



## Supplementary Material

10.1302/2633-1462.210.BJO-2021-0127.R1

### Risk of bias for RCTs, ROBINS 2 tool (RoB2)

#### Ly And Coetzee 2006 (RCT)

**Outcomes:** Primary outcome: PROMs; VAS, AOFAS midfoot score, clinical questionnaires. Secondary outcome: Radiological evaluation for adverse events and complications. Intervention group: ORIF vs Control group: primary arthrodesis.

RoB Domain Signalling Question	Judgement per follow-up outcome assessment			Support for judgements
	AOFAS midfoot	VAS	Clinical questionnaire	
<b>Bias arising from the randomization process</b>				
1.1	No	No	No	Alternation was used as randomization method
1.2	Probably No	Probably No	Probably No	No information, but alternation was hard to conceal.
1.3	No	No	No	No differences in sex, age at baseline and mechanism of injury.

<i>Risk of bias domain judgement</i>	<i>Some concerns</i>	<i>Some concerns</i>	<i>Some concerns</i>	
<b>Bias due to deviations from intended interventions</b>				
2.1	Yes	Yes	Yes	It was not possible to conceal the intervention from subjects
2.2	Yes	Yes	Yes	It was not possible to conceal the intervention from carers
2.3	No	No	No	NA
2.4	NA	NA	NA	NA
2.5	NA	NA	NA	NA
2.6	Yes	Yes	Yes	Not applicable, since there were no changes in intervention groups after allocation
2.7	NA	NA	NA	NA
<i>Risk of bias domain judgement</i>	<i>Low risk</i>	<i>Low risk</i>	<i>Low risk</i>	
<b>Bias due to missing outcome data</b>				
3.1	Yes	Yes	Yes	Outcome data was available for all subjects
3.2	NA	NA	NA	NA
3.3	NA	NA	NA	NA
3.4	NA	NA	NA	NA
<i>Risk of bias domain judgement</i>	<i>Low risk</i>	<i>Low risk</i>	<i>Low risk</i>	
<b>Bias in measurement of the outcome</b>				
4.1	No	No	No	AOFAS, VAS and the functional questionnaire are validated outcome measurements. Adverse events were objectively assessed.
4.2	No	No	No	Data collection in both intervention groups was similar
4.3	Probably yes	Probably yes	Probably yes	Assessors were probably aware of the type of intervention
4.4	Probably yes	Probably yes	Probably yes	The outcome measurements are subjective in nature; it is not certain that the outcomes were not biased by knowledge of the intervention
4.5	Probably yes	Probably yes	Probably yes	The outcome measurements are subjective in nature; it is not certain that the outcomes were not biased by knowledge of the intervention

<i>Risk of bias domain judgement</i>	<i>High Risk</i>	<i>High Risk</i>	<i>High Risk</i>	
<b>Bias in selection of the reported result</b>				
5.1	Probably yes	Probably yes	Probably yes	No information provided, but unlikely since the outcome measurements are not easily changed.
5.2	Probably not	Probably not	Probably not	A power analysis was performed on both outcome measurements before the start of the study.
5.3	Probably not	Probably not	Probably not	There is only one possible way in which the outcome measurement can be analysed.
<i>Risk of bias domain judgement</i>	<i>Low risk</i>	<i>Low risk</i>	<i>Low risk</i>	
<b>OVERALL RISK OF BIAS</b>	<b>HIGH RISK</b>	<b>HIGH RISK</b>	<b>HIGH RISK</b>	

Henning et al. 2009 (RCT)

Outcomes: Primary outcome: PROMs; SF-36, SMFA, patient satisfaction. Intervention group: ORIF vs Control group: primary arthrodesis.

RoB Domain Signalling Question	Judgement per follow-up outcome assessment			Support for judgements
	SF-36	SMFA	Patient satisfaction	
<b>Bias arising from the randomization process</b>				
1.1	Yes	Yes	Yes	A random number generation system was used. Interventions were assigned using envelopes
1.2	Probably yes	Probably yes	Probably yes	Envelopes were unopened until patients arrived in the in pre-operative area.
1.3	Yes	Yes	Yes	There was a higher number of smokers and fewer patients with additional fractures in the ORIF group compared to the PA group

<i>Risk of bias domain judgement</i>	<i>Some concerns</i>	<i>Some concerns</i>	<i>Some concerns</i>	
<b>Bias due to deviations from intended interventions</b>				
2.1	Yes	Yes	Yes	It was not possible to conceal the intervention from subjects
2.2	NI	NI	NI	It was not possible to conceal the intervention from carers
2.3	No	No	No	It was not possible to change the intervention
2.4	NA	NA	NA	NA
2.5	NA	NA	NA	NA
2.6	Yes	Yes	Yes	Not applicable, since there were no changes in intervention groups after allocation.
2.7	NA	NA	NA	NA
<i>Risk of bias domain judgement</i>	<i>Low risk</i>	<i>Low risk</i>	<i>Low risk</i>	
<b>Bias due to missing outcome data</b>				
3.1	No	No	No	Outcome data was available for 32 of the 40 included subjects
3.2	Probably not	Probably not	Probably not	No information provided, but not enough subjects were included to provide a statistically significant relevant result.
3.3	NI	NI	NI	No information about reasons for loss to follow-up
3.4	Probably not	Probably not	Probably not	Loss to follow-up was roughly the same in both groups
<i>Risk of bias domain judgement</i>	<i>Some concerns</i>	<i>Some concerns</i>	<i>Some concerns</i>	
<b>Bias in measurement of the outcome</b>				
4.1	Probably not	Probably not	Probably not	No information, but unlikely
4.2	No	No	No	Data collection was performed with a similar method in both groups
4.3	Yes	Yes	Yes	There was no blinding in this study
4.4	Yes	Yes	Yes	The outcome measurements are subjective in nature; it is not certain that the outcomes were not biased by knowledge of the intervention
4.5	Yes	Yes	Yes	The outcome measurements are subjective in nature; it is not certain that the outcomes were not biased by knowledge of the intervention
<i>Risk of bias domain judgement</i>	<i>High Risk</i>	<i>High Risk</i>	<i>High Risk</i>	

<b>Bias in selection of the reported result</b>				
5.1	Probably yes	Probably yes	Probably yes	No information provided, but unlikely since the outcome measurements are not easily changed.
5.2	Probably not	Probably not	Probably not	No information
5.3	Probably not	Probably not	Probably not	No information
<i>Risk of bias domain judgement</i>	Low risk	Low risk	Low risk	Low risk
<b>OVERALL RISK OF BIAS</b>	<b>HIGH RISK</b>	<b>HIGH RISK</b>	<b>HIGH RISK</b>	

### Stødle et al. 2020 (RCT)

**Outcomes:** Primary outcome: PROMs; AOFAS midfoot score, VAS, SF-36. Intervention group: PA vs Control group: temporary bridge plating

<b>RoB Domain Signalling Question</b>	<b>Judgement per follow-up outcome assessment</b>			<b>Support for judgements</b>
	AOFAS midfoot	VAS	SF-36	
<b>Bias arising from the randomization process</b>				
1.1	Yes	Yes	Yes	Random allocation
1.2	Yes	Yes	Yes	Envelopes for allocation were opaque
1.3	No	No	No	Baseline characteristics were similar in both intervention groups
<i>Risk of bias domain judgement</i>	<i>Low Risk</i>	<i>Low Risk</i>	<i>Low Risk</i>	

<b>Bias due to deviations from intended interventions</b>				
2.1	Yes	Yes	Yes	Patients were not blinded
2.2	Yes	Yes	Yes	Carers were not blinded
2.3	No	No	No	There were no changes in intervention groups
2.4	NA	NA	NA	
2.5	NA	NA	NA	
2.6	Yes	Yes	Yes	An ITT method was used, but there was no loss-to-follow-up
2.7	NA	NA	NA	
<i>Risk of bias domain judgement</i>	<i>Low Risk</i>	<i>Low Risk</i>	<i>Low Risk</i>	
<b>Bias due to missing outcome data</b>				
3.1	Yes	Yes	Yes	Outcome data was available for all included subjects
3.2	NA	NA	NA	
3.3	NA	NA	NA	
3.4	NA	NA	NA	
<i>Risk of bias domain judgement</i>	<i>Low Risk</i>	<i>Low Risk</i>	<i>Low Risk</i>	
<b>Bias in measurement of the outcome</b>				
4.1	No	No	No	Outcome measurements were validated questionnaires, measured at reasonable follow-up moments
4.2	No	No	No	Data collection was performed with a similar method in both groups
4.3	Yes	Yes	Yes	Outcome assessors were not blinded
4.4	Yes	Yes	Yes	Influence on PROMs of knowledge of intervention is possible
4.5	PN	Yes	PN	Not expected, VAS is more susceptible to bias
<i>Risk of bias domain judgement</i>	<i>Some concerns</i>	<i>High Risk</i>	<i>Some concerns</i>	
<b>Bias in selection of the reported result</b>				
5.1	PY	PY	PY	Analysis was conducted following protocol
5.2	No	No	No	All analysed data was published
5.3	Probably not	Probably not	Probably not	There is only one possible way in which the outcome measurement can be analysed.
<i>Risk of bias domain judgement</i>	<i>Low risk</i>	<i>Low risk</i>	<i>Low risk</i>	

<b>OVERALL RISK OF BIAS</b>	<b>Some concerns</b>	<b>HIGH RISK</b>	<b>Some concerns</b>	
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Risk of bias for nRCT studies, ROBINS 1 tool

Van Hove 2018 (nRCT)

**Outcomes: Primary outcome:** Gait analysis. **Secondary outcomes:** PROMs; AOFAS midfoot score, FADI, VAS and SF-36. **Intervention group:** ORIF, PA, conservative vs **control group:** healthy subjects

<b>RoB Domain Signalling Question</b>	<b>Judgement per follow-up outcome assessment</b>					<b>Support for judgements</b>
	Gait analysis	AOFAS midfoot	SF-36	VAS	FADI	

<b>Bias arising due to confounding</b>						
1.1	yes	yes	yes	yes	yes	There was potential confounding
1.2	No	No	No	No	No	There was no possibility to switch interventions
1.3	NA	NA	NA	NA	NA	NA
1.4	Yes	Yes	Yes	Yes	Yes	A logistic regression analysis was performed with all confounding variables
1.5	Yes	Yes	Yes	Yes	Yes	Variables were objective (age, etc.)
1.6	Probably not	Probably not	Probably not	Probably not	Probably not	No information
1.7	NI	NI	NI	NI	NI	No information
1.8	NA	NA	NA	NA	NA	NA
<i>Risk of bias domain judgement</i>	Moderate Risk	Moderate Risk	Moderate Risk	Moderate Risk	Moderate Risk	
<b>Bias in selection of participants for the study</b>						
2.1	No	No	No	No	No	Participants selection for the study was not based on participant characteristics observed after the start of the intervention
2.2	NA	NA	NA	NA	NA	NA
2.3	NA	NA	NA	NA	NA	NA
2.4	Yes	Yes	Yes	Yes	Yes	Start of follow-up was similar in both groups
2.5	NA	NA	NA	NA	NA	NA
<i>Risk of bias domain judgement</i>	Low risk	Low risk	Low risk	Low risk	Low Risk	
<b>Bias in classification of interventions</b>						
3.1	Yes	Yes	Yes	Yes	Yes	Intervention groups were clearly defined
3.2	Yes	Yes	Yes	Yes	Yes	Misclassification is unlikely due to the nature of the intervention (surgery)
3.3	No	No	No	No	No	Classification of intervention status could not be affected by knowledge of the outcome
<i>Risk of bias domain judgement</i>	Low risk	Low risk	Low risk	Low risk	Low risk	



<b>Bias due to deviations from intended interventions</b>						
4.1	No	No	No	No	no	There were no deviations from the intended intervention
4.2	NA	NA	NA	NA	NA	NA
4.3	NI	NI	NI	NI	NI	No information, but unlikely
4.4	Probably yes	Probably yes	Probably yes	Probably yes	Probably yes	No complications during surgery were reported
4.5	Yes	Yes	Yes	Yes	Yes	NA
4.6	NA	NA	NA	NA	NA	NA
<i>Risk of bias domain judgement</i>	Low risk	Low risk	Low risk	Low risk	Low risk	
<b>Bias due to missing data</b>						
5.1	Yes	Yes	Yes	Yes	Yes	Outcome data was available for all subjects
5.2	No	No	No	No	No	No subjects were excluded
5.3	No	No	No	No	No	No subjects were excluded
5.4	NA	NA	NA	NA	NA	NA
5.5	NA	NA	NA	NA	NA	NA
<i>Risk of bias domain judgement</i>	Low risk	Low risk	Low risk	Low risk	Low risk	
<b>Bias in measurement of outcomes</b>						
6.1	No	Yes	Yes	Yes	Yes	Outcome measurements for PROMs were subjective
6.2	Yes	Yes	Yes	Yes	Yes	There was no blinding
6.3	Yes	Yes	Yes	Yes	Yes	Outcome assessment in both groups was similar
6.4	No	No	No	No	No	There were no systematic errors in measurement of outcomes
<i>Risk of bias domain judgement</i>	Low risk	Moderate risk	Moderate risk	Moderate risk	Moderate risk	
<b>Bias in selection of the reported result</b>						
7.1	No	No	No	No	No	All results are reported
7.2	No	No	No	No	No	All results are reported
7.3	No	No	No	No	No	There were no differences in reporting of outcomes in different subgroups

<i>Risk of bias domain judgement</i>	Low risk	Low risk	Low risk	Low risk	Low risk	
<b>OVERALL RISK OF BIAS</b>	<b>LOW RISK</b>	<b>MODERATE RISK</b>	<b>MODERATE RISK</b>	<b>MODERATE RISK</b>	<b>MODERATE RISK</b>	

### Risk of bias for case series, Modified Newcastle Ottawa Quality Assessment Scale (BJsports)

Case series involving either ORIF or PA or comparing both interventions were assessed using the modified Newcastle Quality Assessment scale modified for case series. Stars were awarded in three domains: selection process, comparability and outcome (cohort studies) or exposure (case series). The overall outcome was assessed as followed:

Good quality: 3 or 4 stars in selection domain AND 1 or 2 stars in comparability domain AND 2 or 3 stars in outcome/exposure domain

Fair quality: 2 stars in selection domain AND 1 or 2 stars in comparability domain AND 2 or 3 stars in outcome/exposure domain

Poor quality: 0 or 1 star in selection domain OR 0 stars in comparability domain OR 0 or 1 stars in outcome/exposure domain [25]

Case studies without a control group were assessed as good quality if the maximum number of stars was awarded for questions that did not require a control group. Questions about control groups in these studies were assessed as not applicable (NA).

### Rajapakse 2005 (retrospective analysis)

**Outcomes: Primary outcome:** PROMs; AOFAS midfoot score, return to sport, functional questionnaire. Intervention group: ORIF

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	ICD codes were used to identify eligible subjects
1.2 Representativeness of cases	Yes	All cases included were operated on by one surgeon
1.3 Selection of controls	NA	No controls
1.4 Definition of controls	NA	No controls
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, one star	Study controlled for age, but no other confounders
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	NA	No controls
3.3 Non-response rate	Yes	Good response rate
Total stars awarded	5/6	
Overall quality	Good	Total number of possible stars awarded for a study without controls

### Dubois-Ferrière 2016 (retrospective analysis)

**Outcomes: Primary outcome:** Symptomatic osteoarthritis. PROMs; AOFAS midfoot score, VAS, SF-12, Health Survey Physical Component Summary (PCS). Intervention group: ORIF. Control group: PA

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Identified in one hospital using the hospital database.
1.2 Representativeness of cases	Yes	All cases were treated in the same hospital, with the same protocol

1.3 Selection of controls	Yes	From the same population
1.4 Definition of controls	Yes	Subjects in ORIF and PA group had no history of previous trauma
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, two stars	Study controlled for age, and other confounders (smoking)
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	Yes	Ascertainment method was similar in both groups
3.3 Non-response rate	No	Only half of all patients identified were included in the study
Total stars awarded	8/9	
Overall quality	Good	

### Kirzner 2019 (retrospective analysis)

**Outcomes: Primary outcome:** PROMs; AOFAS score, MOXFQ, patient satisfaction. Intervention group: ORIF vs Control: PA

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	ICD codes were used to identify eligible subjects
1.2 Representativeness of cases	Yes	All cases with trauma of interest were included
1.3 Selection of controls	Yes	ORIF and PA groups were selected from the same database
1.4 Definition of controls	Yes	Subjects in ORIF and PA group had no history of previous trauma
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, two stars	Study controlled for age and other confounders like injury pattern and comorbidities
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	Yes	Ascertainment method was similar in both groups
3.3 Non-response rate	Yes	Good response rate
Total stars awarded	9/9	
Overall quality	Good	Almost maximum number of stars awarded

### Cochran 2017 (retrospective analysis)

**Outcomes: Primary outcome:** Return to duty, FAAM. Intervention group: ORIF vs Control: PA

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	No	No information about subject identification procedures
1.2 Representativeness of cases	Yes	All cases were active duty military personnel
1.3 Selection of controls	Yes	ORIF and PA groups were selected from the same group
1.4 Definition of controls	Yes	Subjects in ORIF and PA groups had no history of previous trauma
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, one star	Study controlled for age and some other confounders
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	Yes	Ascertainment method was similar in both groups
3.3 Non-response rate	No	Outcome data was available for 32 of 48 cases
Total stars awarded	6/9	
Overall quality	Good	At least 3 stars awarded in the selection domain

### Kuo 2017 (retrospective analysis)

**Outcomes:** Primary outcome: PROMs; AOFAS midfoot score, MFA. **Secondary outcome:** Post-traumatic osteoarthritis. Intervention group: ORIF. No control group

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Identification through hospital database
1.2 Representativeness of cases	No	No information
1.3 Selection of controls	NA	NA
1.4 Definition of controls	NA	NA
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, one star	Study controlled for age
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	NA	NA
3.3 Non-response rate	Yes	Outcome data was available for all included subjects
Total stars awarded	4/6	
Overall quality	Fair	No optimal result in either domain

### Qiao 2017 (retrospective analysis)

**Outcomes:** Primary outcome: PROMs; AOFAS hindfoot score, AF-36, VAS. Secondary outcome; Complications. Intervention group: ORIF. Control group: PA

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Identification through hospital database
1.2 Representativeness of cases	Yes	Patients treated for Lisfranc injuries by one surgeon
1.3 Selection of controls	Yes	ORIF and PA subjects derived from the same population
1.4 Definition of controls	Yes	Subjects in ORIF and PA groups had no history of previous trauma
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, one star	Study controlled for age and Myerson classification
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	Yes	Ascertainment method was similar in both groups
3.3 Non-respons rate	Yes	Outcome data was available for all included subjects
Total stars awarded	8/9	
Overall quality	Good	Almost maximum number of stars in all domains

### Hawkinson 2017 (retrospective analysis)

**Outcomes:** Primary outcome: Return to active duty. Intervention group: ORIF vs PA vs Salvage arthrodesis.

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		

1.1 Case definition	Yes	Identification through ICD codes in medical database
1.2 Representativeness of cases	Yes	Patients were active duty military personnel
1.3 Selection of controls	Yes	ORIF, PA and SA subjects derived from the same population
1.4 Definition of controls	No	No information
<b>Comparability</b>		
2.1 Controlled for confounders	No	No confounders are mentioned
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	Yes	Ascertainment method was similar in both groups
3.3 Non-response rate	Yes	Outcome data was available for all included subjects
Total stars awarded	7/9	
Overall quality	Poor	No stars awarded in confounding domain, high risk of confounding

### Fan 2017 (retrospective analysis)

**Outcomes:** Primary outcome PROMs: AOFAS midfoot score, SF-36, FAOS, VAS. Secondary outcomes: Post-traumatic osteoarthritis.  
Intervention group: ORIF vs PA

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Identification through database analysis of three hospitals
1.2 Representativeness of cases	Yes	All acute Lisfranc injuries included
1.3 Selection of controls	Yes	ORIF and PA subjects derived from the same population
1.4 Definition of controls	Yes	Subjects had no previous injuries or comorbidities
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, two stars	Study controlled for age and other confounders like injury pattern and comorbidities
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	Yes	Ascertainment method was similar in both groups
3.3 Non-response rate	Yes	Outcome data was available for all included subjects
Total stars awarded	9/9	
Overall quality	Good	All stars awarded

### Ghate 2012 (retrospective analysis)

**Outcomes:** Primary outcome PROMs: AOFAS midfoot score, Maryland foot score. Secondary outcomes: weightbearing radiographs for complications. Intervention group: ORIF

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Subject selection from medical records
1.2 Representativeness of cases	No	No information
1.3 Selection of controls	NA	NA
1.4 Definition of controls	NA	NA
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, one star	Study controlled for age
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	NA	NA
3.3 Non-response rate	Yes	Outcome data was available for all included subjects
Total stars awarded	3/6	
Overall quality	Poor	Only one star awarded in the selection domain

### Reinhardt 2012 (retrospective analysis)

**Outcomes:** Primary outcome PROMs: AOFAS midfoot score, SF-36, FAOS, VAS. Secondary outcomes: posttraumatic osteoarthritis. Intervention group: Primary partial arthrodesis (PPA)

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Records from two surgeons used as database
1.2 Representativeness of cases	Yes	All subjects undergoing PPA



1.3 Selection of controls	NA	NA
1.4 Definition of controls	NA	NA
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, two stars	Study controlled for age, multiple comorbidities
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	NA	NA
3.3 Non-response rate	Yes	Outcome data available for all subjects
Total stars awarded	6/6	
Overall quality	Good	Maximum number of stars awarded for a study without controls

### Demirkale 2013 (retrospective analysis)

Outcomes: Primary outcome AOFAS midfoot score, FADI. Intervention group: ORIF

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Subject selection from medical records
1.2 Representativeness of cases	Yes	All subjects treated for Lisfranc injury
1.3 Selection of controls	NA	NA
1.4 Definition of controls	NA	NA
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, one star	Study controlled for age
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	NA	NA
3.3 Non-response rate	Yes	Outcome data was available for all subjects
Total stars awarded	5/6	
Overall quality	Good	Almost maximum number of stars awarded for a study without controls

### Wang 2017 (retrospective analysis)

Outcomes: Primary outcome PROMs; AOFAS midfoot score, VAS, SF-36. Intervention group: ORIF vs PA

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Subject selection from medical records
1.2 Representativeness of cases	Yes	All subjects with acute Lisfranc injury
1.3 Selection of controls	Yes	Both groups derived from the same population
1.4 Definition of controls	Yes	Both groups had no prior foot injuries
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, one star	Study controlled for age and mechanism of injury
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	Yes	Ascertainment method was similar in both groups
3.3 Non-response rate	Yes	Outcome data was available for all subjects
Total stars awarded	8/9	
Overall quality	Good	Almost the maximum number of stars in all three domains

### Wu 2020 (retrospective case control study)

**Outcomes:** Primary outcome PROMs; AOFAS midfoot score, SF-12, VAS. Intervention group: ORIF acute treatment vs ORIF delayed treatment

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Subject selection from medical records
1.2 Representativeness of cases	Yes	All subjects with subtle, low-energy Lisfranc injury
1.3 Selection of controls	Yes	Both groups derived from the same population
1.4 Definition of controls	Yes	Both groups had no prior foot injuries
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, two stars	Study controlled for age and other patient characteristics
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	Yes	Ascertainment method was similar in both groups
3.3 Non-response rate	Yes	Outcome data was available for all subjects
Total stars awarded	9/9	

Overall quality	Good	Maximum number of stars in all three domains
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### Mullier 2002 (retrospective case control study)

Outcomes: Primary outcome PROMs; Baltimore painful foot score (PFS) Intervention group: ORIF vs PA

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	Subject selection from medical records
1.2 Representativeness of cases	Yes	All subjects with severe acute Lisfranc injury
1.3 Selection of controls	No	Two different populations
1.4 Definition of controls	No	No information
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, one star	Study controlled for age and injury type
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	Yes	Ascertainment method was similar in both groups
3.3 Non-response rate	Yes	Outcome data was available for all subjects
Total stars awarded	6/9	
Overall quality	Fair	Half of the maximum number of stars in the selection domain awarded

### Teng 2002 (retrospective case control study)

Outcomes: Primary outcome Gait analysis. Secondary outcomes: AOFAS midfoot score, post-traumatic arthritis, alignment. Intervention group: ORIF

<i>Item</i>	<i>Star awarded</i>	<i>Support for judgements</i>
<b>Selection</b>		
1.1 Case definition	Yes	ICD codes were used to identify eligible subjects
1.2 Representativeness of cases	Yes	All subjects with acute Lisfranc injury treated with ORIF

1.3 Selection of controls	NA	No controls
1.4 Definition of controls	NA	No controls
<b>Comparability</b>		
2.1 Controlled for confounders	Yes, one star	Study controlled for age, but no other confounders
<b>Exposure</b>		
3.1 Ascertainment of exposure	Yes	Structured injury data
3.2 Similar in cases and controls	NA	No controls
3.3 Non-response rate	Yes	Good response rate
Total stars awarded	5/6	
Overall quality	Good	Maximum number of stars awarded for a study without controls

**Table i. GRADE ASSESMENT** for case studies using the Newcastle Ottawa scale for Risk of Bias.

Study	Outcome measurement	Stars awarded	Overall quality	Starting level of evidence	RoB	Inconsistency	Indirectness	Imprecision	Publication bias	Total downgrade	Total upgrade	Final level of evidence (after down/upgrading)
Mulier 2002	PFS	6 out of 9	Fair	Low	Downgrade 1 level	No downgrade	No downgrade	Downgrade 1 level	No downgrade	2	0	very low
Demirkale	AOFAS midfoot	5 out of 6	Good	Low	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	low

	FADI	5 out of 6	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
Kirzner 2019	MOXFQ	9 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
	AOFAS midfoot	9 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	low
Hawkinson	RTD	7 out of 9	Poor	Low	Downgrade 1 level	No downgrade	No downgrade	Downgrade 1 level	No downgrade	2	0	very low
Qiao	AOFAS hindfoot	8 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
	VAS	8 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
	SF-36	8 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
Cochran	FAAM	6 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
	RTD	6 out of 9	Good	Low	Downgrade 1 level	No downgrade	No downgrade	Downgrade 1 level	No downgrade	2	0	very low
Rajapakse	AOFAS midfoot	5 out of 6	Good	Low	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	low
Kuo	AOFAS midfoot	4 out of 6	Fair	Low	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	low
	MFA	4 out of 6	Fair	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
Fan	AOFAS (midfoot)	9 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	low
	VAS	9 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
	SF-36	9 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
	FAOS	9 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
Ghate	AOFAS midfoot	3 out of 6	Poor	Low	Downgrade 1 level	No downgrade	No downgrade	No downgrade	No downgrade	1	0	very low
	Maryland foot score	3 out of 6	Poor	Low	Downgrade 1 level	No downgrade	No downgrade	Downgrade 1 level	No downgrade	2	0	very low
Reinhardt	AOFAS midfoot	6 out of 6	Good	Low	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	low
	VAS	6 out of 6	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
	SF-36	6 out of 6	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low

Wang	AOFAS midfoot	8 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	low
	VAS	8 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
	SF-36	8 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
Wu	SF-12	9 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
	AOFAS midfoot	9 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	low
	VAS	9 out of 9	Good	Low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low
Teng	AOFAS midfoot	5 out of 6	Good	low	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	very low

**Table ii. GRADE ASSESMENT for observational studies using the Robins 1 tool.**

Study	Outcome measurement	D1	D2	D3	D4	D5	Overall	Number of domains high risk	Starting level of evidence	RoB	Inconsistency	Indirectness	Imprecision	Publication bias	Total downgrade	Total upgrade	Final level of evidence (after down/upgrading)
Ly and Coetzee	AOFAS	S	L	L	HR	L	HR	1	High	Downgrade	No	No	No	No	1	0	moderate
	midfoot	C	R	R		R				1 level	downgrade	downgrade	downgrade	downgrade			
	VAS	S	L	L	HR	L	HR	1	High	Downgrade	No	No	Downgrade	No	2	0	low
	functional questionnaire	C	R	R		R				1 level	downgrade	downgrade	1 level	downgrade			
Henning	SF-36	S	L	S	HR	L	HR	1	High	Downgrade	No	No	Downgrade	No	2	0	low
		C	R	C		R				1 level	downgrade	downgrade	1 level	downgrade			
	SMFA	S	L	S	HR	L	HR	1	High	Downgrade	No	No	Downgrade	No	2	0	low
		C	R	C		R				1 level	downgrade	downgrade	1 level	downgrade			
Stødle	AOFAS	L	L	L	SC	L	SC	0	High	No	No	No	No	No	0	0	High
	midfoot	R	R	R		R				downgrade	downgrade	downgrade	downgrade	downgrade			
	VAS	L	L	L	HR	L	HR	1	High	Downgrade	No	No	Downgrade	No	2	0	low
		R	R	R		R				1 level	downgrade	downgrade	1 level	downgrade			
SF-36		L	L	L	SC	L	SC	0	High	No	No	No	Downgrade	No	1	0	moderate
		R	R	R		R				downgrade	downgrade	downgrade	1 level	downgrade			

HR, high risk; LR, low risk; SC, some concerns.

**Table iii. GRADE ASSESSMENT** for observational studies using the Robins 2 tool.

Study	Outcome measurement	Risk of bias	Number of domains high risk	Starting level of evidence	RoB	Inconsistency	Indirectness	Imprecision	Publication bias	Total downgrade	Total upgrade	Final level of evidence (after down/upgrading)
van Hove 2018	AOFAS midfoot	MR	0	Moderate	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	Moderate
	FADI	MR	0	Moderate	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	low
	SF-36	MR	0	Moderate	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	low
	VAS	MR	0	Moderate	No downgrade	No downgrade	No downgrade	Downgrade 1 level	No downgrade	1	0	low
	Gait analysis	MR	0	Moderate	No downgrade	No downgrade	No downgrade	No downgrade	No downgrade	0	0	moderate

MR, moderate risk.



## Search Strategy

### PUBMED/MEDLINE

((((((((((((((Lisfranc) OR Lisfranc injury) OR Lisfranc fracture) OR Midfoot) OR tarsometatarsal) OR "Metatarsal Bones/surgery"[Mesh]) OR "Tarsal Bones/injuries"[Mesh]) OR "Tarsal Bones/surgery"[Mesh]) OR tarsal joint) OR "Tarsal Joints"[Mesh]) OR "Foot Bones/injuries"[Mesh]) OR "Foot Bones/surgery"[Mesh])) OR (((((open reduction internal fixation) OR "Open Fracture Reduction"[Mesh]) OR ORIF) OR "Fracture Fixation, Internal"[Mesh]) OR "Fracture Fixation"[Mesh])) AND ((Primary arthrodesis) OR arthrodesis)) AND (((patient reported outcome measures) OR "Patient Reported Outcome Measures"[Mesh]) OR PROM) OR "Postoperative Complications"[Mesh]) OR "Prognosis"[Mesh])) AND (((((((randomised controlled trial) OR "Randomized Controlled Trial" [Publication Type]) OR "Randomized Controlled Trials as Topic"[Mesh]) OR "Comparative Study" [Publication Type]) OR "Observational Studies as Topic"[Mesh]) OR "Observational Study" [Publication Type]) OR observational) OR clinical trial) OR cohort study)

Total 6853 hits, after removing duplicates = 5694 hits

### CENTRAL

Search terms (hits):

- Lisfranc (33)

- ORIF (240)
- Tarsal (188)
- Tarsometatarsal (28)

Total 489 hits, after removing duplicates = 453 hits

### **PEDro**

- Lisfranc: 0 hits
- Tarsometatarsal: 0 hits
- ORIF: 10
- Metatarsal: 31
- Total 31

### **CINAHL**

Search 1:

((Lisfranc OR metatarsal OR tarsal OR midfoot) AND (internal fixation OR ORIF OR internal fixation and open reduction OR fracture fixation)) AND (arthrodesis)

Hits: 115

Search 2:

(Lisfranc OR Lisfranc injury OR Lisfranc fracture OR midfoot OR tarsometatarsal OR metatarsal OR tarsal) AND (open reduction internal fixation OR open fracture reduction OR ORIF OR Fracture Fixation) AND (Primary arthrodesis OR arthrodesis) AND (patient reported outcome measures OR PROM OR Prognosis) AND (randomised controlled trial OR Comparative OR Observational OR clinical trial OR cohort study)

Hits: 372

Total 487 hits, after removing duplicates 386 hits

### **SPORTDiscus**

Search 1:

((Lisfranc OR metatarsal OR tarsal OR midfoot) AND (internal fixation OR ORIF OR internal fixation and open reduction OR fracture fixation)) AND (arthrodesis)

Hits: 36

Search 2:

(Lisfranc OR metatarsal OR tarsal OR midfoot) AND ((internal fixation OR ORIF OR internal fixation and open reduction OR fracture fixation) OR (arthrodesis))

Hits: 335

Search 3:

(Lisfranc OR Lisfranc injury OR Lisfranc fracture OR midfoot OR tarsometatarsal OR metatarsal OR tarsal) AND (open reduction internal fixation OR open fracture reduction OR ORIF OR Fracture Fixation) AND (Primary arthrodesis OR arthrodesis) AND (patient reported outcome measures OR PROM OR Prognosis) AND (randomised controlled trial OR Comparative OR Observational OR clinical trial OR cohort study)

Hits: 159

Total 530 hits, after removing duplicates 442 hits

**EMBASE (via OVID)**

Search 1: 19 hits

7 AND 8 AND 11 AND 15

Search 2: 2,050

((7) AND (8 OR 11))

Search 3: 211

7 AND 8 AND 11

Total 2,280 hits, after removing

2,049 hits

1	exp tarsometatarsal joint/ or exp fracture dislocation/	4498
2	lisfranc.mp.	840
3	tarsometatarsal.mp.	1515
4	ORIF.mp.	2211
5	fracture fixation/	21746
6	exp osteosynthesis/	38706
7	1 or 2 or 3	5358
8	4 or 5 or 6	57876
9	exp arthrodesis/	43486
10	arthrodesis.mp.	18323
11	9 or 10	46582
12	exp patient-reported outcome/	20926
13	PROM\$.mp.	2368689
14	prognosis.mp.	920156
15	12 or 13 or 14	3220332
16	7 and 8 and 11 and 15	19
17	7 and 8 and 11	211
18	8 or 11	101046
19	7 and 18	2050

duplicates

*Figure 1 Search strategy EMBASE*

**Table iv.** Articles identified in each database.

<b>Database</b>	<b>Total amount of articles (hits) identified</b>	<b>Amount of articles (hits) after removing duplicates</b>
Pubmed/MEDLINE	6,853	5,694
EMBASE	2,280	2,049
PEDro	31	31
CENTRAL	489	453
CINAHL	487	386
SPORTDiscus	530	442
Total amount of databases:	10,670	9,055