A meta-analysis of outcomes of external fixation versus plate osteosynthesis for unstable distal radius fractures

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CRD summary
This review compared external fixation with open reduction and internal fixation in the treatment of unstable distal radius fractures. The authors concluded that there is no evidence to support one method over the other and further research is required. The reliance upon largely observational data means that the evidence was weak but does support the need for further research.

Authors' objectives
To compare the effectiveness of external fixation with that of open reduction and internal fixation in the treatment of unstable distal radius fractures (DRFs).

Searching
MEDLINE and EMBASE were searched for articles published in English between 1980 and 2004; the search terms were reported. The reference lists of retrieved articles and of relevant review articles were also checked.

Study selection
Study designs of evaluations included in the review
Studies of any design were eligible provided they included at least 10 patients and had a mean follow-up time of at least 12 months.

Specific interventions included in the review
Studies on the treatment of unstable DRFs, consisting exclusively of external fixation (with or without percutaneous pinning) or open reduction and internal fixation with plate osteosynthesis as primary or delayed primary (within 3 weeks) treatment, were eligible for inclusion. Studies that evaluated nonbridging or dynamic external fixators were excluded. In the included studies, most fractures treated by external fixation were fixed without pins. Fractures treated by internal fixation involved volar plating (49%), dorsal plating (46%) or both (4%).

Participants included in the review
Studies of adults with an unstable DRF (defined by seven criteria listed in the paper) were eligible for inclusion. Studies in which patients were undergoing correction of malunited DRFs were excluded. About 54% of the participants in the included studies were women, the mean age of the participants was about 52 years, and most patients had intra-articular fractures.

Outcomes assessed in the review
The included studies were required to report at least one from a list of primary outcomes relating to range of motion and grip strength, radiographic outcome and complications. Studies that only reported outcomes as descriptive categories, or used imprecise measures that could not be pooled, were excluded. The secondary outcomes of interest included pain rating scales, radiographic rating of post-traumatic arthritis and physician-rated outcome scores.

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
The authors stated that they did not assess validity because most of the included studies were case series, for which no validated method of assessing validity is available.
Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction. For each study, where possible, standard deviations (SDs) and means were extracted (or SDs estimated) and 95% confidence intervals were calculated for continuous outcome measures.

Methods of synthesis
How were the studies combined?
Studies that evaluated internal and external fixation were combined separately. Only studies that presented adequate data were pooled. The mean values were pooled using a random-effects meta-analysis that was weighted by the inverse of the standard error of the raw means. Pooled rates of complications and secondary procedures were calculated for internal and external fixation studies.

How were differences between studies investigated?
Statistical heterogeneity was assessed using the chi-squared test. Forest plots were presented for the meta-analyses of grip strength and mean volar tilt angle. A meta-regression analysis was performed using the random-effects model, with mean patient age, proportion of women, duration of follow-up and publication year as covariates. Pre-planned sensitivity analyses were performed on studies restricted to particular age groups, studies with allocation bias and studies limited to intra-articular fractures only. Sensitivity analyses were also performed to assess the effect of using a fixed-effect rather than a random-effects model for the meta-analysis, and of using reported versus estimated SDs in calculating summary means.

Results of the review
Forty-six studies were included. There were 28 studies (917 patients and 929 fractures) of external fixation: 5 randomised controlled trials against comparators other than internal fixation, 5 prospective cohort studies and 18 case series. There were 18 studies (603 patients and 611 fractures) of internal fixation: 6 prospective cohort studies and 12 case series.

The meta-analysis did not detect clinically or statistically significant differences between external and internal fixation for pooled grip strength, wrist range of motion, radiographic alignment, pain or physician-rated outcomes. There were significantly higher rates of infection (11.9% versus 0.8%), hardware failure (2.8% versus 0.3%) and neuritis (6.3% versus 1.6%) with external fixation, and higher rates of tendon complications (2.6% versus 0.4% for rupture and 5.2% versus 0.1% for tenosynovitis) and early hardware removal (15.9% versus 0.9%) with internal fixation. The meta-regression analysis indicated that after correcting for differences in publication year and proportion of women, there were no differences in outcomes between external and internal fixation. None of the sensitivity analyses altered the findings of the review.

Authors' conclusions
There was no evidence to support the use of internal fixation over traditional external fixation.

CRD commentary
The review addressed a clear question and had clear inclusion criteria for the participants, interventions and outcomes. The search covered two databases and reference lists, and was confined to papers published in the English language. Thus, it is possible that the review could have been affected by language and publication bias. The risk of publication bias was not assessed. The methods used to select studies and extract the data for the review were not reported, so it was difficult to assess the risk of bias and errors arising during the review process. The validity of the included studies was not assessed; this reflects the fact that most of the included studies were uncontrolled case series.

Some relevant details of the included studies were presented. The studies were combined by meta-analysis and differences between the studies were investigated by meta-regression and sensitivity analysis. The two forest plots presented showed evidence of heterogeneity, suggesting that pooling might not have been an appropriate method of combining these studies; the authors acknowledged that the pooling of data from non-comparative studies of different
designs might not have been appropriate and that the power of the meta-analysis to detect differences between fixation methods is unknown. Comparisons between treatments were based on non-comparative data and any conclusions cannot be considered definitive. The authors’ conclusion, that there is no evidence to support one method of fixation over the other, reflects the data presented but should be interpreted with caution in view of the methodological and reporting issues noted.

Implications of the review for practice and research

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

Research: The authors stated that there is a need for a well-designed prospective randomised trial to compare external and internal fixation techniques for DRFs. They recommended that future studies should follow established guidelines for study design and the reporting and analysis of data; use validated patient-rated upper-extremity measures to assess the outcomes; evaluate activities of daily living and functional measures that include capability for work and duration and cost of post-operative rehabilitation; and assess the outcomes at several time points.

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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.