (1.30)	5.40	2.37	0.009
Shoe Inserts	12	3.50 (2.42)	2.84 (2.88)			
Shoes only	13	4.74 (1.98)	2.82 (2.01)			
Timed Walking						
Orthotics	15	7.76 (1.25)	7.03 (1.12)	4.93	2.37	0.013
Shoe Inserts	12	7.40 (1.10)	7.98 (1.30)			
Shoes only	13	8.62 (2.45)	8.36 (2.44)			
Foot Function Index						
Activity Limitations						
Orthotics	15	26.15 (12.85)	8.54 (11.06)	7.77	2.37	0.002
Shoe Inserts	12	14.88 (14.33)	19.96 (19.73)			
Shoes only	13	24.23 (25.80)	27.92 (27.89)			
Foot Pain						
Orthotics	15	42.13 (20.86)	18.35 (17.05)	4.41	2.37	0.019
Shoe Inserts	12	31.48 (18.33)	30.46 (25.56)			
Shoes only	13	42.38 (21.05)	37.54 (25.47)			
Disability						
Orthotics	15	40.27 (23.68)	15.6 (13.51)	4.14	2.37	0.024
Shoe Inserts	12	30.97 (18.85)	29.98 (25.26)			
Shoes only	13	37.08 (23.00)	34.15 (26.35)			
PedsQL Physical Functioning						
Child self-report						
Orthotics	13	56.39 (15.66)	71.88 (15.88)	2.07	2.32	0.143
Shoe Inserts	10	54.38 (15.04)	55.94 (17.46)			
Shoes only	12	50.78 (14.60)	59.78 (18.80)			
Parent proxy-report						
Orthotics	14	48.66 (19.45)	64.96 (19.92)	3.01	2.33	0.063
Shoe Inserts	10	52.81 (8.13)	55.31 (15.80)			
Shoes only	12	53.39 (17.50)	55.95 (13.97)			

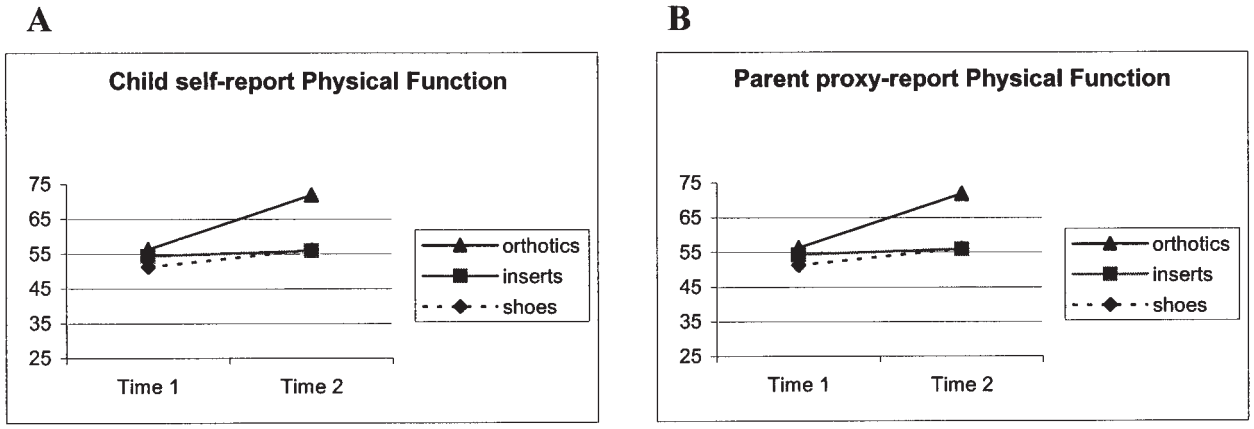

Figure 2. Physical Functionaing Subscale of the PedsQL™ self (A) and proxy (B) reports showing group means at baseline and at 3 month followup visit (higher numbers reflect better function).

as improving function and quality of life was evaluated using 3 of the most commonly prescribed modalities in clinical practice: custom-made orthotics, off-the-shelf shoe inserts, and supportive shoes worn alone. The results of this single-blinded randomized controlled trial show that the group of patients who received custom-made semirigid orthotics had significantly decreased pain, improved speed of ambulation, increased function, and decreased level of disability, compared with children who were given either an off-the-shelf shoe insert or a new supportive athletic shoe worn alone.

Children with arthritis affecting feet and ankles experi-

ence particular problems with ambulation and participation in gross motor activities such as walking on stairs, running, and sports. Medications improve many symptoms, but some patients continue to have poor function and therefore may receive a more supportive shoe, shoe insert, or custom foot orthotic. Custom foot orthotics can correct biomechanical alignment, increase contact area of the foot, and decrease areas of excess peak plantar pressure and pain. In addition, orthotics improve shock absorption in the joints[34-36]. These therapeutic benefits may prevent loss of joint mobility, progression of deformities, abnormal joint pressures, pain, and loss of functional abilities[24]. The low cost associated with this noninvasive intervention justifies its use versus the significant economic costs associated with more invasive interventions such as joint injection and surgical correction of common arthritic foot deformities such as hallux valgus. Given that HRQOL is now recognized as an important outcome and that many rheumatologists consider inclusion of HRQOL a requirement in the evaluation of new interventions, this trial examined the effect of foot orthotics on one aspect of the child's HRQOL by including the Physical Functioning Subscale of the PedsQL as a dependent variable. Although the orthotic group's PedsQL Physical Functioning Subscale scores increased about 3 times the minimally important clinical difference, the group by time interaction for the repeated measures ANOVA only approached significance. This may have been due to inadequate power in this trial to detect a difference with this measure. The power to detect a difference for child self-report was 0.39, while that for parent proxy-report was 0.55, less than the optimal 0.80. Adding 3 hypothetical subjects per group to the child self-report ANOVA and one subject per group to the parent proxy-report ANOVA, using the mean group scores, resulted in p values less than 0.05 (results not shown). The lack of statistical significance may also be a function of the generic nature of the PedsQL Core Scales.

Given that the PedsQL Physical Functioning Scale includes items not necessarily related to foot functioning, the generic nature of this scale might mask an overall effect. While a PedsQL Rheumatology Module does exist[29], it was not used in this trial. Our results point to the importance of including disease- or condition-specific outcome measures as well as generic measures. Because the FFI did document a statistical difference between the groups, it appears that a more specific tool is needed when evaluating local interventions' influences on HRQOL.

Several limitations of our study should be noted. First, only one type of custom orthotic and prefabricated shoe insert was evaluated. There are many types of orthotics and shoe inserts that differ in physical properties due to the materials used. The amount of corrective force of an orthotic and shoe insert varies depending on the supportive material they are made from. Orthotic materials range from flexible, providing minimal support or correction of alignment, to rigid, providing maximal support. Additionally, the amount of shock absorption the orthotic provides varies from soft, absorbing the most shock, to firm, absorbing the least. The needs of the patient, whether accommodative, biomechanical, or functional, influence the choice of orthotic. Materials for a shoe insert can also vary, ranging from flexible to semirigid, providing minimal to moderate support and varying amounts of shock absorption. Because some orthotics or shoe inserts may be more effective than others in treating foot pain and improving functional limitations, it may be helpful to assess different types of custom and prefabricated devices for patients with varying degrees of involvement to determine the most effective intervention. We chose this semirigid orthotic because we experienced success clinically when using it with our patients. We chose the neoprene shoe insert because it was more generic in design and similar to many products on the market that are commonly used.

Another limitation is the relatively short duration of our study. Clinically, our experience has been that changes observed during a 3-month period often last as long as the patient's overall status does not change, and the most significant change occurs during the first 3 months of intervention. In an effort to control as many variables as possible that would influence the outcome of this study, it was important to limit the length so that any documented positive effect could be attributed to the study's intervention and not any change in medication or the natural history of the arthritis.

Finally, our study design necessitated that patients knew their intervention, but that the examiners who took the measurements did not. In an attempt to reduce the placebo effect on the groups that received shoe inserts or orthotics, all patients were instructed that the 3 interventions had been shown to improve foot pain and that it was not known if one intervention was more effective than another.

Our study criteria called for less than 2 years of clinical foot/ankle involvement, no bony anomalies, and no history of foot or ankle surgery. Given the results of our study, the effects of all 3 interventions need to be assessed in children with different and more severe levels of involvement and disability to determine which intervention offers the best results when used by children with anatomic changes and/or orthopedic deformities.

Our chosen interventions represent commonly prescribed conservative medical treatment modalities for patients with arthritis of the feet/ankles. To date, for children, no study has shown that any of these interventions are effective, let alone whether one is superior to another. We found that the group of children who wore custom-made orthotics improved regardless of age, diagnoses, global disease activity, or treatment site when different examiners were blinded to the intervention. Our results document multiple positive outcomes supporting the use of custom designed orthotics over

prefabricated shoe inserts and/or supportive athletic shoes worn alone.

Broader interpretations of these findings suggest that custom-made orthotics represent an effective treatment if they are properly prescribed and designed (made of correct materials) and accurately fitted. Indeed, orthotics may have either a detrimental effect or cause no improvement if the time is not taken to determine the proper type of orthotics for the patient's symptoms and/or malalignments[22,37]. Different diagnosis, disease acuity, number of joints involved, and whether a deformity is flexible or fixed are all considerations that need to be taken into account when determining the appropriate orthotic device. In addition, fitting a patient with the correct orthotic is a dynamic process that requires periodic reevaluation to adjust or modify the devices as needs change and the child with arthritis grows. In addition, compliance with using the prescribed orthotic is directly related to comfort, underscoring the need for periodic reevaluation and adjustment.

While some authors have suggested that custom-made rigid orthotics are not helpful in reducing pain and disability of older patients with arthritis[38], our study shows that with properly customized semirigid devices, improvement in symptoms and function can be achieved. Orthotics represent a conservative intervention shown here to be an effective adjunct to the overall management of children with JIA. The economic burden is less than other medical interventions, including medications. The cost is about $200–$350 US per pair. Growing children may require new orthotics every 1–2 years depending on how fast their feet grow. Once growth ceases, orthotics may last 3–5 years with only minimal costs incurred to refurbish the devices annually.

We have shown that custom-made semirigid orthotics with shock absorbing posts significantly improve pain, speed of ambulation, and self-rated activity and functional ability levels of children with chronic arthritis of the feet and/or ankles when compared with prefabricated off-the-shelf flat neoprene shoe inserts and supportive athletic shoes worn alone. Our study suggests that this intervention should become a standard part of the overall medical regimen for children with foot and/or ankle arthritis. Further, custom foot orthotics should become a standard insurance benefit for patients with arthritis. Additional studies will ascertain whether our results can also be demonstrated in patients with anatomic anomalies or previous surgery, or those with significant disability.

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