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| Question | |
| **Should compression bandage vs. no compression bandage be used for closed extremity joint injuries?** | |
| **Population:** | Adults and children with a closed joint injury |
| **Intervention:** | Application of a compression bandage by a first aid responder |
| **Comparison:** | No application of a compression bandage, i.e. no treatment, elevation, splint or brace. |
| **Main outcomes:** | Reduction of pain; Free from walking pain; Pain at rest; Pain at walking; Swelling; Ankle volume change (ml); Ankle joint function; Range of motion; Time to return to normal walking (Grade I); Time to return to normal walking (Grade II); Return to work; Return to sport. |
| **Setting:** | Pre-hospital first aid setting |
| **Perspective:** |  |
| **Background:** | Closed extremity joint injuries include ligamentous sprains of tendon strains, most commonly of the foot, ankle or wrist. Traditional first aid includes the use of compression through the use of elastic wraps or compression stockings or sleeves.  Closed joint injuries are a common cause of loss of movement or mobility. Strains or sprains where there has been over extension of joint ligaments and/or muscles can be managed with simple first aid treatments and if applied correctly can prevent further damage and lead to a rapid return to normal function. Closed fractured will always require medical intervention.  For many years the treatment for simple closed joint injuries has been the acronym RICE (Rest, Ice, Compression, Elevation), however recent research has questioned the use of ice and compression and has advocated early mobilization.  This systematic review will evaluate the published literature on the value of compression bandages as applied to closed joint injuries (excluding fractures) in the first aid environment. |
| **Conflict of interests:** | There are no declared conflicts of interest |

# Assessment

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| Problem Is the problem a priority? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know | Acute ankle sprain accounts for approximately 300 000 patient attendances to UK emergency departments (EDs) every year, whereas in the USA they occur with an estimated frequency of one injury per 10 000 people per day, amounting to approximately 27 000 injuries each day. One meta-analysis demonstrated a higher incidence of ankle sprain in females compared with males (13.6 vs 6.94 per 1,000 exposures), in children compared with adolescents (2.85 vs 1.94 per 1,000 exposures) and adolescents compared with adults (1.94 vs 0.72 per 1,000 exposures) (Doherty 2014 123). In one systematic review of sports across multiple countries, the ankle was the second most common injured body site following the knee, and ankle sprain was the most common type of ankle injury (Fong 2007 73). Lateral ankle sprains caused by plantarflexion and inversion is a common closed joint injury, (Hertel 2002 364) with the most frequently injured part of the lateral ligament complex being the anterior talofibular ligament. In people with a sedentary lifestyle, such injuries may be less disruptive; however, in athletes and those whose work is more demanding physically, these injuries may have an important life-long effect (O'Connor 2011 255). Without optimal and evidence-based care, people sustaining an initial ankle sprains can “demonstrate high recurrence rates, prolonged symptoms, diminished quality of life, reduced physical activity levels across the lifespan, and propensity to develop chronic ankle instability” (Kaminski 2013 529). In fact, despite the common occurrence of lateral ankle sprains, it has been reported that only approximately 50% of individuals who sustain such injury seek medical attention (Verhagen 2000 291). | Joint sprains can be disabling and result in time lost from work and leisure activities or interfere with activities of daily living.  The cost of x-rays, analgesia, physiotherapy appointments, crutches etc. is very high when totaled together. |
| Desirable Effects How substantial are the desirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ● Trivial ○ Small ○ Moderate ○ Large ○ Varies ○ Don't know | **Pain:**  For the critical outcome **reduction of pain** (measured by a visual analogue scale (VAS)), we have identified low-certainty evidence (downgraded for indirectness and imprecision) from 2 randomized trials (Boyce 2005 91; O’Connor 2011 255) and 1 non-randomized trial (Bilgic 2015 1496) enrolling 122 adult patients with ankle sprains, not showing benefit from the use of a compression bandage, when compared with not using a compression bandage, using a splint or using an Aircast® ankle brace (SMD, 0.34; 95%CI, -0.10–0.79; P=0.12).  For the critical outcome **free from walking pain** after 4 days and 8 days (measured as having pain during walking, yes or no), we have identified very-low-certainty evidence from 1 non-randomized trial (Linde 1984 177) enrolling 100 adult patients with ankle sprains, not showing benefit from the use of a compression bandage, when compared with not using a compression bandage (RR, 1.25; 95%CI, 0.78–2.11, P=0.33 and RR, 1.39; 95%CI, 0.98–1.95, P=0.06, respectively).  For the critical outcome **pain at rest and pain at walking** after 6-9 days (measured by a visual analogue scale (VAS)), we have identified very-low-certainty evidence from 1 non-randomized trial (Bendahou 2014 1005) enrolling 117 adult patients with ankle sprains, not showing benefit from the use of a compression bandage, when compared with use of a non-compressive stocking (MD, -4.4; 95%CI, -9.35–0.55; P=0.08 and MD, -3.30; 95%CI, -11.77–5.17; P=0.45, respectively).  **Swelling:**  For the critical outcome **reduction of swelling/edema** (measured by circumference measurement (cm) or ankle volume change (mL)), we have identified very-low-certainty evidence (downgraded for risk of bias, indirectness and imprecision) from 3 randomized trials (Bendahou 2014 1005; Boyce 2005 91; Rucinski 1991 65) enrolling 172 patients with ankle sprains and 1 non-randomized trial (Bilgic 2015 1496) enrolling 51 adult patients with ankle sprains, not showing benefit from the use of a compression bandage, when compared with not using a compression bandage, or using a non-compressive stocking, a splint or an Aircast® ankle brace (SMD, 0.54; 95%CI, -0.14–1.22; P=0.12).  **Ankle joint function:**  For the important outcome **ankle joint function** (measured by Karlsson score), we have identified low-certainty evidence (downgraded for indirectness and imprecision) from 2 randomized trials (Boyce 2005 91; O’Connor 2011 255) enrolling 71 adult patients with ankle sprains not showing benefit from the use of a compression bandage after 10 days and 1 month, when compared with not using a compression bandage or using an Aircast® ankle brace (SMD, -0.34; 95%CI, -1.16–0.49; P=0.42 and SMD, -0.29; 95%CI, -1.11–0.53; P=0.49; respectively).  **Range of motion:**  For the important outcome **range of motion** (ROM (% of the uninjured ankle range of motion)) after 3-5 days, 2 weeks and 4 weeks, we have identified very-low-certainty evidence (downgraded for risk of bias, indirectness and imprecision) from 1 randomized trial (Leanderson 1995 529) enrolling 73 patients with ankle sprains not showing benefit from the use of a compression bandage when compared with using an Air Stirrup® ankle brace (MD, -7 %; MD, 0 % and MD, 2 %, respectively, 95%CI could not be calculated; P>0.05).  **Recovery time:**  For the important outcome **recovery time** (time to return to normal walking, time to return to stair climbing, time to return to walking with full weight-bearing in days) we have identified very-low-certainty evidence (downgraded for risk of bias, indirectness and imprecision) from 1 randomized trial (Beynnon 2006 1401) enrolling 142 patients with ankle sprains, not showing benefit from the use of a compression bandage when compared with using an Air Stirrup® ankle brace (only mean number of days reported; 95%CI could not be calculated; P>0.05 for all outcomes).  **Return to sports:**  For the important outcome **return to sports**, we have identified very-low-certainty evidence (downgraded for risk of bias, indirectness and imprecision) from 1 randomized trial (Bendahou 2014 1005) enrolling 117 adult patients with ankle sprains, showing benefit for use of a compression bandage when compared with use of non-compressive stockings (only median number of days reported; 95%CI could not be calculated; P<0.02). | Patient satisfaction was not an included outcome, but from personal experience in an emergency department, persons with closed ankle injuries/sprains are dissatisfied with care if not offered a compression wrap and will comment following placement that it ‘feels better’ with a sensation of improved support.  Another potential desirable effect could be faster return to work, potentially reducing lost wages.  Pain reduction with the use of a compression bandage or wrap may depend on proper application of the wrap. |
| Undesirable Effects How substantial are the undesirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large ○ Moderate ○ Small ● Trivial ○ Varies ○ Don't know | **Return to work:**  For the important outcome **return to work**, we have identified very-low-certainty evidence (downgraded for risk of bias, indirectness and imprecision) from 3 randomized trials (Bendahou 2014 1005; Leanderson 1995 529; O’Connor 2011 255) enrolling 226 patients with ankle sprains. One study (Leanderson 1995 529) showed less benefit for use of a compression bandage when compared with using an Air Stirrup® ankle brace (only median number of days reported; absolute effects could not be calculated; P<0.05). Two other studies (Bendahou 2014 1005, O’Connor 2011 255) did not show benefit for use of a compression bandage when compared with not using compression bandage (MD, -2.10 days; 95%CI, -4.97–0.77; P=0.15) or use of non-compressive stockings (only median number of days reported; 95%CI could not be calculated; P=0.20). | A compression wrap that is applied incorrectly with greater pressure at the proximal end may result in a tourniquet effect and cause additional swelling and pain. |
| Certainty of evidence What is the overall certainty of the evidence of effects? | | |
| Judgement | Research evidence | Additional considerations |
| ● Very low ○ Low ○ Moderate ○ High ○ No included studies | Much of the evidence has been gathered from in-hospital studies.  The only evidence addressing this question is from studies on ankle joint injuries, specifically to the lateral ankle, grades 1-3.  There are limitations in study design, indirectness and imprecision. | Although ankle joint injuries are one of the most common closed joint injuries (Doherty 2014 123; Fong 2007 73), it is remains unclear as to whether compression wrap would be effective on other closed joint injuries.  In-hospital studies might involve other not reported care actions such as a feeling of safety/calm by being at a hospital, receiving analgesia, etc. Also, if applying of compression bandage is done by trained/skilled personnel the effect of the bandage might be different than if applied by first aid providers. |
| Values Is there important uncertainty about or variability in how much people value the main outcomes? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Important uncertainty or variability ○ Possibly important uncertainty or variability ● Probably no important uncertainty or variability ○ No important uncertainty or variability | Most people would value the use of compression bandage if it leads to a reduction in pain and/or swelling. Athletes especially, would find it valuable if it would help them to return to sports faster. | Return to full mobilization is important. Any treatment that decreases the time to full mobilization must be considered valuable (time off work, time to return to sport training/competition). |
| Balance of effects Does the balance between desirable and undesirable effects favor the intervention or the comparison? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison ○ Probably favors the comparison ● Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ○ Don't know | Research evidence is only in relation to ankle joints.  There is no improvement in pain relief.  No improvement in swelling, recovery time. | Individuals could value a reduction in pain as more important than the benefits from no improvement in swelling and a slightly lengthened recovery to full function. |
| Resources required How large are the resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large costs ● Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ○ Varies ○ Don't know | In one systematic review of 32 selected for analysis the “direct costs of ankle sprain management ranged from $292 to $2268 per patient (2016 USD), depending on the injury severity and treatment strategy” (Bielska 2019 115). In 5 of the 32 papers, the overall costs (combined direct and indirect costs) of ankle sprain treatment ranged from $1809 to $5271 (2016 USD) in five pa-pers (Bielska 2019 120). | Material costs: US$5.19 for a 4” compression wrap at one major pharmacy.  Training costs: negligible as multiple instructional videos available on YouTube and other websites.  ‘Medical’ compression bandages cost about 8GBP (9.47 Euro or 10.5 USD).  There are many cheaper ‘elasticated bandages’ available but these are not true compression wrap devices.  GT Cotton Elastic Bandage Wrap (3” Wide, 2 Pack) with Hook and Loop Fasteners at Both Ends | Latex Free Hypoallergenic Compression Roll for Ankle Knee Wrist Sprains, Foot Elbow Shoulder Head Injuries 2 x 11.25 USB, 5.75 USD each  #3” ACE wrap 10.23 USD  Dealmed Compression Bandage, Clip Closure, 3" x 4.5 Yards Stretched, 10 Count 8.49 USD |
| Certainty of evidence of required resources What is the certainty of the evidence of resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ○ Low ● Moderate ○ High ○ No included studies | In one systematic review of 32 selected for analysis the “direct costs of ankle sprain management ranged from $292 to $2268 per patient (2016 USD), depending on the injury severity and treatment strategy” (Bielska 2019 115). In 5 of the 32 papers, the overall costs (combined direct and indirect costs) of ankle sprain treatment ranged from $1809 to $5271 (2016 USD) in five papers (Bielska 2019 120). |  |
| Cost effectiveness Does the cost-effectiveness of the intervention favor the intervention or the comparison? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ● Probably favors the intervention ○ Favors the intervention ○ Varies ○ No included studies | One study evaluating the economic impact of different treatment options for ankle sprains in occupational accidents found that when prescribed immobilization or the use of adjunct support or physical therapy (118 cases) were not employed during a period of 37 days on average, with a mean total cost of 3140.14 Euros (Audenaert 2010 937). This was compared to patients without any adjuvant therapy (82 cases) who were characterized by an unemployment rate of 15 days on average, and a total cost of 1077.86 Euros (Audenaert 2010 937). Suggested a simple conventional treatment, consisting of rest, ice, compression and elevation at diagnosis with allowance of early weight bearing in the further clinical course, leads to the quickest full resumption of activities in combination with the lowest medical costs, if compared with any other kind of treatment (Audenaert 2010 937). | Depends on the value of decreasing pain, return to work. |
| Equity What would be the impact on health equity? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Reduced ○ Probably reduced ● Probably no impact ○ Probably increased ○ Increased ○ Varies ○ Don't know | In settings where commercial compression bandages are not easily available, people might make wraps with plant leaves or even use t-shirts which they moisten and wrap around an injured joint. |  |
| Acceptability Is the intervention acceptable to key stakeholders? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know |  | Any intervention that decreases pain will be considered acceptable. Any intervention that allows even limited mobility will be more acceptable.  Both the above are true even if the intervention does lead to a longer recovery period.  Feedback from emergency department patients following application of a compression wrap to a sprained ankle is uniformly positive, and if not applied they ask for something to use on the injury such as a wrap or splint that will help with pain and recovery/return to normal activities. Care providers also express that they feel as if they are doing ‘something’ to help with acute pain and swelling. |
| Feasibility Is the intervention feasible to implement? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ○ Yes ● Varies ○ Don't know | It may require practice or training to apply a compression bandage correctly. The effect of applying a compression bandage might be related to applying the correct pressure, not too loose or too tight, applying from distal to proximal, using either circumferential or sequential pressure, educating individuals of signs of adverse events. | There is a definite need to train first aid providers in applying compression bandage and recognizing closed joint injuries and referring more significant injuries (i.e., fractures and dislocations) for immediate medical care. |

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# Summary of judgements

|  | **Judgement** | | | | | | |
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| **Problem** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |
| **Desirable Effects** | **Trivial** | Small | Moderate | Large |  | Varies | Don't know |
| **Undesirable Effects** | Large | Moderate | Small | **Trivial** |  | Varies | Don't know |
| **Certainty of evidence** | **Very low** | Low | Moderate | High |  |  | No included studies |
| **Values** | Important uncertainty or variability | Possibly important uncertainty or variability | **Probably no important uncertainty or variability** | No important uncertainty or variability |  |  |  |
| **Balance of effects** | Favors the comparison | Probably favors the comparison | **Does not favor either the intervention or the comparison** | Probably favors the intervention | Favors the intervention | Varies | Don't know |
| **Resources required** | Large costs | **Moderate costs** | Negligible costs and savings | Moderate savings | Large savings | Varies | Don't know |
| **Certainty of evidence of required resources** | Very low | Low | **Moderate** | High |  |  | No included studies |
| **Cost effectiveness** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | **Probably favors the intervention** | Favors the intervention | Varies | No included studies |
| **Equity** | Reduced | Probably reduced | **Probably no impact** | Probably increased | Increased | Varies | Don't know |
| **Acceptability** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |
| **Feasibility** | No | Probably no | Probably yes | Yes |  | **Varies** | Don't know |

# Type of recommendation

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| Strong recommendation against the intervention | Conditional recommendation against the intervention | **Conditional recommendation for either the intervention or the comparison** | Conditional recommendation for the intervention | Strong recommendation for the intervention |
| ○ | ○ | **●** | ○ | ○ |

# Conclusions

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| Recommendation |
| We suggest either application of a compression bandage or no application of a compression bandage for adults with an acute closed ankle joint injury (weak recommendation, very low certainty evidence).  Due to a lack of identified evidence, we are unable to recommend for or against use of a compression bandage for closed joint injuries besides the ankle. |
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| Justification |
| · This topic was last reviewed in 2010, however, it did not lead to a treatment recommendation because of limited available evidence.  · The task force indicates that it may require practice or training for laypeople to apply a compression bandage correctly.  · Most studies do not explain how much pressure is applied with the compression bandages, nor do they say for how many days the compression bandages were applied. |

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| Subgroup considerations |
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| Implementation considerations |
| In many places a compression wrap is already considered normal first aid. |

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| Monitoring and evaluation |
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| Research priorities |
| * Only studies including patients with ankle sprains were identified. Additional research is needed to determine whether if this recommendation can be applied to other acute extremity joint injuries, such as to the wrist. * Additional research is required in the out-of-hospital setting to confirm findings of the included studies. * Additional research is required to determine if the intervention of application of a compression bandage compared with doing nothing/no compression bandage results in greater stakeholder satisfaction. * It is unknown whether if a first aid provider can properly apply a compression wrap without training or with the use of simple video instructions currently available online. * It is unsure of how much pressure is needed to produce physiological changes to the body. * It is unsure whether lay providers can apply the compression bandage reliably over time to allow for changes in critical outcomes. * We are unsure of the economic impact (direct and indirect medical cost, lost wages) of compression bandages related to closed joint injuries. * We are unsure of the impact compression bandages play with other adjunct therapies administered in the prehospital setting. |