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Evolving Trends in Return to Sport After Surgical Treatment of Osteochondral Lesions of the Talus

A Systematic Review and Meta-analysis Up To 2024

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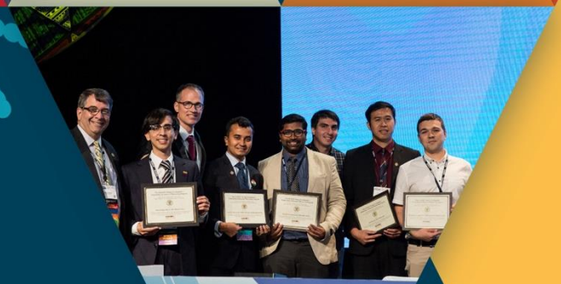

Faculty Disclosure Information

- Nothing to disclosure
- No conflict of interest

INTRODUCTION

- Among athletes, ankle traumas, such as severe sprains, are quite common.
- These traumatic events often damage both the articular **cartilage and the subchondral bone** leading to an osteochondral lesion of the talus (**OLT**).
- Up to **42% of professional soccer players** experiencing OLTs.
- **No consensus** on the most effective treatment, both for the general population and for athletes who require a swift return to pre-injury levels of performance.

MATERIALS AND METHODS

- Systematic review on 3 large electronic **databases** PubMed® Scopus Embase
- **Exclusion Criteria**

Exclusion Criteria	No. of Studies
No sport outcome	305
Less than 10 patients	39
Combination of treatment group/data not reported correctly	53
Language different from English	36
Patient overlap	10
Age < 18	5
Total	451

- Assessment of Methodological Quality: **MINORS** (Methodological Index for Non-Randomized Studies)
- **Patient data:** number of ankles treated, **age**, **sex**, **stage of the defect and the lesion size**, whether the defect was **primary or secondary**, the mean **follow-up duration**, and the **reported OCD classification**
- **Sport Outcome**: preoperative and post- operative mean values of the primary **sports-related outcomes**, Return to sport (**RTS**) at **any level** and return to the **pre-injury level**, mean **time** to RTS
- Preoperative and postoperative mean values of the **primary clinical score**

RESULTS

- **80** studies
- **8 treatment groups**
- 68 were non-comparative studies, with an average MINORS score of 9.7 (range, 3–15). 12 were comparative studies, with an average MINORS score of 15.9 (range, 11–22
- **3155 OLTs (3106 patients)** was reviewed
- 63% of the patients were men, while 37% were women
- mean age at surgery of 34.5 9.9 years
- mean body mass index of 25.7 ± 4.2 kg/m2
- mean lesion size of 111.5 ± 75.8 mm2
- mean follow-up of 4.7 **±** 3.4 years

Table 2
Treatment groups included

	No. of Surgical Strategies
Debridement	2
BMS (bone marrow stimulation)	37
BMS alone	29
BMS + pulsed electromagnetic field therapy	3
BMS + with platelet-rich plasma or mesenchymal stem cell injection	5
Fragment fixation	4
Retrograde drilling	3
Osteochondral replacement	23
Allograft	3
Osteochondral transplantation (OAT)	14
Autologous cancellous bone graft	2
Autologous osteoperiosteal transplantation	4
Chondrogenesis-inducing techniques	12
Bone marrow-derived cell transplantation (BMDCT)	3
Autologous matrix-induced chondrogenesis (AMIC)	9
Cartilage regeneration cell-based techniques	8
Autologous chondrocyte implantation (ACI)	3
Matrix-induced chondrocyte implantation (MACI)	3
Particulate juvenile cartilage transplantation (PJCT)	2
Metal resurfacing implant	4
Total	93

BONE MARROW STIMULATION

- **14** studies reported the **RTS rate**, including a total of **591** patients.
- Overall, **83.3%** (CI 95% 80.3%–86.2%) of them returned to sports regardless of the level.
- **9** studies reported the RTS at pre-injury level: among the 416, only **52.7%** (CI 95% 47.8–57.6) were able to return to their pre-injury level.
- In 8 studies, comprising a total of 329 patients, a mean **RTS time of 18.68** ± 8.50 weeks was calculated.

Table 3
Characteristics of the included patients for bone marrow stimulation group

No. of Studies	31[a]
No. of patients (no. ankles)	1606 (1621)
Age at surgery (29 studies, 1575 patients), years (mean ±SD)	34.8 ± 10.3
BMI (19 studies, 1139 patients), mean ±SD	25.85 ± 4.27
No. of lesions (224 patients), n (%)	
Primary	201 (89.7)
Secondary	23 (10.3)
Lesion size (21 studies, 1239 patients), mm^2, mean ±SD	73.2 ± 37.5
Study type	
Retrospective case series	16
Randomized controlled trial	3
Retrospective cohort studies	3
Prospective cohort studies	1
Retrospective comparative studies	6
Prospective comparative studies	1
Prospective case series	1
Final follow-up (29 studies, 1565 patients), mean ±SD	4.8 ± 3.3
Berndt and Harty classification (11 studies, 555 patients), n (%)	
Stage I	175 (31.5)
Stage II	175 (31.5)
Stage III	144 (25.9)
Stage IV	61 (11.1)
RTS rate (11 studies, 614 patients), mean (95% CI), %	83.3 (80.3–86.2)
RTS to pre-injury level (n), mean (95% CI), %	52.7 (47.8–57.6)
Time to RTS (9 studies, 329 patients), weeks (mean ±SD)	18.68 ± 8.50

CHONDROGENESIS-INDUCING TECHNIQUES
(BONE MARROW-DERIVED CELL TRANSPLANTATION, AUTOLOGOUS MATRIX-INDUCED CHONDROGENESIS)

- **12 studies** involving patients with OLTs treated with chondrogenesis-inducing techniques were included, comprising a total of 452 patients (453 ankles) with a mean age of 34.8 11.1 years.
- The mean follow-up was 4.69 4.54 years.
- **5 studies** reported the **RTS rate** (3 BMDCT and 2 AMIC), involving a total of 191 patients. Among them, **79.6%** (CI 95% 73.8%–85.3%) returned to sports.
- The RTS to pre-injury level was detailed in only one study, as was the mean time to RTS, making pooling of these data impossible.

Table 4
Characteristics of the included patients for chondrogenesis-inducing techniques

No. studies	12[a]
No. Patients (No. ankles)	452 (453)
Age at surgery (11 studies, 427 patients), mean ±SD	34.8 ± 11.1
BMI (8 studies, 310 patients), mean ±SD	25.4 ± 4.6
No. lesions, n (%)	
Primary	N/A
Secondary	
Lesion size (9 studies, 339 patients), mean ±SD	158.3 ± 80.9
Study type	
Retrospective case series	7
Randomized controlled trial	1
Retrospective comparative studies	1
Prospective case series	3
Final follow-up (12 studies, 452 patients), y, mean ±SD	3.5 ± 0.9
Berndt and Harty classification	N/A
RTS rate (5 studies, 232 patients), mean (95% CI), %	79.6 (73.8–85.3)
RTS to pre-injury level (n), mean (95% CI), %	N/A
Time to RTS (No. patients), mean ±SD	N/A

CARTILAGE REGENERATION CELL-BASED TECHNIQUES

(AUTOLOGOUS CHONDROCYTE IMPLANTATION, MATRIX-INDUCED CHONDROCYTE IMPLANTATION, PARTICULATE JUVENILE CARTILAGE TRANSPLANTATION)

- **8 studies**, encompassing a total of 173 patients (174 ankles) with a mean age of 31.8 8.8 years. The mean follow-up was 3.8 2.4 years
- **5 studies** reported the **RTS rate** (3 ACI and 2 MACI), with **70.7%** (95% CI 56.6– 92.9) of 123 patients (124 ankles) returning to sports at any level
- **4 studies** (94 patients, 95 ankles) reported a **return to pre-injury level** of **72.5%** (95% CI 55.9–94.4)

Table 5
Characteristics of the included patients for cartilage implantation

No. studies	8[a]
No. patients (No. ankles)	173 (174)
Age at surgery (7 studies,149 patients), mean ±SD	31.8 ± 8.8
BMI (3 studies, 50 patients), mean ±SD	26.9 ± 5.7
No. lesions (7 studies, 161 patients), n (%)	
Primary	88 (54.6)
Secondary	73 (45.4)
Lesion size (8 studies, 173 patients), mm^2, mean ±SD	197.2 ± 94.7
Study type	
Retrospective case series	3
Retrospective comparative studies	1
Prospective case series	4
Final follow-up (8 studies, 173 patients), mean ±SD	4.18 ± 1.68
Berndt and Harty classification	N/A
RTS rate (5 studies, 123 patients), mean (95% CI), %	70.7 (56.6–92.9)
RTS to pre-injury level (4 studies, 94 patients), mean (95% CI), %	72.5 (55.9–94.4)
Time to RTS (No. patients), mean ±SD	N/A

OSTEOCHONDRAL REPLACEMENT
(OAT, ALLOGRAFT, AUTOLOGOUS OSTEOPERIOSTEAL TRANSPLANTATION)

- **21 studies**, encompassing a total of 620 patients (629 ankles) with a mean age of 26.17 +- 0.89 years
- **11 studies** reported the RTS rate
- Among them, **83.7%** (CI 95% 79.6%–87.8%) returned to sports at **any level**
- However, only **54.6%** (CI 95% 45.6%–63.6%) of patients were able to return to their **pre-injury level** (7 studies, 160 patients, 161 ankles)
- In **3 studies** (116 patients, 117 ankles), a mean RTS time of **34.8 ± 33.9 weeks** was calculated

Table 6
Characteristics of the included patients for osteo(chondral) transplantation

No. Studies	**21**[a]
No. patients (No. ankles)	620 (629)
Age at surgery (608 patients), mean ±SD	35.9 ± 6.1
BMI (323 patients), mean ±SD	26.17 ± 0.89
No. lesions (125 patients), n (%)	
Primary	67 (53.6)
Secondary	56 (46.4)
Lesion size (358 patients), mm^2, mean ±SD	160.1 ± 78.1
Study type	
Retrospective case series	15
Retrospective cohort studies	1
Retrospective comparative studies	1
Prospective case series	4
Final follow-up (21 studies, 620 patients), y, mean ±SD	4.69 ± 4.54
Berndt and Harty classification (3 studies, 43 patients)	
Stage I	0 (0)
Stage II	4 (9)
Stage III	19 (44)
Stage IV	20 (47)
RTS rate (11 studies, 364 patients), mean (95% CI), %	83.7 (79.6–87.8)
RTS to pre-injury level (7 studies, 160 patients), mean (95% CI), %	54.6 (45.6–63.6)
Time to RTS (3 studies, 116 patients), mean ±SD	34.8±33.9

OTHER TREATMENT

- **ARTHROSCOPIC DEBRIDEMENT**: ONLY 2 STUDIES, 22 ANKLES, RTS WAS 95.8% (95% CI 91.3%–100%) RATE, RTS at the pre-injury level was 86.3% (95% CI 80.2%–100%) rate
- **RETROGRADE DRILLING**: 3 studies, 66 patients (66 ankles), only one study reported the RTS value, making pooling of data impossible
- **FRAGMENT FIXATION**: 4 studies, 89 patients (91 ankles), RTS was 84.0% (CI 95% 73.8–94.2) of the patients returning to sports at any level. None of the studies reported the RTS to the pre- injury level or RTS time
- **METAL IMPLANTS**: 2 studies reported an RTS rate, 43 patients, 60.5% (CI 95% 45.8%–75.1%) returned to sports at any level, 41.9% (CI 95% 27.1%–56.6%) were able to return to their pre-injury level. In 3 studies (68 patients), a mean RTS time was 17.4 +- 0.5 weeks

CONCLUSION

- The various surgical treatment options available for talar OCD offer adequate RTS times and rates. However, **RTS rates decrease when considering patients' return to their pre-injury levels**.
- The high number of studies on BMS methods demonstrates that these techniques are often the first choice for treating osteochondral lesions of the talus. Despite this, the **RTS to pre-injury level appears to be statistically lower compared to other methods**.
- **Regenerative cell-based techniques**, while permitting a slower RTS, achieve a higher percentage of **RTS at pre-injury level (72%)**.
- **Osteochondral replacement**, on the other hand, has a high rate of RTS and an RTS at pre-injury level that is lower than regenerative cell-based techniques but superior to BMS.
- Nonetheless, given the poor quality of the included studies and the low number of studies in each subgroup reporting sports-related parameters, it is currently not possible to define a superior treatment.
- A **tailored approach** for each individual case should be pursued to ensure an adequate RTS for the athlete without compromising long-term clinical outcomes.

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