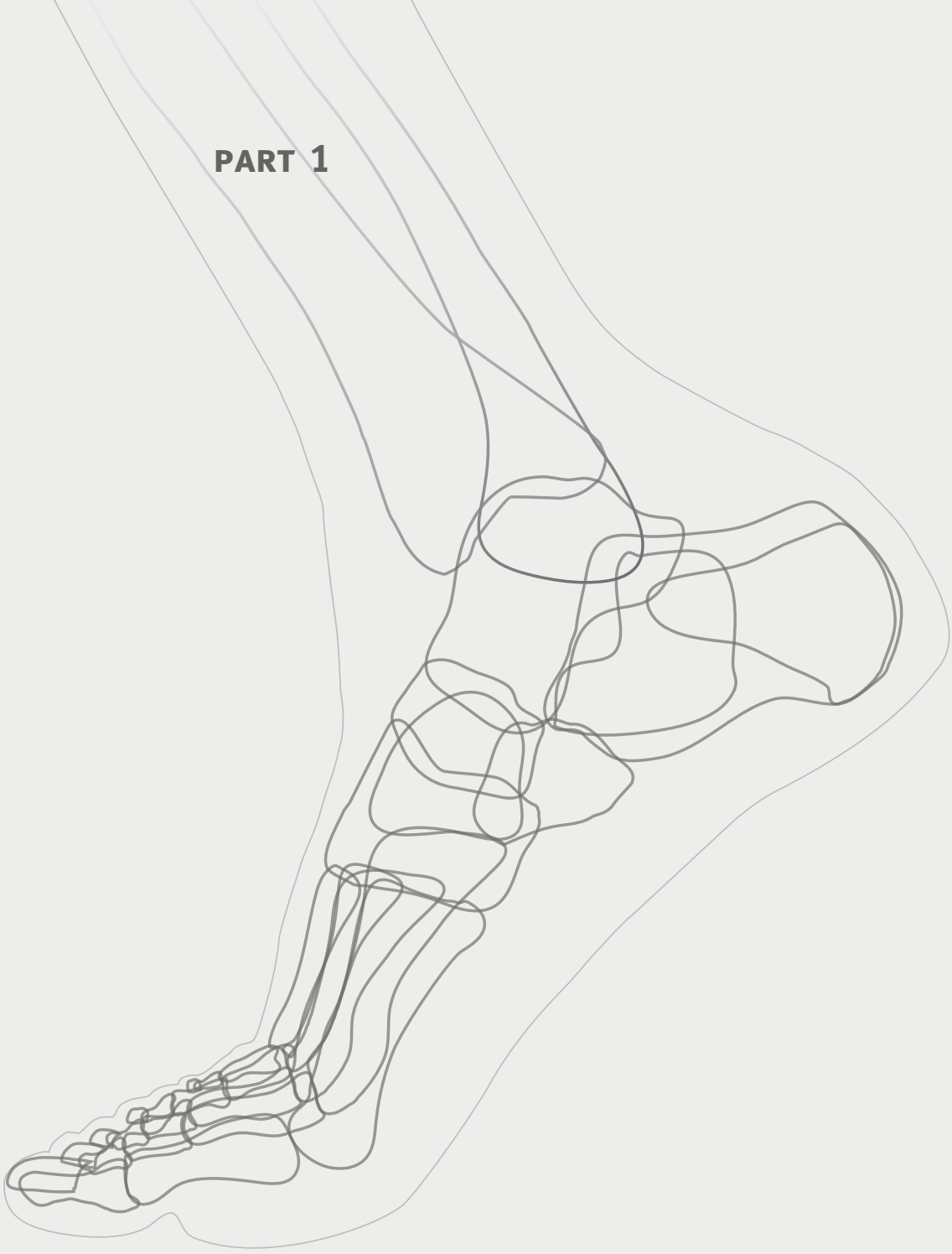
PART 1



CHAPTER 3

The effectiveness of therapeutic shoes in patients with rheumatoid arthritis: a systematic review and meta-analysis

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Abstract

The study summarizes the evidence on the effectiveness of therapeutic shoes on foot function, foot pain, physical functioning, health-related quality of life, adherence, adverse events and patient satisfaction in patients with rheumatoid arthritis (RA). Studies investigating the effect of (ready- or custom-made) therapeutic shoes were included. For between-group designs, studies comparing therapeutic shoes versus non-therapeutic shoes were included. A literature search was conducted in The Cochrane Central Registry for Controlled Trials (CENTRAL), PubMed, EMBASE and PEDro up to January 19, 2017. Quantitative data analysis was conducted; when this was not possible qualitative data analysis was performed. Eleven studies were identified. For custom-made shoes, no studies reporting between-group differences were available. Qualitative data-syntheses of the within-group differences resulted in weak evidence for the reduction of foot pain and improvement of physical functioning. For ready-made shoes, one study reported between-group differences, resulting in inconclusive evidence for improvement of foot function. Quantitative data-analyses of within-group differences resulted in a medium to large effect for the reduction of foot pain (SMD 0.60, 95% CI 0.28–0.92; $P \leq 0.001$; 184 participants) and a small to medium effect for the improvement of physical functioning (SMD 0.30, 95% CI 0.04–0.56; $P = 0.02$; 150 participants). Qualitative data-synthesis of within-group differences resulted in weak evidence for improvement of foot function. Within-group results indicate that therapeutic shoes are likely to be effective in patients with RA. Definitive high-quality RCTs are necessary to investigate the between-group effectiveness of therapeutic shoes in patients with RA.

Background

Foot problems are highly frequent in patients with rheumatoid arthritis (RA) [1-4]. Synovitis of foot joints can lead to joint damage and deformity and subsequently to pain, disability and inability of wearing over-the-counter shoes [5, 6]. The primary approach in the management of RA is systemic pharmacological treatment. An additional locally administered (surgical or conservative) treatment could be required, for example therapeutic shoes [7, 8]. Therapeutic shoes include custom-made and ready-made shoes. Custom-made shoes are developed for the individual patient based on specific measures and specifications, whereby a variety of technical adaptations can be incorporated [9, 10]. Ready-made shoes are serial-produced shoes with extra depth, support, incorporated inlays or technical adaptations [9, 10].

Therapeutic shoes are recommended in guidelines for the treatment of foot problems in patients with RA [11-13]. Especially in patients with established RA and foot deformities or erosions in foot joints, therapeutic shoes are commonly prescribed and frequently used [14, 15]. Two systematic reviews reported evidence that extra-depth therapeutic shoes (with or without foot orthoses) are effective in reducing pain during weight-bearing activities in patients with RA [7, 8]. One systematic review showed positive effects of custom-made foot orthoses on foot pain and plantar pressure distribution in RA [16]. The findings of the reviews on therapeutic shoes (published in 2001 and 2005) were based on a limited number of studies, older than 10 years, while more recent studies are published [7, 8]. Furthermore, the included studies did not cover the whole range of therapeutic shoes available, and no quantitative data-syntheses were conducted [7, 8]. Therefore, the aim of the present review was to systematically summarize the literature (up to January 2017) on the evidence on (i) the effectiveness of therapeutic shoes on the primary outcomes foot function (gait characteristics or plantar foot pressure), foot pain, physical functioning and health-related quality of life (HRQoL), and on (ii) the secondary outcomes compliance (adherence), adverse events and patient satisfaction in patients with RA who received therapeutic shoes.

Methods

Protocol and registration

A detailed protocol for the present study has been previously published in PROSPERO (Prospero Record Registration No.: CRD42016047225). The manuscript was written in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement [17].

Eligibility criteria

Types of studies

Randomized controlled trials (RCT), randomized controlled cross-over trials, (quasi-experimental) clinical trials, prospective- and retrospective uncontrolled studies were included. Only full-text original research reports, published in English, German, French, or Dutch were included. No restrictions concerning the year of publication were used.

Types of participants

The study population comprised adult patients diagnosed with RA, or a defined subgroup of RA patients existed in the study population for whom data were presented separately.

Type of intervention and comparisons

Patients received therapeutic custom-made or ready-made shoes for the treatment of RA related foot problems. For between-group designs, studies comparing therapeutic shoes *versus* non-therapeutic shoes (the patient's own shoes or standardized conventional shoes) were included.

Type of outcomes

Studies were eligible if foot function (pressure or gait parameters), foot pain, physical functioning (performance-based or self-reported), health related quality of life (HRQoL), participant satisfaction, adverse events or adherence were assessed. If the study provided data from more than one measurement instrument, data were analyzed that were highest in hierarchy based on the psychometric properties of the instruments used [18]. The following hierarchies (highest to lowest within the categories i-iv) were used: (i) foot function: *plantar pressure measurement, gait analyses, (ii)* foot pain: *Foot Function Index subscale pain (FFI pain), Visual Analogue Scale for foot pain during walking (VAS foot pain), other instrument, (iii)* physical functioning: *Foot Function Index subscale disability (FFI disability), timed walking test, other instrument,* and (iv) HRQoL: *Foot Health Status Questionnaire subscale general health (FHSQ general health), Visual Analogue Scale for general well-being (VAS general well-being), other instrument.*

Information sources, search and study selection

The following electronic databases were searched from inception to January 19, 2017: the Cochrane Central Registry for Controlled Trials (CENTRAL), PubMed, EMBASE and PEDro. A two-way search strategy was employed using "rheumatoid arthritis" with "shoes" and related synonyms. The following database search strategy for PubMed was used: (("Arthritis, Rheumatoid"[Mesh] OR rheumatoid arthritis [tiab])) AND ("Shoes"[Mesh] OR shoe* [tiab] OR footwear* [tiab]). Each database was searched independently by two researchers (MTD and MvdL). In addition, references lists of all selected publications were checked to retrieve relevant publications which have not been found with the computerized search.

Titles or abstracts were first screened independently by two reviewers (MTD and MvdL). For each selected study, the full article was retrieved. Next, the two reviewers independently

performed final selection of studies to be included in the review based on the eligibility criteria. Disagreements on inclusion were resolved by discussion between the two reviewers.

Data collection process, data items and summary measures

Data were extracted by one reviewer (MTD) using a standardized template, and verified by a second reviewer (MvdL). Information was extracted from each included study on: authors, year of publication, study design, participant description (number of participants, setting, diagnosis, age and clinical characteristics), description of intervention, longest point of follow-up, outcome measures and -if applicable- mean and standard deviations for baseline, follow-up and change scores in the outcomes, or percentages of change in the outcomes. Means were estimated from graphs, when no numerical data were supplied [19]. Disagreements or discrepancies on data extraction were resolved by discussion.

Methodological quality of individual studies

The methodological quality of RCTs for between group comparisons was assessed with the Physiotherapy Evidence Database (PEDro) scale [20]. The PEDro scale has been shown to be a valid, reliable and frequently used tool [21-23]. It consists of 11 items to measure the quality of each included trial. Eight items (item 2-9) are used to assess internal validity and two items to assess interpretability of results (item 10-11). Item 1, assessing external validity, is excluded in calculating the total score [24]. Therefore, the score may range from 0 to 10 points. When blinding of subjects or therapists was not feasible the maximum possible score is 8, e.g. when the patient's own shoes were used as control intervention. The score obtained for each study was divided by the maximum possible score and multiplied by 100 to provide a "study quality percentage". Study quality percentages were then classified as high (60-100%), fair (40-50%), or low (≤30%) according to Teasell et al. [25].

The methodological quality for within-group comparisons in RCTs, randomized controlled cross-over trials, (quasi-experimental) clinical trials, prospective- and retrospective uncontrolled studies was assessed by using the Downs and Black checklist [26]. This checklist is recommended by the COCHRANE for quality assessment of non-controlled trials [27]. The checklist consists of 27 items which assess the strength of reporting, external validity, internal validity and statistical power. As recommended in the literature, the power subscale (question 27) was not used in this study due to item ambiguity [28]. Moreover, the five questions (5, 14, 23, 24 and 25) specific for between-group comparison were excluded. Therefore, a 21-item scale was used with a score ranging from 0 to 21 points. The score obtained for each study was divided by the maximum possible score and multiplied by 100 to provide a "study quality percentage". Study quality percentages were then classified as low (< 50.0%), fair (≥ 50.0 and < 66.6%) and high (≥ 66.7%)[29].

Quality assessments were independently evaluated by two reviewers (MTD and MvdL). Disagreements were resolved by discussion and, if necessary, by consultation of the third reviewer (JD).

Data synthesis

Data synthesis was conducted for the effect of therapeutic shoes on foot function, foot

pain, physical functioning, HRQoL, participant satisfaction, adverse events or adherence. A distinction was made between (i) ready-made and custom-made therapeutic shoes, and (ii) within-group and between-group comparisons.

Quantitative data analysis (meta-analysis) was conducted for outcome measures that had pre- and post-test scores available. Sensitivity meta-analyses (fair- and high- quality studies versus low-, fair- and high- quality studies) were conducted in case of a sufficient number of studies. Pooling of effect sizes across studies was performed using the standardized mean difference (SMD) and 95% confidence intervals (CI) in a random effects model [30]. SMDs were interpreted as 0.2 (small), 0.5 (medium) and 0.8 (large) [31]. The results are presented in forest plots for each comparison. Meta-analyses were conducted in Review Manager (RevMan 5.3) computer software. Heterogeneity was tested using the eye ball test (forest plot) and by calculating I^2. The level of heterogeneity was categorized as low (<25%), moderate (>25% and <75%) and high (>75%) [32]. Results of meta-analyses with a high level of heterogeneity across studies were interpreted with caution.

When quantitative data analysis was not possible a qualitative data analysis (best-evidence synthesis) was conducted for outcome measures that had pre- and post-test scores available. The data were summarized by assigning five levels of evidence (strong, moderate, weak, inconclusive and inconsistent) according to criteria adapted from Ariëns et al. (***Table 1***) [33].

Results

Study selection

The literature search resulted in a total number of 505 hits. After duplicate removal, 288 hits were screened on title or abstract. This resulted in 16 full-text articles that were studied for eligibility, of which 11 articles were included in the systematic review ***(Figure 1)***. A post hoc search for ongoing clinical trials was conducted in the trial registers of the U.S. National Library of Medicine and the World Health Organization, as suggested by peer reviewers. No relevant ongoing trials were identified.

Characteristics of included studies

The included studies consisted of three randomized controlled trials [34-36], two randomized controlled cross-over trials [37,38], four prospective uncontrolled studies [9,39-41], and two retrospective uncontrolled studies [42, 43]. Two studies comprised a between-group design comparing ready-

Table 1. Strength of evidence criteria [33]

Strong	At least 2 high-quality studies with consistent findings
Moderate	1 high-quality study and at least 2 low-quality studies with consistent findings
Weak	At least 2 low-quality studies with consistent findings
Inconclusive	Insufficient or conflicting studies
Inconsistent	Agreement of findings in <75% of studies

made therapeutic shoes with non-therapeutic shoes [35, 38] of which one study reported between-group differences [38]. A detailed description of the included studies is presented in ***Table 2***.

Methodological quality of included individual studies

Initial overall agreement on methodological quality scores for between-group comparisons was 100% and for within-group comparisons 94%. No consultation of the third reviewer was necessary to resolve disagreement. Two studies with a between-group design (ready-made therapeutic shoes *versus* non-therapeutic shoes) were included, of which one was considered to be of high quality [38], and one of fair quality [35]. Ten studies reported within-group differences after wearing custom-made therapeutic shoes [9, 42, 43] or ready-made therapeutic shoes [34-37, 39-42]. Two studies were considered to be of high quality [9, 37], and three of low quality [41-43]. Methodological quality for between-group differences is presented in ***Table 3*** and for within-group differences is presented in ***Table 4***.

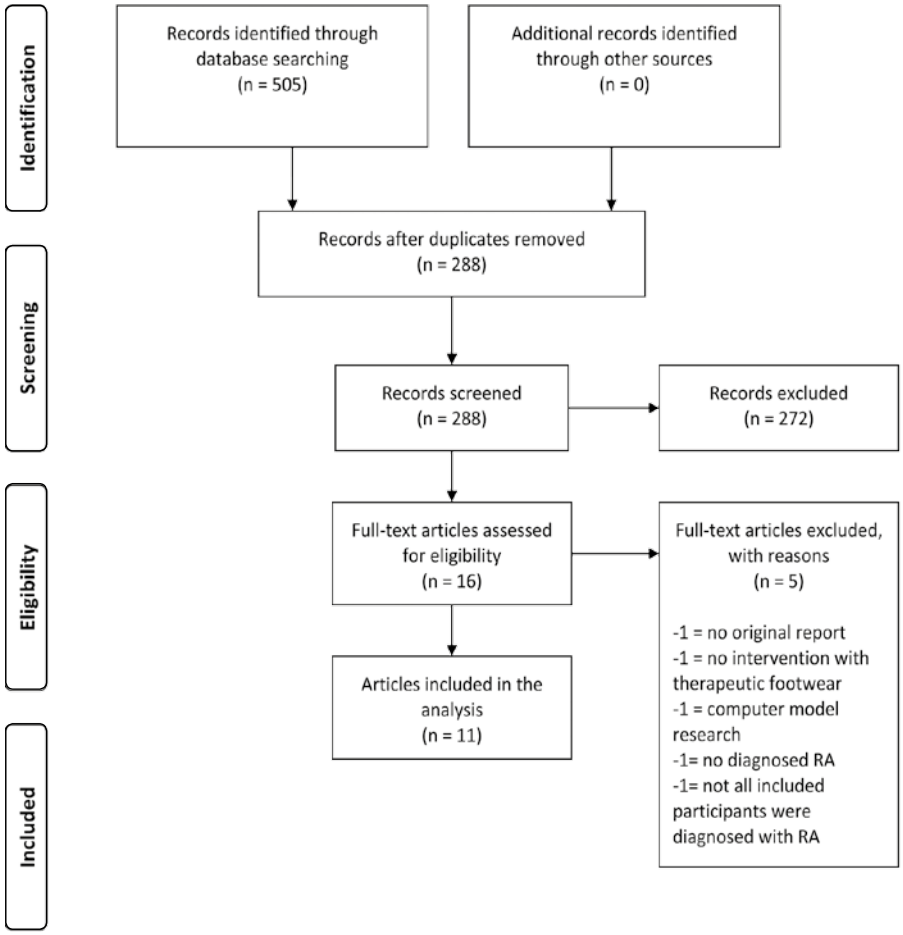


Figure 1. PRISMA flow diagram

Table 2. Characteristics of included studies

Author (year)	Study design	Participant description	Intervention	Time	Outcome
Dahmen et al. 2014 (9)	prospective uncontrolled study	- N=114 - outpatient clinic - definite diagnosis of RA - median age 60 (IQR 48-67) - prescription of custom-made therapeutic footwear for the first time	*Custom-made therapeutic shoes:* - hand-made therapeutic shoes for the individual patient	26 weeks	WOMAC *(primary outcome)* VAS pain Likert scale for joint pain HAQ wearing quotient (actual/maximum wearing duration) *(primary outcome)* actual wearing duration (hours per day)
Park et al. 1981 (43)	retrospective uncontrolled study	- N=71 - RA - Mean age 58.3 (range 38-75) - foot problems (metatarsalgia, bunions, etc.)	*Custom-made therapeutic shoes:* - individually made surgical shoes	-	relief of symptoms^ adherence^ reasons for dissatisfaction with footwear^ footwear acceptability^
Pullar et al. 1983 (42)	retrospective uncontrolled study	- N=39 - RA - age range 29-78 - prescription for special footwear	*Custom-made therapeutic shoes:* - individually made surgical shoes Ready-made therapeutic shoes: - shoes made to more general specifications (comfort shoes)	-	adherence^ adverse events^ satisfaction^
Chalmers et al. 2000 (37)	randomized controlled cross-over trial	- N=28 - occupational therapy department of hospital - definitive diagnosis of RA - age women: mean 60 (SD 10) - age men: mean 63 (SD 2) - subluxed MTP joints - bilaterally MTP joint pain	*Ready-made therapeutic shoes:* - extra-depth supportive shoes with semi-rigid orthoses - extra-depth supportive shoes with soft orthoses - extra-depth supportive shoes with original insoles	12 weeks for each intervention, separated by 2 week washouts	50 foot walking time, s* VAS pain *(primary outcome)* RB* TADL VAS treatment effectiveness treatment preference questionnaire
Cho et al. 2008 (34)	randomized controlled trial	- N=42 (22 intervention-group, 20 control-group) - university hospital - definitive diagnosis of RA - stable disease activity - mean age 48.7 (SD 11.7) - foot pathology	*Ready-made therapeutic shoes:* - forefoot-rockered extra depth shoes with a wide toebox with custom made insoles consisting of a medial longitudinal arch support, medial heel post and metatarsal pad. - forefoot-rockered extra depth shoes with a wide toebox with ready-made soft simple insoles	6 months	VAS pain *(primary outcome)* FFI *(primary outcome)*
Fransen et al. 1997 (35)	randomized controlled trial	- N=30 (15 intervention-group, 15 control-group) - public hospital - RA - stabilized arthritis medication - mean age intervention-group: 59.1 (SD 14.2) - mean age control-group: 60.1 (SD 8.9) - foot pain	*Ready-made therapeutic shoes:* - extra depth shoes with long inside counter, pillow back foam-padded collar, soft leather upper with removable cushion inlay *Non-therapeutic shoes:* - the patient's own shoes	2 months	8-meter electric footswitch walkway (velocity, cadence, stride)* pain free walking time in minutes^ VAS pain during walking VAS pain during ascending/descending stairs VAS general fatigue VAS general well-being HAQ

2. Continued

r (year)	Study design	Participant description	Intervention	Time	Outcome
ssy et al. 38)	randomized, single blind, cross-over trial	- N=20 - community sample of patients recruited - definite diagnosis of RA - stable RA - mean age 59.9 (SD 11.0) - forefoot pain	*Ready-made therapeutic shoes:* - off-the shelf orthopaedic footwear: Canfield Leisure and Leisure for women and men (P.W. Minor and Son, Batavia, New York, USA) *Non-therapeutic shoes:* - standardized conventional (control) shoes: Dunlop Volley (Pacific Dunlop Ltd., Melbourne, Australia) worn without the sockliner - running footwear: Brooks Glycerin 3 (Texas Peak Pty Ltd., Melbourne, Australia), commercially available 'premium' cushioned	-	in-shoe plantar foot pressure (peak pressure, pressure-time integral) *(primary outcome)* VAS perception of footwear comfort nomination of the most acceptable footwear^
ms et al. 36)	randomized controlled trial	- N=80 (40 traditional design-group, 40 new design-group) - four local rheumatology clinics - definite diagnosis of RA - foot deformity and pain - difficulty in obtaining retail footwear	*Ready-made therapeutic shoes:* - traditional design ready-made therapeutic shoes (current footwear developed by clinicians to meet the clinician's perceptions of patient's needs, with flat insole) - new design ready-made therapeutic shoes (incorporation of several features that were identified by the patient as being their preferred features of footwear, with firm contoured insole)	12 weeks	FFI *(primary outcome)* FHSQ (primary outcome)
t et al. 1976	prospective uncontrolled study	- N=25 - hospital - stable RA - forefoot deformities and callosities - high functional level	*Ready-made therapeutic shoes:* - experimental and individually adapted sandal with adequate width and length, a forgiving innersole with a short heel, and sole lever arms.	6 months	Harris mat footprint test (plantar pressure assessment) Brand slipper sock test (plantar pressure assessment) Likert scale for foot pain
rzadeh et al. 2013	prospective uncontrolled study	- N=18 - definite diagnosis of RA, with non-active disease - mean age 47.16 (SD 8.1) - foot and ankle pain	*Ready-made therapeutic shoes:* - high-top shoes extended above the lateral malleoli, wide toe box and velcro closures adapted with a custom made heel-to-toe rocker sole	30 days	FFI
r et al. 1990	prospective uncontrolled study	- N=25 - outpatient clinic - definite diagnosis of RA - mean age 57 (range 35-74) - forefoot pain and deformity - difficulty in obtaining retail footwear	*Ready-made therapeutic shoes:* - light weight heath-mouldable shoes with extra depth and extra forefoot width	≥3 months	NRS walking ability NRS comfort

visual analogue scale. RB = Robinson Bashall Functional Assessment. TADL = Toronto Activities of Daily Living Measure. FFI = foot function index. WOMAC = Western ontario and McMasters universities osteoarthritis Index. HAQ = Health Assessment Questionnaire. numeric rating scale. FHSQ = Foot Health Status Questionnaire. ^= interview-based. *= performance-based. Age mean (SD).

Table 3. Methodological quality for between-group designs of RCTs as evaluated using the PEDro checklist

Reference	External validity (0-1)	Internal validity (0-10)										Total score	Quality
	1	2	3	4	5	6	7	8	9	10	11		
Fransen et al. 1997 (35)*	1	1	0	1	na	na	0	1	0	0	1	4/8 (50%)	Fair
Hennessy et al. 2007 (38)*	1	1	1	1	1	0	0	1	1	1	1	8/10 (80%)	High

* = ready-made therapeutic shoes. High quality = study quality percentage 60-100%. Fair quality = study quality percentage 40-50%. *Low quality = study quality percentage* ≤30%. *na = not applicable.*

Table 4. Methodological quality of within-group differences as evaluated using the Downs & Black checklist

Reference	Reporting (0-11)									External validity (0-3)			Internal validity: bias (0-7)						Internal validity: Confounding (0-6)			Total score	Quality
	1	2	3	4	6	7	8	9	10	11	12	13	15	16	17	18	19	20	21	22	26		
Dahmen et al. (9)^	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	18/21 (86%)	High
Park et al. (43)^	1	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5/21 (24%)	Low
Pullar et al. (42)^*	1	0	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	9/21 (43%)	Low
Chalmers et al. (37)	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	18/21 (86%)	High
Bagherzadeh Cham et al. (39)*	1	1	1	1	1	1	0	1	1	0	0	0	0	1	1	1	0	1	0	0	1	13/21 (62%)	Fair
Cho et al. (34)*	1	1	1	1	1	1	0	0	1	0	0	0	0	0	1	1	0	1	1	1	0	12/21 (57%)	Fair
Fransen et al. (35)*	1	1	1	1	1	1	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	12/21 (57%)	Fair
Moncur et al. (40)*	1	1	0	1	1	0	1	1	1	0	0	0	0	1	0	1	1	1	1	0	1	13/21 (62%)	Fair
Williams et al. (36)*	1	1	1	1	1	1	1	0	1	0	0	1	0	1	1	1	0	1	0	0	0	13/21 (62%)	Fair
Barrett et al. (41)*	1	1	0	1	1	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	8/21 (38%)	Low

^ = custom-made therapeutic shoes. * = ready-made therapeutic shoes. High quality = study quality percentage ≥66.7%. Fair quality = study quality percentage ≥50.066.6%. Low quality = study quality percentage <50.0%. na = not applicable.

Custom-made therapeutic shoes: between-group effects

For custom-made shoes no data-synthesis was performed due to a lack of studies investigating the between-group effects.

Custom-made therapeutic shoes: within-group effects

For custom-made therapeutic shoes qualitative syntheses of within-group results and an overview of evidence is presented in ***Appendix 1***.

Foot pain

Qualitative data-synthesis resulted in weak evidence for the effect of custom-made therapeutic shoes on foot pain in a within-group comparison. Reduction of foot pain was found in one high quality study [9] and one low quality study [43]. In the high quality study a significant foot pain reduction of 10% was found, after wearing custom-made therapeutic shoes [9].

Physical functioning

Qualitative data-synthesis resulted in weak evidence for the effect of custom-made therapeutic shoes on physical functioning in a within-group comparison. Improvement in physical functioning was found in one high quality study [9] and one low quality study [43]. In the high quality study a significant 9% improvement in self-reported physical functioning was found, after wearing custom-made therapeutic shoes [9].

Secondary outcomes

Adherence was investigated in three studies: one of high [9] and two of low quality [42, 43]. A mean wearing quotient of 54% (SD 25.0) and a mean wearing time of 7.7 (SD 3.8) hours a day was reported in one study of high quality [9]. Adverse events and patient satisfaction were reported in two studies of low quality [42, 43]. A detailed description is presented in ***Appendix 1***.

Ready-made therapeutic shoes: between-group effects

For ready-made therapeutic shoes qualitative synthesis of between-group results and an overview of evidence is presented in ***Appendix 2***. Only one included RCT reported between-group differences for the comparison of (ready-made) therapeutic shoes *versus* non-therapeutic shoes (standardized conventional shoes).

Foot function

Qualitative data-syntheses resulted in inconclusive evidence for the effect of ready-made therapeutic shoes on foot function in a between-group comparison. One high quality randomized, single blind, cross-over trial was included in this analysis [38]. In this study a comparison was made between ready-made therapeutic shoes and standardised conventional (control) shoes. A significant reduction of in-shoe plantar peak pressure (kPa) and in-shoe pressure-time integral (kPa s) in regions of interest was found favoring patients wearing ready-made therapeutic shoes compared to those wearing control shoes [38].

Secondary outcomes

Qualitative data-syntheses resulted in inconclusive evidence for the effect of ready-made therapeutic shoes on patient satisfaction in a between-group comparison. Patient satisfaction was investigated in one high quality [38] randomized controlled cross-over trial. A significant higher patient satisfaction was found in patients who received ready-made therapeutic shoes compared to patients who received standardised conventional (control) shoes.

Ready-made therapeutic shoes: within-group effects

For ready-made therapeutic shoes an overview of within-group results is presented in *Appendix 3*.

Figure 2. Forest plot of data pooling for the within-group differences of (a) foot pain, (b) physical functioning, and (c) health related quality of life, after wearing ready-made therapeutic shoes.

Figure 2a. forest plot for within group differences of foot pain after wearing ready-made therapeutic shoes

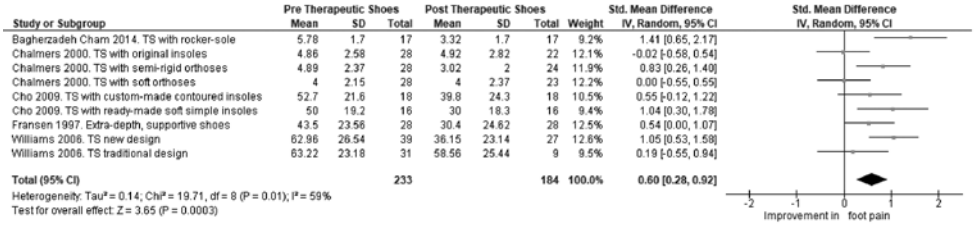


Figure 2b. forest plot for within group differences of physical functioning (self-reported and performance-based) after wearing ready-made therapeutic shoes

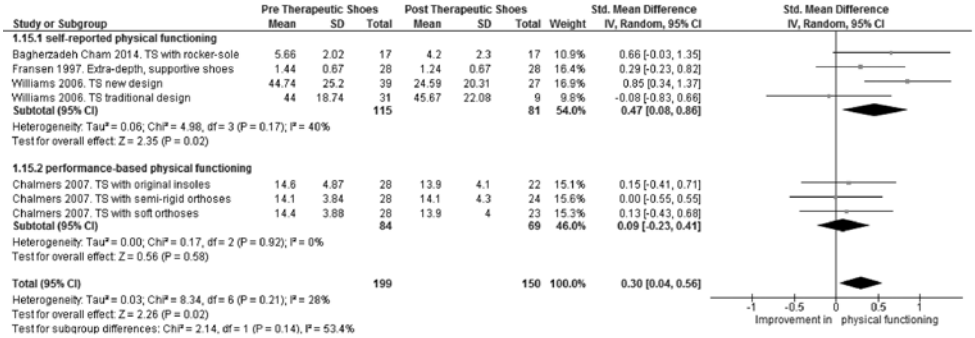
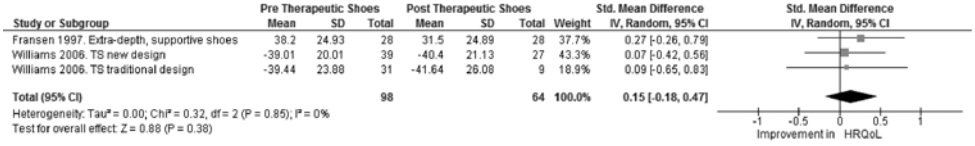


Figure 2c. forest plot for within group differences of health related quality of life after wearing ready-made therapeutic shoes



Foot function

Qualitative data-synthesis resulted in weak evidence for the effect of ready-made therapeutic shoes on foot function in a within-group comparison. Improvement of gait characteristics (gait velocity, cadence and stride length) were found in one fair quality study [35]. Reduction of plantar pressure in high pressure areas was found in one low quality study [43].

Foot pain

The effect of ready-made therapeutic shoes on foot pain was investigated in a within-group comparison in six studies: three RCT's [34-36], one randomized controlled cross-over trial [37], and two prospective uncontrolled studies [39, 41]. The within-group differences reported in five out of six studies were included in a meta-analysis to pool the final pain scores [34-37, 39]. Pooled scores showed a medium to large, statistically significant, effect for the reduction of foot pain after wearing ready-made therapeutic shoes (SMD 0.60, 95% CI 0.28 to 0.92; P≤0.001; 184 participants; ***Figure 2a***). Statistical heterogeneity was moderate (Heterogeneity: Chi^2=19.71, df=8 (P=0.01); I^2=59%).

Physical functioning

The effect of ready-made therapeutic shoes on physical functioning was investigated in a within-group comparison in five studies: two RCT's [35, 36], one randomized controlled cross-over trial [37] and two prospective uncontrolled study's [39, 40]. The within-group differences reported in four out of five studies were included in a meta-analysis to pool the final physical functioning scores [35-37, 39]. Pooled scores showed a small to medium, statistically significant, effect for the improvement of physical functioning after wearing ready-made therapeutic shoes (SMD 0.30, 95% CI 0.04 to 0.56; P=0.02; 150 participants; ***Figure 2b***). Statistical heterogeneity was moderate (Heterogeneity: Chi^2=8.34, df=6 (P=0.21); I^2=28%). Additional sensitivity analysis showed a medium, statistically significant, effect for the improvement on self-reported physical functioning after wearing ready-made therapeutic shoes (SMD 0.47, 95% CI 0.08 to 0.86; P=0.02; 81 participants; ***Figure 2b***), but no effect on performance-based physical functioning was found (SMD 0.09, 95% CI -0.23 to 0.41; P=0.92; 69 participants; ***Figure 2b***).

Health related quality of life

The effect of ready-made therapeutic shoes on HRQoL was investigated in a within-group comparison in two RCT's [35, 36]. The within-group differences reported in the RCT's were included in a meta-analysis to pool the final HRQoL scores [35, 36]. Pooled scores showed a non-significant effect for the improvement of HRQoL after wearing ready-made therapeutic shoes (SMD 0.15, 95% CI -0.18 to 0.47; P=0.38; 64 participants; ***Figure 2c***). Despite the clinical heterogeneity of HRQoL measures, statistical heterogeneity was absent (Heterogeneity: Chi^2=0.32, df=2 (P=0.85); I^2=0%).

Secondary outcomes

Adherence was investigated in three studies (one of high quality [37], one of fair quality [40] and one of low quality [42]). In the high quality study a mean wearing time of 6.2 (SD 2.3) and 5.9

(SD 2.4) hours a day was reported for two types of ready-made therapeutic shoes [37]. The fair quality study reported that the ready-made therapeutic shoes were worn all day in 80% of the patients [40].

Adverse events were investigated in three studies (two of fair quality [36, 40] and one of low quality [42]). In these fair quality studies the most common adverse events were "heels slipped out of the shoes" in 5% of the patients [36] and "the shoes are hot to wear" in 5% [36] and 12% [40] of the patients.

Patient satisfaction was investigated in two studies (one of fair quality [40] and one of low quality [42]). In the fair quality study a significant improvement of 4.4 points on a Numeric Rating Scale for comfort was found after wearing ready-made therapeutic shoes [40].

Discussion

The objective of the present study was to investigate whether therapeutic shoes reduce pain and improve foot function, physical function and HRQoL in patients with RA. Furthermore, the secondary outcomes adherence, adverse events and patient satisfaction after wearing therapeutic shoes in patients with RA were investigated. For custom-made therapeutic shoes, no studies were available investigating the effect in a between-group design (therapeutic shoes *versus* non-therapeutic shoes). In within-group designs, weak evidence was found for the reduction of foot pain and improvement of self-reported physical functioning. For ready-made therapeutic shoes, improvement in foot function (reduction of plantar pressure) was inconclusive, based on one controlled, between-group design [38]. In within-group designs, (i) weak evidence was found for the improvement of foot function, (ii) a medium to large effect was found for the reduction of foot pain and (iii) a small to medium effect was found for improvement of physical function.

Compared to the previously published systematic reviews on therapeutic shoes [7, 8], five additional studies were included in the present systematic review (two RCT's [34, 36], one randomized controlled cross-over trial [38], and two prospective non-controlled studies [9, 39]). The results of the present review confirmed the finding by Egan et al. [7] and Farrow et al. [8] that therapeutic shoes are likely to be beneficial in reducing foot pain in patients with RA (based on within-group effects). Additionally, our review showed evidence for the improvement of physical functioning after wearing custom-made and ready-made therapeutic shoes. Finally, in the present study the within-group differences of foot function, foot pain, physical functioning and HRQoL after wearing ready-made therapeutic shoes were quantified.

Overall, few high quality studies with relatively small sample sizes were included in the present review. Due to a limited number of studies, there was inconclusive evidence from between-group comparisons that therapeutic shoes are more effective than non-therapeutic shoes. Only one included study (n=20) compared (ready-made) therapeutic shoes with the control intervention (non-therapeutic shoes; standardized conventional shoes) [38]. Furthermore, within this study running shoes were compared with the control intervention [38]. The results of this study showed a significant better perceived comfort and significant

plantar pressure reduction for the therapeutic- and running shoe-conditions compared to the control-condition. However, more plantar pressure reduction was found during wearing the running shoes than during wearing the therapeutic shoes. Another study (n=30) investigated the effect of (ready-made) therapeutic shoes compared to non-therapeutic shoes (the patient's own shoes) [35]. However, no between-group results were reported in this study [35]. The results of this study showed an improvement (with small to large effect sizes) in the therapeutic shoes-group in weight-bearing pain scores, physical function, gait velocity and gait stride length [35]. In contrast, no significant changes in pain, physical functioning or gait scores in the non-therapeutic shoes-group were found [35]. For quantification of between-group differences of therapeutic shoes on foot function, foot pain, physical functioning and HRQoL additional research is necessary. In future research it is recommended to conduct definitive, high-quality RCTs with adequate sample sizes to investigate the effect of (i) custom-made therapeutic shoes *versus* control shoes or the patient's own shoes, (ii) ready-made therapeutic shoes *versus* control shoes or the patient's own shoes, and (iii) custom-made therapeutic shoes *versus* ready-made therapeutic shoes. Recruitment of patients with an indication for therapeutic shoes should be considered, whereby patients on a waiting list for therapeutic shoes could serve as a control group. Furthermore, conducting a randomized controlled cross-over trial with washout-periods between interventions can be considered [37]. Whether such an RCT should be conducted in a national or international context should also be taken into consideration. Across countries there are significant differences in prescribing, designing and producing therapeutic shoes, as well as financial compensation from health care insurances.

Adherence was reported in six out of thirteen included studies, showing variable wearing-duration across studies. Adherence is an important factor for the effectiveness of therapeutic shoes [44]. Assessment of adherence can be based on observational measurements or on self-report, for example by using patient diaries or the Monitor-Orthopedic-Shoes questionnaire [9, 45]. Preferably an objective measurement instrument is used, for example a temperature-based adherence-to-treatment monitor which can be incorporated in the therapeutic shoes [46]. Low adherence of therapeutic shoes is a well-known problem [47]. Strategies to improve adherence target the usability (effectiveness, efficiency and satisfaction) and acceptance of therapeutic shoes by the patient [45, 48]. Usability and acceptance can be influenced by involving the patient in the designing and monitoring process of the therapeutic shoes to meet both clinical needs of the patient and personal needs related to body image [36]. Good communication between prescribing clinicians and the individual patients is of great importance [48]. Using specific communication techniques for improved acceptance and adherence of therapeutic shoes can be considered [49].

The systematic review highlights some areas for further research. Foot function was understudied, only three studies report on this outcome domain [35, 38, 41], and in the oldest study non-digital measurements were used [41]. Nowadays, digital walkway systems and plantar pressure measurements (especially in-shoe plantar pressure measurements) would be more applicable [46, 50]. Another area for further research is the responsiveness of measurement instruments. For most of the measurement instruments in the included studies, the ability to detect change over time in the construct to be measured is unknown [18]. Furthermore,

different shoe characteristics of therapeutic shoes were investigated in the included studies (e.g. different types of incorporated foot orthoses and technical adaptations and the use of different materials). In the present review we made a distinction between custom-made and ready-made therapeutic shoes. However, also within these types of therapeutic shoes the shoe characteristics varied. It is therefore not possible to draw conclusions from our review regarding the effect of specific shoe characteristics on foot-related outcomes. This implies that defining indications for specific shoe characteristics could be topics for future research. Also, further investigation on summarizing the effect of studies comparing different orthoses can be recommended [34, 36, 37]. This was not within the focus of the present study.

The present study has some limitations. A possible limitation is that we included only published full-text articles. It may be that not all studies carried out have actually been published. Therefore publication bias cannot be ruled out. Another limitation could be the method used for assessing the methodological quality of within-group comparisons. Due to the absence of a checklist specific for within-group designs, a checklist (Downs and Black) developed for assessing randomized and non-randomized trails was used. The items specific for between-group designs were omitted.

Conclusions

Within-group results indicate that therapeutic shoes are likely to be effective in patients with RA. Definitive, high-quality RCTs with adequate sample sizes are necessary to investigate the between-group effectiveness of therapeutic shoes in patients with RA.

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Appendices

Appendix 1. Qualitative synthesis of within-group results and overview of evidence for custom-made therapeutic shoes

Author, year (ref.)	Intervention	Outcome	Results pre-TS median (IQR)	post-TS median (IQR)	p-value	Level of evidence
Foot pain						**Weak** *Consistent findings (reduction of foot pain) in one high quality study (9) and one low quality study (43)*
Dahmen et al, 2014 (9)	hand-made therapeutic shoes for the individual patient	VAS pain during walking (0-100)	68 (49-85)	48 (22-67)	<0.001	
		VAS pain at rest (0-100)	26 (10-51)	24 (8-49)	0.18	
		VAS pain during standing (0-100)	46 (27-72)	36 (18-57)	<0.001	
		WOMAC pain (0-100)	40 (30-60)	30 (15-45)	<0.001	
Park et al, 1981 (43)	individually made surgical shoes	63% relieve, 6% no relieve and 31% reduction of symptoms (metatarsalgia)				
Physical functioning						**Weak** *Consistent findings (improvement in physical functioning) in one high quality study (9) and one low quality study (43)*
Dahmen et al, 2014 (9)	hand-made therapeutic shoes for the individual patient	WOMAC physical functioning (0-100)	38 (24-59)	29 (16-46)	<0.001	
		WOMAC stiffness (0-100)	50 (25-63)	38 (25-50)	<0.001	
		HAQ total (0-3)	1.13 (0.75-1.63)	1.00 (0.63-1.47)	0.003	
		HAQ walking (0-3)	1.00 (0.00-2.00)	1.00 (0.00-1.00)	<0.001	
Park et al, 1981 (43)	individually made surgical shoes	63% relieve, 6% unrelieve and 31 reduction of symptoms (walking ability)				
Adherence						**Not applicable**
Dahmen et al, 2014 (9)	hand-made therapeutic shoes for the individual patient	Wearing quotient, % (SD)	54 (25)			
		Mean wearing time, h (SD)	7.7 (3.8)			
		VAS wear-and-tear (SD) (0-100)	40 (19)			
		69% worn (almost) continuously, 14% worn only on special occasions, 17% worn rarely or never				
Pullar et al, 1983 (42)	individually made surgical shoes	33% worn all day, 37% worn ≥0.5 day, 30% worn <0.5 day				
Park et al, 1981 (43)	individually made surgical shoes	52% worn all day, 35% worn part of the day, 10% worn occasionally, 3% never worn				
Adverse events						**Not applicable**
Pullar et al, 1983 (42)	individually made surgical shoes	15% with reasons “poor fit”, “hard leather”, “high ankles”				
Park et al, 1981 (43)	individually made surgical shoes	36% “difficult to break in”, 23% “weight”, 35% “fit and comfort”				
Patient satisfaction						**Not applicable**
Pullar et al, 1983 (42)	individually made surgical shoes	78% satisfied, 7% unsatisfied, 15% neither				
Park et al, 1981 (43)	individually made surgical shoes	51% satisfied, 49% unsatisfied				

TS = therapeutic shoes. IQR = interquartile-range. VAS = visual analogue scale. WOMAC = Western ontario and McMasters universities osteoarthritis Index. HAQ = Health Assessment Questionnaire. SD = standard deviation.

Appendix 2. Qualitative synthesis of between-group results and overview of evidence for ready-made shoes

Author, year (ref.)	Intervention	Outcome	Results			Level of evidence
Foot function			**TS mean (SD)**	**non-TS mean (SD)**	**p-value**	**Inconclusive**
Hennessy et al, 2007 (38)	ready-made therapeutic shoes: *- off-the shelf orthopaedic footwear* versus non-therapeutic shoes: *- standardized conventional (control) shoes*	In-shoe plantar peak pressure (kPa) total foot	332.6 (79.9)	409.5 (98.6)	<0.05	*Insufficient included studies investigated the effect of ready-made shoes on foot function in a between-group comparison*
		In-shoe plantar peak pressure (kPa) rearfoot	209.4 (53.1)	260.3 (70.3)	<0.05	
		In-shoe plantar peak pressure (kPa) midfoot	96.3 (37.9)	111.3 (50.6)	≥0.05	
		In-shoe plantar peak pressure (kPa) forefoot	326.0 (85.4)	404.5 (100.1)	<0.05	
		In-shoe plantar pressure-time integral (kPa s) total foot	116.8 (18.5)	143.5 (30.6)	<0.05	
		In-shoe plantar pressure-time integral (kPa s) rearfoot	62.2 (18.0)	66.2 (17.7)	≥0.05	
		In-shoe plantar pressure-time integral (kPa s) midfoot	35.5 (13.9)	36.4 (20.3)	≥0.05	
		In-shoe plantar pressure-time integral (kPa s) forefoot	83.0 (14.7)	107.3 (26.3)	<0.05	
Patient satisfaction			**TS mean (SD)**	**non-TS mean (SD)**	**p-value**	**Inconclusive**
Hennessy et al, 2007 (38)	ready-made therapeutic shoes: *off-the shelf orthopaedic footwear* versus non-therapeutic shoes: *- standardized conventional (control) shoes*	VAS perception of footwear comfort (0-150)	91.2 (40.3)	56.0 (44.4)	0.012	*Insufficient included studies investigated the effect of ready-made shoes on patient satisfaction in a between-group comparison*

TS = therapeutic shoes. non-TS = non-therapeutic shoes (conventional standardized shoes / the patient's own shoes. SD = standard deviation. VAS = visual analogue scale.

Appendix 3. Qualitative / quantitative synthesis of within-group results and overview of evidence for ready-made therapeutic shoes

Author, year (ref.)	Intervention	Outcome	Results			Level of evidence
			pre-TS mean (SD)	post-TS mean (SD)	p-value	
Foot function						**Weak** *Consistent findings (improvement of foot function) in one fair quality study (35) and one low quality study (41)*
Fransen et al, 1997 (35)	extra depth shoes with long inside counter, pillow back foam-padded collar, soft leather upper with removable cushion inlay	normal gait velocity ($cm.s^{-1}$)*	96.5 (22.6)	101.8 (21.8)	0.0004	
		normal cadence ($steps.min^{-1}$)*	104.1 (8.9)	105.1 (8.3)	0.35	
		normal stride length (cm)*	109.3 (22.6)	116.1 (22.6)	0.0001	
		fast gait velocity ($cm.s^{-1}$)*	114.7 (26.3)	122.0 (26.2)	0.0012	
		fast cadence ($steps.min^{-1}$)*	116.5 (11.4)	118.6 (10.1)	0.045	
		fast stride length (cm)*	118.2 (24.5)	124.6 (25.1)	0.0009	
Barrett et al, 1976 (41)	experimental and individually adapted sandal with adequate width and length, a forgiving innersole with a short heel, and sole lever arms.	plantar foot pressure with Harris mat footprint test	plantar pressure reduction in 80% of the high-pressure areas			
		plantar foot pressure with Brand slipper sock test	plantar pressure reduction in 91% of the high-pressure areas			
Foot pain						**Medium to large effect** *SMD 0.60 95% CI 0.28 to 0.92 P≤0.001*
Cho et al, 2009 (34)	forefoot-rockered extra depth shoes with a wide toebox with custom made insoles consisting of a medial longitudinal arch support, medial heel post and metatarsal pad	VAS foot pain (0-10)	52.7 (21.6)	39.8 (24.3)	<0.05	
Cho et al, 2009 (34)	forefoot-rockered extra depth shoes with a wide toebox with ready-made soft simple insoles	VAS foot pain (0-10)	50.0 (19.2)	30.0 (18.3)	<0.05	
Fransen et al, 1997 (35)	extra depth shoes with long inside counter, pillow back foam-padded collar, soft leather upper with removable cushion inlay	VAS foot pain during walking (0-100)	43.5 (23.56)	30.4 (24.62)	0.0002	
		VAS foot pain during stair descending/ascending	48.4 (22.46)	32.4 (24.13)	0.0001	
		VAS foot pain non-weight bearing	29.7 (27.86)	20.6 (23.97)	0.007	
		pain-free walking time (minutes)*	10.0 (14.65)	22.1 (20.49)	0.0007	
Williams et al, 2006 (36)	traditional design ready-made therapeutic shoes (current footwear developed by clinicians to meet the clinician's perceptions of patient's needs, with flat insole)	FFI pain (0-100) FHSQ foot pain (0-100)	63.22 (23.18) 44.04 (26.27)	58.56 (25.44) 39.45 (23.63)	0.13 0.37	
Williams et al, 2006 (36)	new design ready-made therapeutic shoes (incorporation of several features that were identified by the patient as being their preferred features of footwear, with firm contoured insole)	FFI pain (0-100) FHSQ foot pain (0-100)	62.96 (26.54) 39.13 (28.44)	36.15 (23.14) 65.04 (16.36)	0.00 0.00	
Chalmers et al, 2000 (37)	extra-depth supportive shoes with semi-rigid orthoses	VAS foot pain (0-10)	4.89 (2.37)	3.02 (2.00)	0.013	

Appendix 3. Qualitative / quantitative synthesis of within-group results and overview of evidence for ready-made therapeutic shoes

Author, year (ref.)	Intervention	Outcome	Results			Level of evidence
			pre-TS mean (SD)	post-TS mean (SD)	p-value	
Chalmers et al, 2000 (37)	extra-depth supportive shoes with soft orthoses	VAS foot pain (0-10)	4.00 (2.15)	4.00 (2.37)	≥0.05	
Chalmers et al, 2000 (37)	extra-depth supportive shoes with original insoles	VAS foot pain (0-10)	4.86 (2.58)	4.92 (2.82)	≥0.05	
Bagherzadeh Cham, 2014 (39)	high-top shoes extended above the lateral malleoli, wide toe box and velcro closures adapted with a custom made heel-to-toe rocker sole	FFI pain (0-10)	5.78 (1.7)	3.32 (1.7)	0.001	
Barrett et al, 1976 (41)	experimental and individually adapted sandal with adequate width and length, a forgiving innersole with a short heel, and sole lever arms.	Likert scale for foot pain (1= no pain, 5=pain with each step)	60% improved from category 5 to 2 40% improved from category 3 to 1			
Physical functioning						**Small to medium effect** *SMD 0.30* *95% CI 0.04 to 0.56* *P=0.02*
Fransen et al, 1997 (35)	extra depth shoes with long inside counter, pillow back foam-padded collar, soft leather upper with removable cushion inlay	VAS general fatigue (0-100)	41.2 (29.06)	35.7 (25.41)	0.20	
		HAQ disability index (0-3)	1.44 (0.67)	1.24 (0.67)	0.0001	
Williams et al, 2006 (36)	traditional design ready-made therapeutic shoes (current footwear developed by clinicians to meet the clinician's perceptions of patient's needs, with flat insole)	FFI disability (0-100)	44.00 (18.74)	45.67 (22.08)	0.51	
		FFI limitation (0-100)	6.67 (2.83)	8.56 (5.86)	0.15	
		FHSQ physical activity (0-100)	27.44 (27.41)	26.84 (30.70)	0.83	
Williams et al, 2006 (36)	new design ready-made therapeutic shoes (incorporation of several features that were identified by the patient as being their preferred features of footwear, with firm contoured insole)	FFI disability (0-100)	44.74 (25.20)	24.59 (20.31)	0.00	
		FFI limitation (0-100)	7.52 (4.23)	2.56 (2.19)	0.00	
		FHSQ physical activity (0-100)	30.99 (22.58)	36.98 (27.02)	0.02	
Chalmers et al, 2000 (37)	extra-depth supportive shoes with semi-rigid orthoses	RB walking, s*	88.2 (17.5)	86.9 (21.4)	≥0.05	
		RB stairs, s*	92.8 (8.2)	92.4 (11.3)	≥0.05	
		RB stand, s*	576.3 (77.1)	561.1 (100.5)	≥0.05	
		TADL walking	7.1 (0.90)	7.0 (1.08)	≥0.05	
		TADL stairs	5.0 (0.20)	5.0 (0.20)	≥0.05	
		50 foot walking time, s*	14.1 (3.84)	14.1 (4.3)	≥0.05	
Chalmers et al, 2000 (37)	extra-depth supportive shoes with soft orthoses	RB walking, s*	83.5 (21.0)	88.9 (19.6)	≥0.05	
		RB stairs, s*	92.0 (10.7)	91.6 (11.0)	≥0.05	
		RB stand, s*	538.7 (146.7)	570.4 (86.5)	≥0.05	
		TADL walking	7.0 (0.98)	7.0 (1.11)	≥0.05	
		TADL stairs	5.0 (0.00)	5.0 (0.21)	≥0.05	

Appendix 3. Qualitative / quantitative synthesis of within-group results and overview of evidence for ready-made therapeutic shoes

Author, year (ref.)	Intervention	Outcome	Results			Level of evidence
			pre-TS mean (SD)	post-TS mean (SD)	p-value	
Chalmers et al, 2000 (37)	extra-depth supportive shoes with original insoles	RB walking, s*	86.1 (21.0)	86.4 (19.9)	≥0.05	
		RB stairs, s*	90.9 (15.6)	90.9 (11.9)	≥0.05	
		RB stand, s*	556.6 (113.3)	556.8 (131.1)	≥0.05	
		TADL walking	6.9 (1.15)	6.9 (1.15)	≥0.05	
		TADL stairs	5.0 (0.20)	5.0 (0.21)	≥0.05	
		50 foot walking time, s*	14.6 (4.87)	13.9 (4.1)	≥0.05	
Bagherzadeh Cham, 2014 (39)	high-top shoes extended above the lateral malleoli, wide toe box and velcro closures adapted with a custom made heel-to-toe rocker sole	FFI disability (0-10) FFI activity limitation (0-10)	5.66 (2.02) 2.82 (2.4)	4.2 (2.3) 1.3 (1.5)	0.044 0.04	
Moncur et al, 1990 (40)	light weight heath-mouldable shoes with extra depth and extra forefoot width	NRS walking ability (0-10)	4.5	8.5	0.01	
Health related quality of life						**Non-significant effect**
Fransen et al, 1997 (35)	extra depth shoes with long inside counter, pillow back foam-padded collar, soft leather upper with removable cushion inlay	VAS general well-being (0-100)	38.2 (24.93)	31.5 (24.89)	0.017	
Williams et al, 2006 (36)	traditional design ready-made therapeutic shoes (current footwear developed by clinicians to meet the clinician's perceptions of patient's needs, with flat insole)	FHSQ general health (0-100)	39.44 (23.88)	41.64 (26.08)	0.70	
		FHSQ general foot health (0-100)	20.14 (18.44)	19.44 (21.17)	0.85	
		FHSQ social capacity (0-100)	55.56 (27.53)	56.53 (29.06)	0.83	
		FHSQ vigour	44.11 (18.86)	44.11 (19.24)	0.99	
Williams et al, 2006 (36)	new design ready-made therapeutic shoes (incorporation of several features that were identified by the patient as being their preferred features of footwear, with firm contoured insole)	FHSQ general health (0-100)	39.01 (20.01)	40.40 (21.13)	0.66	
		FHSQ general foot health (0-100)	16.12 (15.72)	39.29 (22.58)	0.00	
		FHSQ social capacity (0-100)	54.99 (27.31)	60.33 (28.33)	0.17	
		FHSQ vigour	37.15 (16.4)	40.82 (19.71)	0.24	
Adherence						**Not applicable**
Chalmers et al, 2000 (37)	extra-depth supportive shoes with semi-rigid orthoses	Mean wearing time, h (SD)	6.15 (2.32)			
Chalmers et al, 2000 (37)	extra-depth supportive shoes with soft orthoses	Mean wearing time, h (SD)	5.89 (2.36)			
Chalmers et al, 2000 (37)	extra-depth supportive shoes with original insoles	Mean wearing time, h (SD)	5.79 (2.53)			

Appendix 3. Qualitative / quantitative synthesis of within-group results and overview of evidence for ready-made therapeutic shoes

Author, year (ref.)	Intervention	Outcome	Results			Level of evidence
			pre-TS mean (SD)	post-TS mean (SD)	p-value	
Moncur et al, 1990 (40)	light weight heath-mouldable shoes with extra depth and extra forefoot width	80% worn always, 20% worn sometimes				
Pullar et al, 1983 (42)	shoes made to more general specifications (comfort shoes)	33% worn all day, 17% worn ≥0.5 day, 50% worn <0.5 day				
Adverse events						**Not applicable**
Williams et al, 2006 (36)	traditional design ready-made therapeutic shoes (current footwear developed by clinicians to meet the clinician's perceptions of patient's needs, with flat insole)	10% with reasons "hotter than previous footwear", "unfit", "slippage at heel"				
Williams et al, 2006 (36)	new design ready-made therapeutic shoes (incorporation of several features that were identified by the patient as being their preferred features of footwear, with firm contoured insole)	8% "slippage at the heel"				
Moncur et al, 1990 (40)	light weight heath-mouldable shoes with extra depth and extra forefoot width	12% "shoes are hot to wear"				
Pullar et al, 1983 (42)	shoes made to more general specifications (comfort shoes)	8% with reason "poor fit"				
Patient satisfaction						**Not applicable**
Moncur et al, 1990 (40)	light weight heath-mouldable shoes with extra depth and extra forefoot width	NRS comfort (0-10)	5.0	9.4	<0.0001	
Pullar et al, 1983 (42)	shoes made to more general specifications (comfort shoes)	75% satisfied, 25% unsatisfied				

TS = therapeutic shoes. non-TS = non-therapeutic shoes (conventional standardized shoes / the patient's own shoes). SD = standard deviation. FO = foot orthoses. VAS = visual analogue scale. FFI = foot function index. FHSQ = Foot Health Status Questionnaire. HAQ = Health Assessment Questionnaire. RB = Robinson Bashall Functional Assessment. TADL = Toronto Activities of Daily Living Measure. NRS = numeric rating scale. *= performance-based.