The use of casts in the management of joint mobility and hypertonia following brain injury in adults: a systematic review

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CRD summary
This review assessed casts for joint hypomobility and hypertonia in adults with brain injury. There is insufficient evidence to assess the effect of casts on spasticity and function. Although the authors concluded that casts improve the range of motion, the evidence to support this conclusion is weak.

Authors' objectives
To assess the effectiveness of casts in treating joint hypomobility and hypertonia in adults with brain injury.

Searching
MEDLINE and CINAHL were searched from January 1982 to January 2003 for reports in the English language; details of the search strategy were presented. The reference lists in relevant studies were checked.

Study selection
Study designs of evaluations included in the review
Experimental and quasi-experimental studies were eligible for inclusion. The included studies were crossover randomised controlled trials (RCTs), various types of observational studies and case reports.

Specific interventions included in the review
Studies that used casting as the main intervention were eligible for inclusion.

In the included studies, casts were applied to ankle plantar flexors, elbow flexors, wrist flexors, and both ankle and knee flexors. The participants wore casts from one day to a mean of 102 days, and in most cases the time spent in a cast was determined on an individual basis. Some participants had casts applied to more than one joint. In some studies the patients were weight bearing through the casts; in other studies the degree of weight bearing was not explicitly stated. The participants in the studies were also receiving rehabilitation including medical and pharmacological treatments.

Participants included in the review
Studies of adults with an acquired brain injury, whom the investigators described as having spasticity, were eligible for inclusion. Studies of children (aged less than 16 years) and people with cerebral palsy were excluded. Most of the included studies were of patients with a traumatic brain injury; other studies included patients with cerebrovascular accident, cerebral hypoxia, cerebral ischaemia, cerebral aneurysm and 'other'. All of the included studies were of patients in the acute or subacute stage of recovery.

Outcomes assessed in the review
The inclusion criteria were not specified in terms of outcomes. The outcomes assessed in the review were spasticity, passive range of motion (PROM) and 'function'. The included studies measured spasticity using clinical improvement, the joint angle at which a stretch reflex was elicited plus the ability to perform rapid alternating movements, and vibratory inhibition using electromyography. Two studies measured PROM using a standardised torque-controlled measure, but most studies did not report the reliability or validity of the methods used to measure PROM. Studies used different scales to measure function or ambulation. Most of the studies assessed the outcomes when the cast was finally removed, but 2 studies assessed PROM from 5 to 684 days and 1 month after casting, respectively.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.
Assessment of study quality
Validity was assessed using seven criteria that had been modified from criteria described by Sackett: random assignment to treatments; blinding; monitoring of the intervention; drop-outs; reliability and validity of methods used to measure the outcomes; and confounding factors (see Other Publications of Related Interest nos.1-2). In addition, the studies were graded using a hierarchy of study design: level I studies were large RCTs; level II studies were small RCTs; level III studies were non-randomised studies; level IV studies were case series; and level V studies were case reports. The authors did not state how validity was assessed, or who performed the validity assessment.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
The characteristics of the included studies were summarised in the text of the review. The studies were grouped by outcome and a narrative synthesis was undertaken in which the evidence was graded using a hierarchy of evidence. Level A evidence was provided by at least one large RCT; level B evidence by at least one small RCT; and level C evidence by non-randomised studies, case series or case reports.

How were differences between studies investigated?
Differences were discussed with respect to participants and study quality, particularly study design and the methods used to assess the outcomes.

Results of the review
Thirteen studies (263 patients in total) were included. There were 2 small RCTs (23 patients), 3 non-randomised studies (133 patients), 3 prospective case series (37 patients), 2 retrospective case series (67 patients), one single-subject research study, and 2 case reports (2 patients).

Overall, the studies were of a poor quality. Ten studies fulfilled less than 3 of the 7 quality criteria, two met 4 criteria and one met 5 criteria. Methodological limitations included the use of cointerventions, the lack of random assignment to treatments, the lack of blinding, and the poor reliability and validity of methods used to measure the outcomes.

Spasticity: 5 studies were identified (1 small RCT, 2 prospective case series, 1 retrospective case series and 1 case report). A level C recommendation was made for the use of casts in reducing spasticity. This recommendation was based on one small RCT (15 patients) and one prospective case series (8 patients) that found a significant reduction in spasticity with casting.

PROM: 10 studies were identified. A level B recommendation was made for the use of casts in improving PROM. This recommendation was based on 2 RCTs (9 and 15 patients) that reported significant increases in PROM with casting.

Function or ambulation: 4 studies were identified. The results were inconsistent and no level of recommendation was possible.

Authors' conclusions
There was sufficient evidence to support the use of casts in improving the PROM or reducing loss of range of motion in adults with brain injuries, but there was insufficient evidence to determine the effect of casts on spasticity or function.

CRD commentary
The review question was clear in terms of the study design, intervention and participants, but were not adhered to since observational studies and case series are not experimental or quasi-experimental studies. The inclusion criteria were not
defined in terms of outcomes. Several relevant sources were searched and the search terms were stated. However, limiting the search to studies published in English and listed in only two databases might have resulted in the omission of other relevant studies. No specific attempt was made to locate unpublished studies, thus raising the possibility of publication bias. The methods used to select the studies, assess validity and extract the data were not described; hence, any efforts made to reduce errors and bias cannot be judged. Of particular interest would have been information about whether the results from observational studies were adjusted for confounding factors and which data were extracted from crossover RCTs. Validity was assessed and some relevant information on the included studies was tabulated. The results of the validity assessment were reported and some methodological limitations of the studies were discussed. The studies were summarised and the evidence was graded according to study design. The authors’ recommendations on the use of casts for improving PROM were based on 2 small RCTs with a total of 24 patients. Hence the evidence is very limited. This means that the review findings pertaining to PROM should be interpreted with caution.

**Implications of the review for practice and research**

**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that future studies of casts in adults with brain injury should be well-designed (no details) and assess spasticity (using a common definition), muscle function, functional independence, activity and participation (according to the International Classification of Function, Disability and Health classification), optimal timing and duration of casting, the effects of casts on muscle force production, and muscle atrophy.

**Bibliographic details**


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**Other publications of related interest**


**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Adult; Brain Injuries /complications /rehabilitation; Casts, Surgical; Child; Humans; Muscle Hypertonia /etiology /therapy; Muscle Spasticity /etiology /therapy; Physical Therapy Modalities; Randomized Controlled Trials as Topic; Range of Motion, Articular; Treatment Outcome

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract
contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.