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Bracing After Knee Arthroscopy: A Rapid Review

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Evidence Development and Standards Branch at Health Quality Ontario

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Conflict of Interest Statement

All authors in the Evidence Development and Standards branch at Health Quality Ontario are impartial. There are no competing interests or conflicts of interest to declare.

Rapid Review Methodology

Rapid reviews are completed in 2–4-week time frames. Clinical questions are developed by the Evidence Development and Standards branch at Health Quality Ontario, in consultation with experts, end users, and/or applicants in the topic area. A systematic literature search is then conducted to identify relevant systematic reviews, health technology assessments, and meta-analyses. The methods prioritize systematic reviews, which, if found, are rated by AMSTAR to determine the methodological quality of the review. If the systematic review has evaluated the included primary studies using the GRADE Working Group criteria (http://www.gradeworkinggroup.org/index.htm), the results are reported and the rapid review process is complete. If the systematic review has not evaluated the primary studies using GRADE, the primary studies in the systematic review are retrieved and the GRADE criteria are applied to 2 outcomes. If no systematic review is found, then RCTs or observational studies are included, and their risk of bias is assessed. All rapid reviews are developed and finalized in consultation with experts.

About Health Quality Ontario

Health Quality Ontario is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians, and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. The Evidence Development and Standards branch works with expert advisory panels, clinical experts, scientific collaborators, and field evaluation partners to conduct evidence-based reviews that evaluate the effectiveness and cost-effectiveness of health interventions in Ontario.

Based on the evidence provided by Evidence Development and Standards and its partners, the Ontario Health Technology Advisory Committee—a standing advisory subcommittee of the Health Quality Ontario Board—makes recommendations about the uptake, diffusion, distribution, or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders, and policy-makers.

Health Quality Ontario's research is published as part of the *Ontario Health Technology Assessment Series,* which is indexed in MEDLINE/PubMed, Excerpta Medica/Embase, and the Centre for Reviews and Dissemination database. Corresponding Ontario Health Technology Advisory Committee recommendations and other associated reports are also published on the Health Quality Ontario website. Visit http://www.hqontario.ca for more information.

About Health Quality Ontario Publications

To conduct its rapid reviews, the Evidence Development and Standards branch and its research partners review the available scientific literature, making every effort to consider all relevant national and international research; collaborate with partners across relevant government branches; consult with expert advisory panels, clinical and other external experts, and developers of health technologies; and solicit any necessary supplemental information.

In addition, Evidence Development and Standards collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits, economic and human resources, and ethical, regulatory, social, and legal issues relating to the intervention may be included to assist in making timely and relevant decisions to optimize patient outcomes.

Disclaimer

This rapid review is the work of the Evidence Development and Standards branch at Health Quality Ontario, and is developed from analysis, interpretation, and comparison of published scientific research. It also incorporates, when available, Ontario data and information provided by experts. As this is a rapid review, it may not reflect all the available scientific research and is not intended as an exhaustive analysis. Health Quality Ontario assumes no responsibility for omissions or incomplete analysis resulting from its rapid reviews. In addition, it is possible that other relevant scientific findings may have been reported since completion of the review. This report is current as of the date of the literature search specified in the Research Methods section. Health Quality Ontario makes no representation that the literature search captured every publication that was or could be applicable to the subject matter of the report. This rapid review may be superseded by an updated publication on the same topic. Please check the Health Quality Ontario website for a list of all publications: http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations.

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List of Abbreviations

ACL	Anterior cruciate ligament
AMSTAR	Assessment of Multiple Systematic Reviews
GRADE	Grading of Recommendations Assessment, Development, and Evaluation
RCT	Randomized controlled trial
SR	Systematic review

Background

As legislated in Ontario's *Excellent Care for All Act*, Health Quality Ontario's mandate includes the provision of objective, evidence-informed advice about health care funding mechanisms, incentives, and opportunities to improve quality and efficiency in the health care system. As part of its Quality-Based Procedures (QBP) initiative, Health Quality Ontario works with multidisciplinary expert panels (composed of leading clinicians, scientists, and administrators) to develop evidence-based practice recommendations and define episodes of care for selected disease areas or procedures. Health Quality Ontario's recommendations are intended to inform the Ministry of Health and Long-Term Care's Health System Funding Strategy.

For more information on Health Quality Ontario's Quality-Based Procedures initiative, visit www.hqontario.ca.

Objective of Analysis

The objective of this analysis was to determine the effectiveness of postoperative knee bracing after arthroscopic surgery of the knee.

Technology/Technique

The use of bracing after arthroscopic anterior cruciate ligament (ACL) reconstruction remains controversial. In a 2004 survey of the Canadian Orthopaedic Association, just under 50% of surgeons said they used a knee brace in the immediate postoperative period. (1) The primary reason stated for bracing was to reduce postoperative pain, followed by graft protection and the maintenance of full extension. (1)

Two primary types of brace are used after arthroscopic knee surgery—rehabilitative and functional—defined primarily by when the brace is applied and how much it limits range of motion. Rehabilitative braces are typically worn in the early postoperative and rehabilitative period to limit knee range of motion or extension/flexion motion and stresses. (2) The intent is to decrease pain, protect the knee from injury or graft strain, and help achieve knee extension. These braces can range from splints with complete immobilization to a hinged brace that allows varying limits on range of motion. Functional braces are braces worn after return to physical activity or sport. With functional braces, the intent is to stabilize the knee and decrease the risk of re-injury. (2)

Rapid Review

Research Question

What is the effectiveness of postoperative bracing after arthroscopic surgery of the knee?

Research Methods

Literature Search

Search Strategy

A literature search was performed on March 7, 2014, using Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid Embase, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), and EBM Reviews, for studies published from January 1, 2007, to March 7, 2014. (Appendix 1 provides details of the search strategies.) Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

- English-language full-text publications
- published between January 1, 2007, and March 7, 2014
- systematic reviews (SRs), meta-analyses, and health technology assessments
- reporting on arthroscopic surgery of the knee*
- evaluating the use of a knee brace in the early postoperative and rehabilitative period
- comparing knee brace to no knee brace after surgery

*Based on Expert Panel feedback, studies of ACL reconstruction where the type of surgery was not stated were assumed to be studies of arthroscopic surgeries of the knee.

Exclusion Criteria

- knee braces used after return to physical activity (e.g., functional knee braces used after rehabilitation)

Outcomes of Interest

- pain
- functional status
  - return to physical activity or sport
- re-operations
- re-injury

Expert Panel

In December 2013, an Expert Advisory Panel for Patients Undergoing Knee Arthroscopic Surgery was struck. Members of the panel included physicians, personnel from the Ministry of Health and Long-Term Care, health care administrators, and allied health professionals.

The role of the expert advisory panel was to provide advice on primary patient groupings; to review the evidence, guidance, and publications related to defined patient populations; to identify and prioritize interventions for review; and to advise on the development of a care pathway model. The role of panel members was to provide advice on the scope of the project, the methods used, and the findings. However, the statements, conclusions, and views expressed in this report do not necessarily represent the views of the expert panel members.

Quality of Evidence

The Assessment of Multiple Systematic Reviews (AMSTAR) measurement tool was used to assess the methodological quality of systematic reviews. (3)

The quality of the body of evidence for each outcome was examined according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) Working Group criteria. (4) The overall quality was determined to be high, moderate, low, or very low using a step-wise, structural methodology.

Study design was the first consideration; the starting assumption was that randomized controlled trials (RCTs) are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—were then taken into account. Limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 main factors that may raise the quality of evidence were considered: the large magnitude of effect, the dose response gradient, and any residual confounding factors. (4) For more detailed information, please refer to the latest series of GRADE articles. (4)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	High confidence in the effect estimate—the true effect lies close to the estimate of the effect.
Moderate	Moderate confidence in the effect estimate—the true effect is likely to be close to the estimate of the effect, but may be substantially different.
Low	Low confidence in the effect estimate—the true effect may be substantially different from the estimate of the effect.
Very Low	Very low confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of the effect.

Results of Rapid Review

The database search yielded 17 citations published between January 1, 2007, and March 7, 2014 (duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment.

Six systematic reviews (SRs) were identified that evaluated the use of bracing after knee arthroscopy—all among the ACL reconstruction population. No studies were identified that evaluated the use of bracing for meniscal repair alone. The reference lists of the included studies and health technology assessment websites were hand-searched to identify other relevant studies, and no additional citations were included.

A summary of the SRs on post-arthroscopy knee bracing is provided in Appendix 2, Table A1.

Quality Assessment of Systematic Reviews

AMSTAR scores ranged from 2 to 7 (see Appendix 3, Table A2). Four of the SRs evaluated all rehabilitation components after ACL reconstruction, each with a defined section on postoperative bracing. (5-8) None of these 4 provided clear inclusion and exclusion criteria related to bracing, and all 4 included studies with comparators other than no bracing (e.g., cast, soft brace, different brace range of motion), with limited information on the interventions and comparators. Lobb et al (7) was a review of other SRs; however, it provided no data on the individual RCTs within the included SRs, and was not inclusive of all SRs published in this field. For these reasons, these 4 SRs were excluded from this rapid review.

Only 2 SRs focused directly on the effectiveness of postoperative knee braces. (2;9) The study by Smith and Davies (9) was selected for this rapid review because it had the highest AMSTAR rating, focused on knee bracing, and limited itself to RCTs that compared bracing to no bracing in the first 3 months after surgery. Smith and Davies only captured studies published up to 2006. However, a review of the RCTs within the SRs with updated literature searches found that only 1 article had been published since.

Summary of Individual RCTs Within Included Systematic Review

The Smith and Davies (9) review included 7 RCTs evaluating the use of knee bracing in the postoperative period, 6 of which included outcomes of interest for our rapid review. Overall, considerable clinical heterogeneity was observed among the RCTs included in the Smith and Davies (9) review. In all RCTs, knee braces were worn in the early postoperative period, but the type of brace used and the procedures around its usage varied. Some studies required braces to be worn day and night and during rehabilitation activities, while others allowed for brace removal during physiotherapy or other exercise. Two studies used braces that were locked in full extension for the entire study follow-up period, while others allowed some range of motion or increased range of motion over time. One study used a rehabilitative brace for the first 2 weeks, and then a functional brace for 10 weeks. In 6 studies, the non-braced patients had no external support after surgery; in 1 study they had neoprene sleeves.

Little detail on the rehabilitation protocols was provided, although Smith and Davies (9) noted that a variety of rehabilitation types were used at different time points. A summary of the RCTs included in their review is presented in Table 1.

Table 1: Summary of RCTs Included in Selected Systematic Review

Author, Year	No. of RCTs	Type of Surgery	Age Range (years)	Duration in Splint	Follow-up Period
Smith and Davies, 2008 (9)	7	Arthroscopic bone-patella tendon-bone ACL reconstruction (acute and chronic ruptures)	14 to 53	5 RCTs: 3 to 6 weeks 2 RCTs: 3 months	2 weeks to 5 years

Abbreviations: ACL, anterior cruciate ligament; No., number; RCT, randomized controlled trial.

Functional Status

As shown in Table 2, 6 RCTs evaluated the impact of knee bracing, using various measures of functional status. Overall, at final follow up, no study found a significant improvement in any functional status measure for the bracing versus the non-bracing group; 1 study found an improvement in Cincinnati Knee Score at 3 months, but no difference at other time points. Two studies found a significant improvement in functional status for the *non-bracing* group in comparison to the bracing group at 6 months; however, there was no difference at 1- or 2-year follow ups. (9)

No study directly evaluated the time before return to physical activity or sport as an outcome measure.

Table 2: Functional Status After Arthroscopic ACL Reconstruction for Patients Who Did and Did Not Undergo Postoperative Knee Bracing—Summary of Systematic Review Results

Functional Status Measure	Number of Studies	Results for Bracing Versus Non-Bracing Groups
Tegner activity scale	6	• 5 studies identified no significant difference • 1 study found a significant improvement at 6 months for the *non-bracing* group, but no difference at 2 years
Lysholm score	4	• No significant difference at any time point
One-leg hop test	5	• 4 studies identified no significant difference at any time point • 1 study found significant improvement at 24 weeks for the *non-bracing* group, but no difference at 1 year
IKDC evaluation	2	• No significant difference at any time point
Cincinnati Knee Score	1	• Significant improvement at 3 months, but no significant difference at 6, 12, or 24 months
OAK score	1	• No significant difference at any time point
Stairs or triple jump	1	• No significant difference at any time point

Abbreviations: ACL, anterior cruciate ligament; IKDC, International Knee Documentation Committee; OAK, Orthopädische Arbeitsgemeinschaft Knie.
Source: Smith and Davies, 2008. (9)

Pain

Smith and Davies (9) identified 3 studies that evaluated pain using the Visual Analog Scale.
Two of the 3 studies found no significant difference in pain at any time point between the 2 groups, and 1 study found higher pain with the non-braced group after 2 weeks, but no difference thereafter. (9)

Re-Operations or Re-Injury

The systematic review by Smith and Davies (9) did not directly look at re-operations or re-injury as an outcome measure. Complications were assessed, however, some of which included injuries and may have resulted in surgical intervention. Overall, the review found no significant differences in any complication measure assessed, including meniscal injury, rupture of reconstructed ACL, and extension or flexion deficit.

Quality-of-Evidence Assessment

Given that Smith and Davies (9) described results from the individual studies narratively, with no quantitative synthesis, grading of outcomes was not possible based on data reported in their systematic review. Therefore this rapid review assessed only risk of bias for each individual study, based on information from the quality assessment provided within the Smith and Davies review (see Appendix 3, Table A3). All the RCTs had serious limitations due to risk of bias for each outcome assessed, thus decreasing our confidence in their results. In addition, Smith and Davies (9) have stated that 5 of the studies failed to provide a sample size calculation and that, therefore, non-significance may be attributed to a lack of statistical power.

Conclusions

- Based on 1 systematic review comprising studies with serious risk of bias, there was no significant difference in functional status, pain, or complication rates among patients receiving a postoperative knee brace, in comparison with no knee brace, during the early rehabilitation stage after arthroscopic ACL reconstruction.
- No studies were identified that reported on return to activity or sport as an outcome measure.
- No studies were identified that evaluated the use of postoperative bracing after meniscal procedures.

Acknowledgements

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Leslie Gauthier	Hamilton Health Sciences	Director, Perioperative Services

Name	Affiliation(s)	Appointment(s)
Winnie Doyle	St Joseph's Healthcare, Hamilton	VP President Patient Services, Chief Nursing Executive

Appendices

Appendix 1: Literature Search Strategies

Databases: EBM Reviews - Cochrane Database of Systematic Reviews 2005 to January 2014, EBM Reviews - ACP Journal Club 1991 to February 2014, EBM Reviews - Database of Abstracts of Reviews of Effects 1st Quarter 2014, EBM Reviews - Cochrane Central Register of Controlled Trials January 2014, EBM Reviews - Cochrane Methodology Register 3rd Quarter 2012, EBM Reviews - Health Technology Assessment 1st Quarter 2014, EBM Reviews - NHS Economic Evaluation Database 1st Quarter 2014, Ovid MEDLINE(R) 1946 to February Week 4 2014, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations March 06, 2014

Search Strategy

#	Searches	Results
1	Arthroscopy/	17125
2	exp Knee Joint/ or exp Knee Injuries/	53656
3	and/1-2	6486
4	Anterior Cruciate Ligament/ or Medial Collateral Ligament, Knee/ or Posterior Cruciate Ligament/ or Anterior Cruciate Ligament Reconstruction/	11988
5	(((arthroscop* or reconstruct* or repair* or surg* or orthop*) and (anterior cruciate ligament* or posterior cruciate ligament* or meniscal or menisci or meniscus or menisectom* or semilunar cartilage* or ACL or PCL or MCL)) or (arthroscop* and knee*)).ti,ab.	19935
6	or/3-5	24981
7	exp Braces/ or exp Immobilization/	27502
8	(brace* or bracing or splint* or immobilis* or immobiliz*).ti,ab.	96489
9	7 or 8	114363
10	6 and 9	787
11	limit 10 to (english language and yr="2007 -Current") [Limit not valid in CDSR,ACP Journal Club,DARE,CCTR,CLCMR; records were retained]	175
12	Meta Analysis.pt.	46125
13	Meta-Analysis/ or exp Technology Assessment, Biomedical/	55143
14	(meta analy* or metaanaly* or pooled analysis or (systematic* adj2 review*) or published studies or published literature or medline or embase or data synthesis or data extraction or cochrane).ti,ab.	198195
15	((health technolog* or biomedical technolog*) adj2 assess*).ti,ab.	2713
16	or/12-15	214460
17	11 and 16	19
18	remove duplicates from 17	17

Appendix 2: Summary of Identified Systematic Reviews

Table A1: Systematic Reviews Evaluating Postoperative Knee Bracing after Arthroscopic Knee Surgery

Author, Year	Population	Included Study Types; Type of Review	Search Dates	No. of Studies on Knee Bracing	Conclusions on Knee Bracing
Lobb et al, 2012 (7)	Post-traumatic ACL reconstruction by hamstring or patella tendon auto-graft	SRs; Narrative	Up to April 2011	2	There is strong evidence of no added benefit of bracing after ACL reconstruction as an adjunct to standard treatment in the short term. Its use is therefore not recommended.
Kruse et al, 2012 (6)	Patella-tendon and hamstring graft ACL reconstructions	RCTs; Narrative	2006 to 2010	6	Bracing following ACL reconstruction is still deemed neither necessary nor beneficial, and immediate postoperative range of knee motion is safe.
Andersson et al, 2009 (5)	ACL reconstruction	RCTs; Narrative	1995 to 2009	11	The use of a postoperative knee brace does not affect the clinical outcome after ACL reconstruction.
Smith and Davies, 2008 (9)	ACL reconstruction	RCTs; Narrative	Up to 2006	7	There appear to be no significant longer-term differences in clinical outcomes between patients who wore postoperative knee braces and those who did not.
Wright et al, 2008 (8)	ACL reconstruction	RCTs; Narrative	1966 to 2005	1 SR[a]	Postoperative bracing was not necessary following ACL reconstruction.
Wright and Fetzer, 2007 (2)	ACL reconstruction	RCTs; Narrative	1966 to 2005	11	The use of bracing after ACL reconstruction is not supported by currently available evidence.

Abbreviations: AMSTAR, Assessment of Multiple Systematic Reviews; ACL, anterior cruciate ligament; No., number; RCT, randomized controlled trial; SR, systematic review.
[a]Although only RCTs were included in the Wright et al review, it referenced the 2007 systematic review of RCTs co-authored by Wright.

Appendix 3: Evidence Quality Assessment

Table A2: AMSTAR Scores of Systematic Reviews Evaluating Postoperative Knee Bracing After Arthroscopic Knee Surgery

Author, Year	AMSTAR Score[a]	(1) Provided Study Design	(2) Duplicate Study Selection	(3) Broad Literature Search	(4) Considered Status of Publication	(5) Listed Excluded Studies	(6) Provided Characteristics of Studies	(7) Assessed Scientific Quality	(8) Considered Quality in Report	(9) Methods to Combine Appropriate[b]	(10) Assessed Publication Bias	(11) Stated Conflict of Interest
Lobb et al, 2012 (7)	7	✓	✓	✓	✓	✗	✗	✓	✓	✗	✗	✓
Kruse et al, 2012 (6)	5	✗	✓	✓	✗	✗	✓	✓	✗	✗	✗	✓
Andersson et al, 2009 (5)	2	✗	✗	✗	✗	✗	X	✓	✓	✗	✗	✗
Smith and Davies (9)	7	✓	✓	✓	✗	✗	✓	✓	✓	✗	✗	✓
Wright et al, 2008 (8)	4	✗	✗	✓	✗	✗	✓	✓	✗	✗	✗	✓
Wright and Fetzer, 2007 (2)	5	✓	✗	✓	✗	✗	✓	✓	✓	✗	✗	✗

Abbreviations: AMSTAR, Assessment of Multiple Systematic Reviews.

[a]Maximum possible score is 11. Details of AMSTAR score are described in Shea et al. (3)

[b]No studies stated that a meta-analysis was not planned or why a meta-analysis was not conducted.

Table A3: Risk of Bias Among Randomized Controlled Trials for the Comparison of Postoperative Knee Bracing and No Knee Bracing[a]

Author, Year	Allocation Concealment	Blinding	Complete Accounting of Patients and Outcome Events	Selective Reporting Bias	Other Limitations
Brandsson et al, 2001 (10)	Serious limitations[b]	Serious limitations[c]	Serious limitations[d]	No limitations	No limitations
Harlainen and Sandelin, 2006 (11)	Serious limitations[b]	Serious limitations[c]	Serious limitations[d]	No limitations	Serious limitations[e]
Kartus et al, 1997 (12)	Serious limitations[b]	Serious limitations[c]	No limitations	No limitations	Serious limitations[e,f]
Moller et al, 2001 (13)	Serious limitations[b]	Serious limitations[c]	Serious limitations[d]	No limitations	No limitations
Muellner et al, 1998 (14)	Serious limitations[b]	Serious limitations[c]	No limitations	No limitations	No limitations
Risberg et al, 1999 (15)	Serious limitations[b]	Serious limitations[c]	Serious limitations[d]	No limitations	No limitations

[a] Risk of bias assessment based on Smith and Davies (9)
[b] Inadequate allocation concealment.
[c] Inadequate blinding of subject, clinician, or assessor.
[d] No intention-to-treat analysis conducted.
[e] Study used quasi-randomization.
[f] Baseline was not comparable between study groups.

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