Systematic Review

Patients Generally May Return to Driving 4 Weeks After Hip Arthroscopy and 6 Weeks After Knee Arthroscopy: A Systematic Review and Meta-analysis

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Purpose: To consolidate the evidence from the available literature and undertake a meta-analysis to provide a reference for physicians to make evidence-based recommendations to their patients regarding the return to driving after hip or knee arthroscopic procedures. **Methods:** A systematic review was conducted using Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. The OVID, Embase, and Cochrane databases were searched through June 2020 for articles containing keywords and/or MeSH (Medical Subject Headings) terms "hip arthroscopy" and "knee arthroscopy" in conjunction with "total brake response time" or "reaction time" in the context of automobile driving. A title review and full article review were performed to assess quality and select relevant articles. A meta-analysis of qualifying articles was undertaken. **Results:** Eight studies met the inclusion criteria for meta-analysis of brake reaction time (BRT). Meta-analysis of all knee BRTs showed times slower than or equal to baseline BRTs through 5 weeks, with a trend of improving BRTs from 6 to 10 weeks (weeks 8 and 10 were significant, $P < .05$). Among all hip BRTs, week 2 showed times slower than baseline BRTs, but after week 4, a trend toward faster BRTs was observed through week 8 (week 8 was significant, $P < .05$). **Conclusions:** BRTs met baseline or control values and continued to improve after 6 weeks after knee arthroscopy and after 4 weeks after hip arthroscopy. On the basis of these results, it would be safe to recommend a return to driving at 6 weeks after knee arthroscopic procedures and 4 weeks after hip arthroscopic procedures. **Clinical Relevance:** These results can be used by surgeons to base their recommendations on to provide guidance for their patients on the resumption of driving. Although BRT is an important aspect of driving ability, there are additional factors that need to be taken into consideration when making these recommendations, including cessation of opioid analgesics, strength of the surgical limb, and range of motion.

Hip and knee arthroscopies are some of the most common orthopaedic procedures performed. Studies in the United States have suggested that 70,000 hip arthroscopies are performed annually, with a further 984,607 knees arthroscopies.[1,2] Such procedures have many advantages over their open-procedure counterparts, such as less postoperative swelling, reduced pain, faster recovery time, and reduced risk of complications.[3] Arthroscopy is available for the treatment of a wide variety of orthopaedic conditions, including anterior cruciate ligament (ACL) reconstruction, meniscectomy, labral repair, femoroacetabular

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impingement treatment, and removal of loose bodies, among many others.[3,4] With patients eager to return to their normal functional level for work, for school, or otherwise, physicians often encounter the question "When can I drive?" at some point in the course of treating of their patients.

Driving involves complex and rapid skill sequences requiring the ability to interact simultaneously with both the vehicle and the external environment. Historically, driving impairment has been described as an increased time needed to perform an emergency stop[5] (often tested as brake reaction time [BRT]); simulations to determine the BRT of a patient after surgery is neither a cost-effective nor practical solution to implement in every clinic or facility that offers arthroscopic surgery. One study found that most physicians recommended that their patients could return to driving after narcotics were discontinued and whenever the patients' postoperative symptoms would allow for driving.[6] A study on self-regulation of driving found a significant correlation with self-regulation related to driving and the subject's perception of his or her overall health.[7] However, it was also found that the study participants rated their overall health much higher than expected, suggesting that the patient's perception of health may not be the most reliable indicator of the ability to return to driving, adding yet another layer of complexity regarding when and how to make recommendations to return to driving for patients after arthroscopic surgery.

The effects of other orthopaedic surgical procedures, such as hip or knee arthroplasty, on the optimal return-to-driving time have also been examined. Whereas the effects of these procedures on driving ability have been better documented,[8] there is a paucity in the literature investigating the effects of hip and knee arthroscopy on driving ability. Among the studies that exist, the recommendations for the optimal time to return to driving are varied.

When making postoperative recommendations for the return to driving, the safety of the patient is paramount. Additionally, there are legal ramifications, as well as the potential of harm to other individuals, that are equally as important to consider when making these recommendations. Previous reviews have combined and presented the results and recommendations from existing studies, but none have completed a meta-analysis of the existing data to search for overarching trends or patterns.[5,8-12]

The purpose of this study was to consolidate the evidence from the available literature and undertake a meta-analysis to provide a reference for physicians to make evidence-based recommendations to their patients regarding the return to driving after hip or knee arthroscopic procedures. We hypothesized that driving ability would be adversely affected in the postoperative period after arthroscopic procedures, making a return to driving during this period unsafe for the patient.

Methods

Search Strategy and Selection

The procedures for this review were developed based on Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines.[13] The OVID, Embase, and Cochrane databases were all used for this systematic review. A brief review of related articles helped to determine the optimal keywords and MeSH (Medical Subject Headings) terms to be used. These terms were incorporated into the search protocol prior to data collection. The search protocol is shown in Appendix Table 1.

Study Selection

The inclusion criteria were established following the PICO (population-intervention-comparison-outcomes) approach: The population was defined as adults (age $\geq$ 18 years) undergoing hip or knee arthroscopy who were able to drive (in possession of a driver's license). The intervention was defined as hip or knee arthroscopy. The comparator was defined as the preoperative baseline or control cohort. Regarding outcomes, the primary outcome measured was the total brake response time. The secondary outcomes were reaction time, movement time, and braking force.

All studies published prior to July 1, 2020, were considered for eligibility. Table 1 summarizes the inclusion and exclusion criteria used. Titles and abstracts were screened for relevance prior to full inspection. The references of all included studies were reviewed to locate any articles that may have been missed in the database search. Duplicate articles between the databases were removed, and the full texts of all studies meeting the inclusion criteria were obtained.

Statistical Analysis and Assessment of Methodologic Quality

Data were extracted from each relevant study and analyzed using RevMan 5.4 (Review Manager, version 5.4; Cochrane, London, England). Means and standard deviations for BRTs were obtained from available study data for meta-analysis. BRTs were compared with preoperative or control values in 3 separate analyses; right (hip or knee) BRTs, left (hip or knee) BRTs, and all (hip or knee) BRTs. Standardized mean differences between preoperative or control BRTs and postoperative BRTs were assessed. When confidence intervals, standard errors, and P values were given in place of standard deviations,[14] standard deviations were imputed using the methods described in the *Cochrane Handbook for Systematic Reviews of Interventions* (chapter 7.7.3.3).[15]

With varying methodologies and outcome measures, heterogeneity among studies was considered likely, and a random-effects model was used for analysis. In all analyses, $P < .05$ was considered statistically significant.

Table 1. Details of Inclusion and Exclusion Criteria for Selection of Included Articles

Studies Were Included if they met ≥1 of the following Inclusion Criteria:
Objective, quantitative measurement such as brake reaction times or related values
Qualitative, patient-reported survey data for return to driving
Review of current literature focusing on recommendations for return to driving in context of either hip or knee arthroscopic soft-tissue repair
Studies were excluded if they met ≥1 of the following exclusion criteria:
Duplicate of previously included study
Abstract only
Not English-language study
Inclusion criteria not met

Additionally, the I^2 value was calculated to measure the heterogeneity of the included studies, indicating the percentage of variation in the meta-analysis caused by heterogeneity rather than chance. An I^2 value lower than 30% was considered low heterogeneity, whereas an I^2 value greater than 75% was considered high heterogeneity.[15]

Articles selected for the meta-analysis were critically appraised and examined for bias using the Critical Appraisal Skills Programme (CASP) checklist.[16] Each study was graded as having a low, medium, or high risk of bias.

The methodologic quality of the included studies was assessed using the Methodological Index for Non-randomized Studies (MINORS) index.[17] The MINORS index produces a score between 0 and 24, with scores of 0 (not reported), 1 (reported but inadequate), or 2 (reported and adequate) being given for 12 separate factors.[17] The score is designed to assess the methodologic quality of nonrandomized surgical studies, whether comparative or noncomparative, with the ideal score being 16 for noncomparative studies and 24 for comparative studies.[17] The level of evidence was graded using the Oxford Centre for Evidence-Based Medicine (OCEBM) scale for levels of evidence.[18]

The overall quality of the evidence in the meta-analysis was assessed using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system.[19] Recommendations were classified as either high (we are very confident that the effect in the study reflects the actual effect), moderate (we are quite confident that the effect in the study is close to the true effect, but it is also possible that it is substantially different), low (the true effect may differ significantly from the estimate), or very low (true effect is probably markedly different from the estimated effect).

Results

The PRISMA flowchart is shown in Fig 1. After searches of the 3 databases and removal of duplicates, a total of 22 articles were identified. On a full article review, 4 articles were removed because of lack of relevance, abstract-only status, inability to access, and repeat of a previous study. One additional article was found based on a review of references from the previously collected articles. On the basis of the inclusion and exclusion criteria, a total of 19 relevant articles remained. The articles were classified as either prospective cohort, comparative, or case-control studies[14,20-26]; repeated-measures design[27]; surveys or questionnaires[6,28]; literature reviews[8-10,28,29]; or systematic reviews.[11] Of the remaining studies, 8 contained quantitative data on BRTs and were included in the meta-analysis. Table 2 details the characteristics of all included studies.

Methodologic Quality

Table 3 provides an overview of the Critical Appraisal Skills Programme (CASP), MINORS, and Oxford Centre for Evidence-Based Medicine (OCEBM) bias assessments, which were completed for all of the studies included in the meta-analysis. Fourteen studies were graded as low risk; 2 studies, low/moderate risk; 2 studies, moderate risk; and 1 study, moderate/high risk.

Grading of Recommendations, Assessment, Development and Evaluation (GRADE) analysis (Appendix Table 2) showed the quality of evidence for most of the pooled analyses to be low or very low. On the basis of this, there is a possibility that the true effect may differ significantly from the estimate.

Systematic Review

There were 1,103 patients, with a total of 1,095 remaining after we accounted for loss to follow-up and participant dropout. In the studies that reported the mean age, there was a range of 22 ± 4.61 years[26] to 44 ± 11.4 years.[22]

Within the existing literature, there was a range of recommendations for optimal return-to-driving time after hip and knee arthroscopic procedures (Fig 2). The most frequent recommendation for the timing of the return to driving was 6 weeks postoperatively, as reported by Cooper[29] and Fleury et al.[10] after ACL reconstruction (either side) and by Ho and Furlan[9] after right-sided ACL reconstruction specifically. This is consistent with recommendations made by Gotlin et al.[27] and Nguyen et al.[21] based on their prospective experimental studies. Wasserman et al.[22] studied the BRTs of 3 different groups based on the type of surgical graft for ACL reconstruction. They, too, recommended waiting 6 weeks to return to driving after hamstring and bone—patellar tendon—bone autograft procedures but recommended waiting only 3 weeks after surgery for tibialis anterior autograft procedures.[22] However, these suggestions differ from those of DiSilvestro et al.,[11] who recommended a return to driving after ACL reconstruction at 4 weeks postoperatively. Both Hau et al.[20]

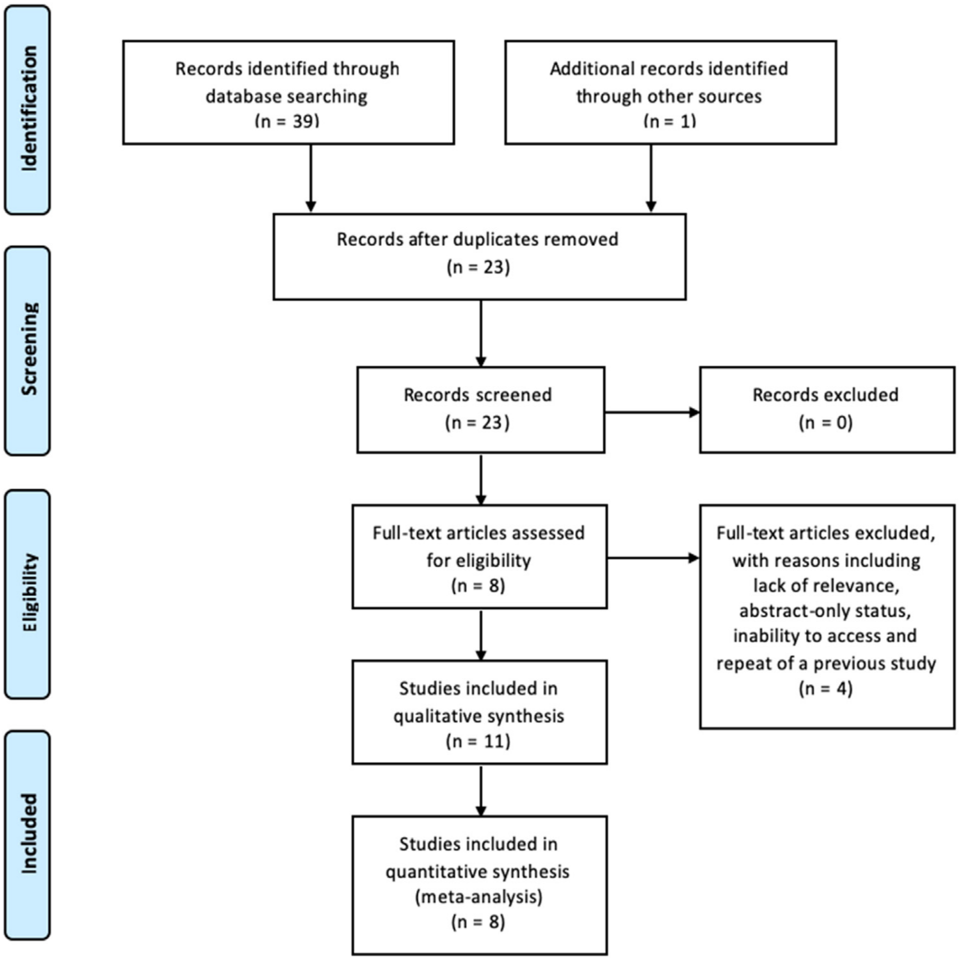


Fig 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram for selection of articles used for systematic review and meta-analysis.

and Argintar et al.[6] suggested waiting at least 1 week to drive after simple knee arthroscopy (meniscectomy, chondroplasty, and diagnostic arthroscopy).

In a survey of surgeons performing right knee arthroscopy and their patients, Argintar et al.[6] found that just under 30% of physicians had incorporated guidance on the return to driving during each of the preoperative patient visits. Of the physicians, 57% initiated this conversation half of the time or less frequently and 33.4% initiated this conversation a quarter of the time or less frequently.[6] Most of the physicians surveyed recommended to patients that they could return to driving once pain medications (i.e., opioid analgesics) ceased and when their postoperative symptoms allowed for it. Of the patients surveyed, only 8% stated that their doctor gave them advice regarding returning to driving. When they did receive advice, a large majority (88%) followed the advice they were given. By use of a linear regression model and dummy variables, it was found that patients who were given 2 pieces of advice displayed a longer time to driving than did patients given a only 1 piece of advice.[6] Of note, a study that examined early functional milestones after ACL reconstruction discovered predictors of an earlier return to driving, which included higher age, male sex, and left-sided surgery.[30]

Regarding hip arthroscopy, there was also a varied distribution of recommendations. Vera et al.[23] recommended a return 2 weeks after left hip arthroscopy and 6 weeks after right hip arthroscopy. Momaya et al.[25] similarly recommended a return to driving after 2 weeks but did not differentiate between left- and right-sided surgery. With a recommendation falling in the middle, Balazs et al.[14] recommended returning to driving 4 weeks after hip arthroscopy, also not differentiating by side of surgery. In a survey of patients in 3 different groups based on surgical approach (simultaneous treatment, staged treatment, or single-hip treatment), Mei-Dan et al.[31] found that there was no significant difference in the time after surgery when patients returned to driving. They also noted that the return to daily activities in the bilateral surgery group was similar to that in the unilateral surgery group, "with the advantage of a single rehabilitation."[31]

Table 2. Characteristics of All Included Studies in Systematic Review

Study Title	Authors	Type of Study	Year Published	Participants, n	Mean Age, yr	Timeline	Outcomes
Return to Driving After Hip Arthroscopy	Momaya et al.[25]	Prospective study (cohort)	2018	14 (4 participants dropped out)	27.39 ± 9.13 in surgical group and 28.35 ± 5.81 in control group	The study period was October 2014 to November 2015, with follow-up performed every 2 wk for a total of 8 wk.	Right BRTs
Evaluation of Driving Skills After Anterior Cruciate Ligament Reconstruction With Hamstring Autograft	Valentí et al.[24]	Prospective study (cohort)	2018	62	32.39 ± 9.27 in surgical group and 28.58 ± 8.91 in control group	Subjects completed simulated driving and reaction time tests between 4-6 wk postoperatively.	Right and left BRTs
Measurement of Brake Response Time After Right Anterior Cruciate Ligament Reconstruction	Gotlin et al.[27]	Prospective repeated-measure design	2000	35	31.2 in surgical group and 29.3 in control group	Multiple variables were measured every 2 wk for a total of 10 wk postoperatively.	Right BRTs
Reaction Time and Brake Pedal Depression Following Arthroscopic Hip Surgery: A Prospective Case-Control Study	Balazs et al.[14]	Prospective case-control study	2018	118	33.7 in surgical group and 33.3 in control group	BRT and BPD were measured preoperatively and at 2, 4, and 6 wk postoperatively.	Right and left BRTs
Brake Reaction Time After Hip Arthroscopy for Femoroacetabular Impingement and Labral Tear	Vera et al.[23]	Prospective comparative study (Level II, diagnostic)	2017	40 (2 participants failed to meet testing time frame and were excluded)	37.1 ± 12.7 for right knee, 32.1 ± 9.2 for left knee, 35.5 ± 11.1 for right control, and 32.6 ± 8.4 for left control	BRTs and sit-to-stand numbers were measured preoperatively and every 2 wk postoperatively for a total of 8 wk.	Right and left BRTs and sit-to-stand scores
Braking Reaction Time After Right-Knee Anterior Cruciate Ligament Reconstruction: A Comparison of 3 Grafts	Wasserman et al.[22]	Case-control study	2017	57	29.2 ± 8.2 for HS, 25.0 ± 4.2 for BPTB, 44.0 ± 11.4 for TA, and 30.4 ± 3.8 for control	Thirty healthy volunteers were tested during 1 visit to determine normal mean values, and 27 treatment subjects were tested at 1, 3, and 6 wk after ACL reconstruction.	Right BRTs
Driving Reaction Time Before and After Anterior Cruciate Ligament Reconstruction	Nguyen et al.[21]	Cohort, prospective, comparative study	2000	73	30.2 ± 7.9 for right knee, 30.3 ± 8.5 for left knee, and 33.8 ± 10.8 in control group	Each patient underwent driving reaction time and stand tests both preoperatively and at 2, 4, 6, and 8 wk postoperatively.	Right and left BRTs

(continued)

Table 2. Continued

Study Title	Authors	Type of Study	Year Published	Participants, n	Mean Age, yr	Timeline	Outcomes
Driving Reaction Time After Right Knee Arthroscopy	Hau et al.[20]	Cohort, prospective, comparative study	2000	55	42.2 ± 14.2 in surgical group and 33.6 ± 11.0 control	Each patient was tested both preoperatively and at 1 wk and 4 wk after arthroscopy.	Right BRTs
A Comparative Study of the Neuromuscular Response During a Dynamic Activity After Anterior Cruciate Ligament Reconstruction	Oliver et al.[26]	Prospective, comparative, matched, controlled study	2019	25 (2 participants later dropped out)	22 ± 4.61	Each patient underwent measurement preoperatively and again at 4 and 6 mo postoperatively.	Neuromuscular response of 5 different lower limb muscles
Bilateral Hip Arthroscopy Under the Same Anesthetic for Patients With Symptomatic Bilateral Femoroacetabular Impingement: 1-Year Outcomes	Mei-Dan et al.[31]	Retrospective comparative study	2014	76	33	Patients were divided into 3 groups based on the approach to hip arthroscopy (simultaneous treatment, staged treatment, or single-hip treatment).	Time (day) of return to various activities and time (day) of cessation of medications
Examination of Early Functional Recovery After ACL Reconstruction: Functional Milestone Achievement and Self-Reported Function	Obermeier et al.[30]	Prospective, longitudinal, observational study	2018	182	28 ± 12	Data were collected via survey before surgery as well as 1, 2, 4, 8, and 12 wk after surgery.	SMFA scores, week of return to driving, and week of cessation of pain medication
Recommendations for Driving After Right Knee Arthroscopy	Argintar et al.[6]	Survey	2013	266 (197 doctors and 69 patients)	—	Questionnaires were emailed to surgeons and patients were identified as having undergone knee arthroscopic surgical procedures (including any combination of partial meniscectomy, chondroplasty, or debridement). Any patients undergoing additional ligamentous reconstruction, microfracture, open arthrotomy,	Frequency of recommendations for postoperative driving, when physicians recommend to return to driving postoperatively, how often patients look at physicians' advice, when patients look at physicians' advice, and what policies insurance companies have in place for return

(continued)

Table 2. Continued

Study Title	Authors	Type of Study	Year Published	Participants, n	Mean Age, yr	Timeline	Outcomes
						hardware introduction, or any procedure on the left knee were excluded from the study.	to driving postoperatively
Knee Arthroscopy and Driving. Results of a Prospective Questionnaire Survey and Review of the Literature	Lewis et al.[28]	Review/prospective questionnaire	2011	100	—	Patients were given surveys at their 2-wk follow-up appointment.	Aspects of consent, when patients returned to driving, and whether patients experienced any adverse events
Driving After Orthopaedic Surgery	Marecek and Schafer[5]	Review	2013	—	—	—	—
Resuming Motor Vehicle Driving Following Orthopaedic Surgery or Limb Trauma	Fleury et al.[10]	Review	2012	—	—	—	—
Clinical Decision Making: Doctor, When Can I Drive?	Cooper[29]	Review	2007	—	—	—	—
Driving Following Acute Lower Limb Painful Events	Ho and Furlan[9]	Review	2012	—	—	—	—
Driving After Upper or Lower Extremity Orthopaedic Surgery	MacKenzie et al.[8]	Review	2019	—	—	—	—
When Can I Drive After Orthopaedic Surgery? A Systematic Review	DiSilvestro et al.[11]	Systematic review	2016	—	—	—	—

NOTE. A dash indicates data were not available in the study. Age is presented as mean ± standard deviation.

ACL, anterior cruciate ligament; BPD, brake pedal depression; BPTB, bone−patellar tendon−bone; BRT, brake reaction time; HS, hamstring; SMFA, Short Musculoskeletal Function Assessment; TA, tibialis anterior.

Table 3. Summary of CASP Evaluation Results, MINORS Scores, and OCEBM Levels for Included Studies

Authors	Question 1	Question 2	Question 3	Question 4	Question 5a/b or Question 5	Question 6a/b or Question 6	Results	Precision	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12	Risk of Bias	MINORS Index Score	OCEBM Rating
CASP cohort																	
Obermeier et al.[30]	Yes	Yes	Yes	Yes	Yes/yes	Yes/yes	The results may help clinicians better predict how their patients will recover and could possibly lead to making recommendations to their patients to help them recover more quickly based on these findings.	$P < .05$ was considered statistically significant.			Yes	Yes	Yes	The results of this study can provide more evidence-based approaches for recommendations for the return to driving after arthroscopy.	Moderate	17	4
Momaya et al.[25]	Yes	Yes	Yes	Yes	Yes/yes	Yes/yes	These data suggest that most patients may return to driving 2 wk after a right-sided hip arthroscopy procedure, as indicated by their braking performance.	$P < .05$ was considered statistically significant.			Yes	Yes	Yes	This evidence combined with other evidence from other literature can contribute to guidelines regarding the return to driving after hip arthroscopy, particularly between weeks 2-4 of postoperative recovery.	Low	18	3
Valentí et al. [24]	Yes	Yes	Yes	Yes	Yes/yes	Unclear/no	The patients who underwent ACL reconstruction had the same skill and ability as the control group at 4-6 wk after surgery. According to visual reaction times, the driving simulation test in the study, and the available literature, patients who underwent ACL reconstruction with HS grafts and anatomic techniques were able to drive at 4-6 wk after surgery.	$P < .05$ was considered statistically significant.			Unclear	Yes	Yes	When used in conjunction with other available evidence, this evidence could provide reinforcement to recommending a specific time to return to driving after ACL reconstruction with or without other soft-tissue repair (either right or left leg).	Moderate	17	3
Gotlin et al.[27]	Yes	Yes	Yes	Yes	Yes/yes	Yes/yes	No significant sex differences across main effects were detected. Brake response times for men improved significantly after week 6 ($P < .05$) and week 10 ($P < .01$). Brake response times for women in the ACL	$P < .05$ was considered statistically significant.			Yes	Unclear	Yes	After right ACL reconstruction, patients who participate in an accelerated rehabilitation program can achieve brake response times that are at or near the average of a large database of control subjects by 4-6 wk.	Low	18	3

(continued)

Table 3. Continued

Authors	Question 1	Question 2	Question 3	Question 4	Question 5a/b or Question 5	Question 6a/b or Question 6	Results	Precision	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12	Risk of Bias	MINORS Index Score	OCEBM Rating
							treatment group matched control times at 6 wk. The 6-m walk times for control subjects were faster than those for the ACL group preoperatively (2.6 seconds vs 5.5 seconds) but equalized by week 6. It is important to note that only the male group met the level of statistical significance.							The evidence (when combined with other evidence) may be able to provide a tentative guideline on when patients can safely return to driving after right ACL repair. Significant sex-based differences call for further research.			
Vera et al.[23]	Yes	Yes	Yes	Yes	Yes/yes	Yes/yes	The study analyzed 19 subjects (aged 37.1 ± 12.7 yr, 10 women, 11 right hips). All subjects underwent arthroscopic labral repair and FAI correction. There was no difference between the preoperative BRT (604 ± 148 ms) and postoperative BRTs (608 ms at 2 wk, 566 ms at 4 wk, 559 ms at 6 wk, and 595 ms at 8 wk). There was no difference between controls and subjects at any time point.	$P < .05$ was considered statistically significant.			Yes	Unclear	No	The evidence could possibly be used in conjunction with other evidence to make recommendations on the return to driving after hip arthroscopy; however, a lack of overall evidence suggests the need for more research on the topic.	Moderate	17	3
Nguyen et al.[21]	Yes	Yes	Yes	Yes	Yes/yes	Yes/yes	In the control group, improvement was seen in all 3 tests over a period of 8 wk, with marked improvement after 2 wk. In the left ACL group, the stepping and reaction time tests showed a pattern of improvement similar to that in the control group. However, the standing test	$P < .05$ was considered statistically significant.			Yes	Yes	Yes	This study provides quantitative evidence on which to base recommendations to patients, although the evidence is 20 yr old.	Low	18	3

(continued)

Table 3. Continued

Authors	Question 1	Question 2	Question 3	Question 4	Question 5a/b or Question 5	Question 6a/b or Question 6	Results	Precision	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12	Risk of Bias	MINORS Index Score	OCEBM Rating
							showed a marked decrease after 2 wk and then improved over time but remained slower than that in controls after 8 wk, even though 53.3% of patients had returned to the preoperative level after 6 wk. In the right ACL group, there was a marked decrease in the performance of all tests after 2 wk. Again, the tests improved over time but did not equal those of controls after 8 wk. However, after 6 wk, only 37.5% of patients had returned to their preoperative level via the stepping test; 56.3%, via the standing test; and 75%, via the reaction time test.										
Hau et al.[20]	Yes	Yes	Yes	Yes	Yes/yes	Yes/yes	Just over 60% of patients after 1 wk had a slower reaction time than preoperatively. The type of arthroscopic surgery performed did not have an effect on the change in reaction time. At 4 wk postoperatively, the number of steps and stands increased compared with preoperative tests. The average reaction time had also improved (changes were significant). However, 30% of patients tested after	$P < .05$ was considered statistically significant.			Yes	Yes	Unclear	This study provides quantitative evidence on which to base recommendations to patients, although the evidence is 20 yr old.	Moderate	17	3

(continued)

Table 3. Continued

Authors	Question 1	Question 2	Question 3	Question 4	Question 5a/b or Question 5	Question 6a/b or Question 6	Results	Precision	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12	Risk of Bias	MINORS Index Score	OCEBM Rating
							4 wk still had slower reaction times than the preoperative reaction times.										
Mei-Dan et al.[31]	Yes	Yes	No	Unclear	Yes/yes	Yes/yes	The groups were not randomized, some crossover occurred, and more patients elected to undergo simultaneous approaches to hip surgery, which could lead to favoring of the results for that category.	$P < .05$ was considered statistically significant.			Unclear	Unclear	Unclear	Simultaneous femoroacetabular impingement surgery does not lead to higher rates of complications, postoperative pain, analgesic use, or side effects. The return to daily activities is similar to that of a single-hip procedure with the advantage of a single rehabilitation.	Moderate	16	3
CASP case control																	
Oliver et al.[26]	Yes	Yes	Yes	Yes	Yes	Yes/yes	Comparison of reaction times in the vastus medialis showed that the time for the injured knee was longer preoperatively but it reduced over time, reaching a value at 6 mo postoperatively that was close to the reaction time in the uninjured knee group. In the rectus femoris, biceps femoris, and semitendinosus muscles, the reaction times in the injured knee group were similar to those in the uninjured knee group at the preoperative and postoperative visits.	$P < .05$ was considered statistically significant.			Yes	Unclear	Unclear	—	Moderate	17	4
Balazs et al.[14]	Yes	Yes	Yes	Yes	Yes	Yes/yes	The results showed that there was a significantly increased BRT in patients undergoing right hip arthroscopy, which reached	$P < .05$ was considered statistically significant.			Yes	Yes	Yes	—	Low	18	3

(continued)

Table 3. Continued

Authors	Question 1	Question 2	Question 3	Question 4	Question 5a/b or Question 5	Question 6a/b or Question 6	Results	Precision	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12	Risk of Bias	MINORS Index Score	OCEBM Rating
							baseline levels at 4-6 wk postoperatively. Patients undergoing left hip arthroscopy had BRTs that were unaffected before and after surgery.										
Wasserman et al.[22]	Yes	Yes	Yes	Yes	Yes	Yes/yes	Patients who underwent right knee ACLR with TA allograft regained normal braking times by week 3 postoperatively. In contrast, those treated with BPTB or HS autograft showed significantly delayed braking times at 3 wk but returned to normal braking ability by week 6. Those treated with an autograft had an earlier return of normalized BRT than BTT.	$P < .05$ was considered statistically significant.			Yes	Yes	Yes	—	Low	18	4
CASP systematic review																	
Marecek and Schafer[5]	Yes	Yes	Yes	Yes	Yes	—	Relevant sections included the lower-extremity portion on arthroscopy and ACL repair. Patients may anticipate a quick recovery after arthroscopic knee surgery; however, braking function does not return until 4 wk after arthroscopy and 6 wk after right ACL reconstruction. After left ACL reconstruction, patients may drive as early as 2 wk after surgery. However, there is			Yes	Yes	Yes	—	—	Low	—	—

(continued)

Table 3. Continued

Authors	Question 1	Question 2	Question 3	Question 4	Question 5a/b or Question 5	Question 6a/b or Question 6	Results	Precision	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12	Risk of Bias	MINORS Index Score	OCEBM Rating
							significant variability between patients; the step and stand tests may help guide decision making.										
Fleury et al.[10]	Yes	Yes	Yes	Yes	Yes	—	For knee arthroplasty, the review cited an article comparing 30 surgical subjects with 25 healthy subjects. For most patients, TTB times returned to normal after 4 wk; however, approximately 30% of those patients still had suboptimal TTB times after 1 mo. The authors recommended waiting a minimum of 4 wk to drive after simple knee arthroplasty. After ACL reconstruction, the 2 studies cited both noted TTB times returning to normal after 6 wk, so they recommended waiting at least 6 wk to drive postoperatively.			Yes	Yes	Yes	—	—	Low	—	—
Cooper[29]	Yes	Yes	Yes	Yes	Yes	—	The recommendation after knee arthroscopy was listed as 1 wk, and that after ACL repair was listed as 4-6 wk.			Yes	Unclear	Yes	—	—	Low	—	—
Ho and Furlan[9]	Yes	Yes	Yes	Yes	Yes	—	This study consolidates information and recommendations from previous literature and suggests the need for further scientific research that also accounts for other variables, such as			Yes	Yes	Yes	—	—	Low	—	—

(continued)

Table 3. Continued

Authors	Question 1	Question 2	Question 3	Question 4	Question 5a/b or Question 5	Question 6a/b or Question 6	Results	Precision	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12	Risk of Bias	MINORS Index Score	OCEBM Rating
							comorbidities, pain levels, medication use, visual acuity, driving experience, and lower limb function.										
MacKenzie et al.[8]	Yes	Yes	Yes	Yes	Yes	—				Yes	Yes	Yes	—	—	Low	—	—
DiSilvestro et al.[11]	Yes	Yes	Yes	Yes	Unclear	—				Unclear	Yes	Yes	—	—	Low/ moderate	—	—
CASP qualitative																	
Argintar et al.[6]	Yes	Yes	Yes	Yes	Yes	Yes	During routine preoperative consultation, 29.7% of physicians always incorporated postoperative driving instructions. Of the physicians surveyed, 57% brought up these conversations half of the time or less frequently, 33.4% brought them up one-quarter of the time or less frequently, and 3.1% never discussed this topic. Further subanalysis showed that community-based physicians and physicians who performed >50 knee arthroscopic procedures annually discussed postoperative driving restrictions more commonly. Most physicians recommended driving once narcotic use stopped (70%), when patients believed they could subjectively control their vehicles (57.1%), and when postoperative symptoms allowed		Yes	Unclear	Yes	This could be useful in encouraging doctors to use more literature and evidence in making their driving recommen dations to patient's post operatively or to bring up the conversation more often.			Low	—	—

(continued)

Table 3. Continued

Authors	Question 1	Question 2	Question 3	Question 4	Question 5a/b or Question 5	Question 6a/b or Question 6	Results	Precision	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12	Risk of Bias	MINORS Index Score	OCEBM Rating
							for safe driving (38.8%). Of the patients surveyed, only 8% received advice from their doctors; of these, 88% followed the advice. Most began driving "when they felt comfortable" around 4-7 d postoperatively. Linear regression found that patients who followed 2 pieces of advice exhibited a longer time to driving than they would have if they had only followed a singular piece of advice from their physicians (e.g., not taking narcotics and/or being comfortable).										
Lewis et al.[28]	Yes	Yes	Unclear	Yes	No	Unclear	The authors "have illustrated the need for thorough consenting, further research in this area, and the development of universal guidelines surrounding the return to driving after surgery."		Unclear	No	Yes	Establishes need for universal guideline for recommen dations to return to driving after arthroscopy.			Moderate/ high	—	—

ACL, anterior cruciate ligament; ACLR, anterior cruciate ligament reconstruction; BPTB, bone—patellar tendon—bone; BTT, brake travel time; CASP, Critical Appraisal Skills Programme; FAI, femoroacetabular impingement; HS, hamstring; MINORS, Methodological Index for Non-randomized Studies; OCEBM, Oxford Centre for Evidence-Based Medicine; TA, tibialis anterior; TTB, total time to break.

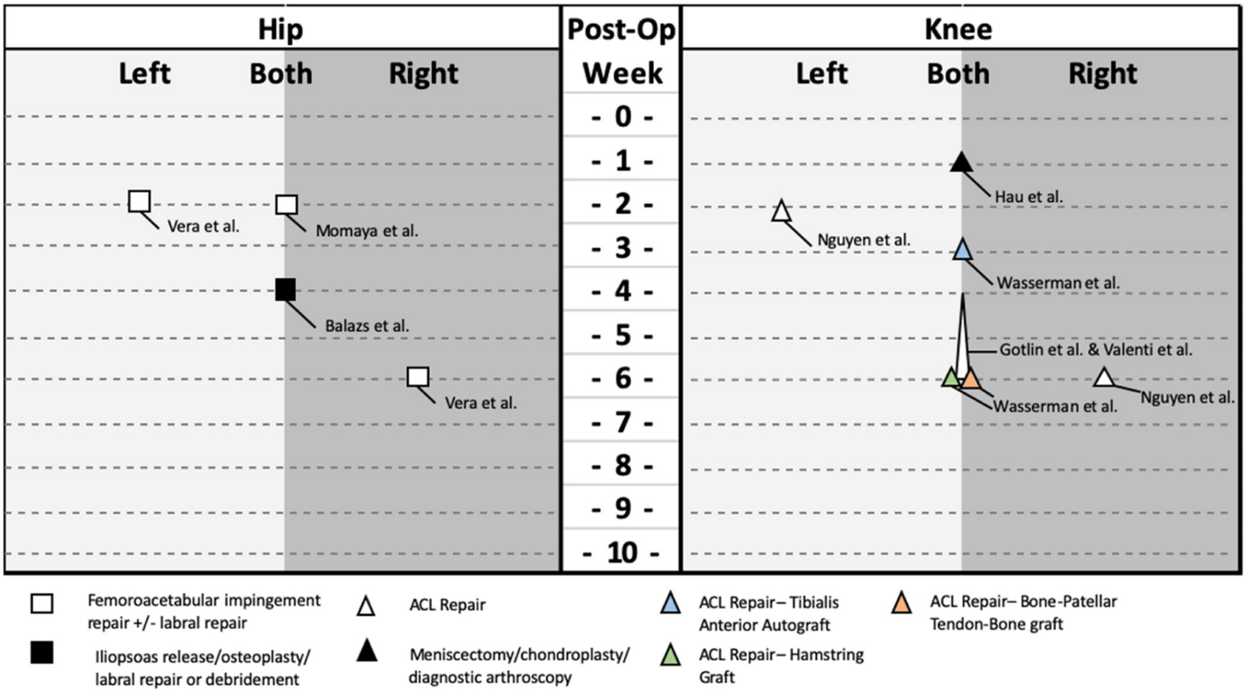


Fig 2. Summary of recommendations for return to driving per study: visual depiction of operative procedure performed and time required to return to driving. (ACL, anterior cruciate ligament; Post-Op, postoperative.)

Meta-analysis

The demographic characteristics of patients included in the meta-analysis are detailed in Table 4, and the results of each of the included studies are presented in Table 5. In total, 436 patients were included in the meta-analysis, with an age range from 28.6 ± 8.91 years[30] to 44 ± 11.4 years.[22] Of these studies, 5 were cohort studies, 2 were case-control studies, and 1 was a prospective comparative study. BRT data were extracted from all studies, and all data were pooled for analysis. Postoperative BRT data were compared with preoperative BRTs where available and with control group data when preoperative data were not provided.[22,24,27]

Knee Arthroscopy

For right knee arthroscopic procedures, collective means for week 1 after surgery showed average BRTs considerably slower than preoperative or control values. Weeks 2 through 10 showed a general trend of decreasing (faster) BRTs, although only weeks 5 and 10 showed statistically significant findings (Fig 3). In the left knee arthroscopy group, weeks 2 through 4 showed BRTs slower than or near baseline values, whereas weeks 6 through 8 showed improved average BRTs compared with preoperative or control values (Fig 4). None of the values were statistically significant. Within the group of combined left and right knee arthroscopies ("all knee BRTs"), BRTs were slower than or near baseline BRTs from week 1 through week 5 postoperatively. There was a trend of improving BRTs from week 6 through week 10, although only weeks 8 and 10 showed statistically significant findings (Fig 5).

Hip Arthroscopy

Within the right hip arthroscopy group, there was a clear trend of improving BRTs, with average BRTs being faster than baseline after week 4 (Fig 6). Left hip arthroscopy mean BRTs showed similar improving trends. Mean BRTs were faster than preoperative or control values after week 6 (Fig 7). Within the right hip group, only week 8 showed significant findings. No values were statistically significant within the left hip arthroscopy group. In the combined left and right hip arthroscopy group ("all hip BRTs"), week 2 showed a mean BRT near baseline values. Weeks 4 through 6 were, on average, faster than baseline, although only week 8 showed statistically significant findings. There was a trend of improving BRTs in the all hip BRT group (Fig 8).

Discussion

This systematic review found variations in the recommendations for the return to driving after both hip and knee arthroscopy procedures. Regarding knee arthroscopy, recommendations ranged from 1 week to 6 weeks and were, in part, dependent on the procedure performed and/or laterality of the procedure. For hip arthroscopy, recommendations ranged from 2 weeks to 6 weeks, again depending on laterality for 1 study. Meta-analysis of all knee BRTs showed that at 6 weeks, the

Table 4. Demographic Characteristics of Participants in Studies Included in Meta-analysis

Authors	Year	Procedure	No. of Participants	No. of Male Participants	No. of Female Participants	Laterality	Age, yr		Measured Variables Used in Meta-analysis
							Surgical	Control	
Nguyen et al.[21]	2000	ACL repair	40 (31 surgical and 9 control)	18	13	16 right and 15 left	30.2 ± 7.9 for right knee and 30.3 ± 8.5 for left knee	33.8 ± 10.8	Right BRT and left BRT
Gotlin et al.[27]	2000	ACL repair	35 (14 surgical and 21 control)	12 surgical and 15 control	15 surgical and 15 control	Right only	31.2	29.3	Right BRT
Hau et al.[20]	2000	Partial meniscectomy, chondroplasty, and diagnostic arthroscopy	55 (30 surgical and 25 control)	9 surgical and 8 control	21 surgical and 17 control	Right only	42.2 ± 14.2	33.6 ± 11.0	Right BRT
Wasserman et al.[22]	2017	ACL repair	57 (27 surgical and 30 control)	12 surgical and 15 control	15 surgical and 15 control	Right only	29.2 ± 8.2 for HS, 25.0 ± 4.2 for BPTB, and 44.0 ± 11.4 for TA	30.4 ± 3.8	Right BRT
Valentí et al.[24]	2018	ACL repair	62 (31 surgical and 31 control)	27 surgical and 22 control	7 surgical and 9 control	18 right and 13 left	32.39 ± 9.27	28.58 ± 8.91	Right BRT and left BRT
Vera et al.[23]	2017	Femoroacetabular impingement repair and labral repair	38 (19 surgical and 19 control)	9 surgical and 9 control	10 surgical and 10 control	11 right and 8 left	37.1 ± 12.7 for right knee and 32.1 ± 9.2 for left knee	35.5 ± 11.1 for right control and 32.6 ± 8.4 for left control	Right BRT
Balazs et al.[14]	2018	Femoroacetabular impingement repair	118 (59 surgical and 59 control)	32 surgical and 32 control	27 surgical and 27 control	33 right and 26 left	33.7	33.3	Right BRT and left BRT
Momaya et al.[25]	2018	Labral repair, iliopsoas release, osteoplasty, and labral debridement	31 (14 surgical and 17 control)	3 surgical and 4 control	11 surgical and 13 control	Right only	27.39 ± 9.13	28.35 ± 5.81	Right BRT and left BRT

NOTE. Age is presented as mean ± standard deviation.
BPTB, bone–patellar tendon–bone; BRT, brake reaction time; HS, hamstring; TA, tibialis anterior.

Table 5. Summary of All BRT Data From Studies Included in Meta-analysis

		BRT, ms								
Authors	Group	Preoperative	1 wk	2 wk	3 wk	4 wk	5 wk	6 wk	8 wk	10 wk
Nguyen et al.[21]	Right	738 ± 198		1,503 ± 954		805 ± 241		733 ± 209	686 ± 177	
	Left	662 ± 183		660 ± 253		625 ± 173		589 ± 157	595 ± 150	
	Control	694 ± 182		590 ± 145		590 ± 169		587 ± 168	578 ± 137	
Gotlin et al.[27*]	Female right	—		490		470		420	420	430
	Male right	—		420		390		369	369	377
	Female control	—		449		390		410	360	400
	Male control	—		450		430		440	435	420
Hau et al.[20]	Right	736 ± 191	920 ± 519			685 ± 174				
	Control	634 ± 140	550 ± 115			582 ± 121				
Wasserman et al.[22†]	HS		970 ± 220		800 ± 160			730 ± 90		
	BPTB		900 ± 190		780 ± 150			760 ± 190		
	TA		1,000 ± 240		740 ± 140			700 ± 140		
	Control		720 ± 90		720 ± 90			720 ± 90		
Valentí et al.[24‡]	Right						463.9 ± 41.71			
	Left						379.04 ± 20.75			
	Control right						390.4 ± 31.13			
	Control left						330.54 ± 26.9			
Vera et al.[23]	Right	604 ± 148		608 ± 168		566 ± 118		559 ± 134	595 ± 95.5	
	Left	598 ± 121		567 ± 143		616 ± 178		579 ± 162	523 ± 87.8	
	Control right	516 ± 125								
	Control left	504 ± 63.4								
Balazs et al.[14§]	Right	573 (533-616)		688 (637-743)		594 (547-645)		569 (526-615)		
	Left	566 (519-616		563 (512-618)		567 (515-623)		550 (500-604)		
	Control	520 (504-536)								
Momaya et al.[25]	Right	1,960 ± 180		1,840 ± 300		1,840 ± 140		1,860 ± 250	1,860 ± 170	
	Control	1,770 ± 180		1,720 ± 170		1,170 ± 110		1,670 ± 270	1,690 ± 260	

NOTE. Data are presented as mean ± standard deviation unless otherwise indicated.

BPTB, bone−patellar tendon−bone; BRT, brake reaction time; HS, hamstring; TA, tibialis anterior.

*No preoperative values were reported; postoperative BRTs were compared with control values.

†All procedures were right sided; groups were categorized by the type of ligament used for reconstruction.

‡Postoperative BRTs were collected between weeks 4 and 6.

§Data are reported as mean (confidence interval).

Study or Subgroup	Post-op Mean	Post-op SD	Post-op Total	Pre-op Mean	Pre-op SD	Pre-op Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.1.1 Week 1								
Hau 2000	0.92	0.519	30	0.736	0.191	30	51.7%	0.46 [−0.05, 0.98]
Wasserman 2017	0.956571	0.216645	21	0.72	0.09	30	48.3%	1.51 [0.87, 2.14]
Subtotal (95% CI)			**51**			**60**	**100.0%**	**0.97 [−0.05, 1.99]**
Heterogeneity: $Tau^2 = 0.45$; $Chi^2 = 6.24$, df = 1 (P = 0.01); $I^2 = 84\%$								
Test for overall effect: Z = 1.86 (P = 0.06)								
1.1.2 Week 2								
Gotlin 2000	0.436639	0.0186788	14	0.449751	0.0186788	21	50.3%	−0.69 [−1.38, 0.01]
Nguyen 2000	1.503	0.954	16	0.738	0.198	16	49.7%	1.08 [0.33, 1.83]
Subtotal (95% CI)			**30**			**37**	**100.0%**	**0.19 [−1.54, 1.93]**
Heterogeneity: $Tau^2 = 1.43$; $Chi^2 = 11.47$, df = 1 (P = 0.0007); $I^2 = 91\%$								
Test for overall effect: Z = 0.22 (P = 0.83)								
1.1.3 Week 3								
Wasserman 2017	0.773256	0.149985	21	0.72	0.09	30	100.0%	0.44 [−0.12, 1.01]
Subtotal (95% CI)			**21**			**30**	**100.0%**	**0.44 [−0.12, 1.01]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.54 (P = 0.12)								
1.1.4 Week 4								
Gotlin 2000	0.410807	0.0031412	14	0.413012	0.0031412	21	32.4%	−0.69 [−1.38, 0.01]
Hau 2000	0.685	0.174	30	0.736	0.191	30	35.9%	−0.28 [−0.78, 0.23]
Nguyen 2000	0.954	0.241	16	0.738	0.198	16	31.7%	0.95 [0.22, 1.69]
Subtotal (95% CI)			**60**			**67**	**100.0%**	**−0.02 [−0.89, 0.85]**
Heterogeneity: $Tau^2 = 0.48$; $Chi^2 = 11.04$, df = 2 (P = 0.004); $I^2 = 82\%$								
Test for overall effect: Z = 0.04 (P = 0.97)								
1.1.5 Week 5								
Valenti 2018	0.4639	0.04171	18	0.3904	0.03113	18	100.0%	1.95 [1.14, 2.76]
Subtotal (95% CI)			**18**			**18**	**100.0%**	**1.95 [1.14, 2.76]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 4.73 (P < 0.00001)								
1.1.6 Week 6								
Gotlin 2000	0.379869	0.0675765	14	0.427306	0.0675765	21	30.0%	−0.69 [−1.38, 0.01]
Nguyen 2000	0.733	0.209	16	0.738	0.198	16	30.3%	−0.02 [−0.72, 0.67]
Wasserman 2017	0.729927	0.139986	21	0.72	0.09	30	39.8%	0.09 [−0.47, 0.64]
Subtotal (95% CI)			**51**			**67**	**100.0%**	**−0.18 [−0.64, 0.28]**
Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 3.08$, df = 2 (P = 0.21); $I^2 = 35\%$								
Test for overall effect: Z = 0.76 (P = 0.45)								
1.1.7 Week 8								
Gotlin 2000	0.379869	0.0329499	14	0.402999	0.0329499	21	49.9%	−0.69 [−1.38, 0.01]
Nguyen 2000	0.686	0.177	16	0.738	0.198	16	50.1%	−0.27 [−0.97, 0.43]
Subtotal (95% CI)			**30**			**37**	**100.0%**	**−0.48 [−0.97, 0.02]**
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.68$, df = 1 (P = 0.41); $I^2 = 0\%$								
Test for overall effect: Z = 1.90 (P = 0.06)								
1.1.8 Week 10								
Gotlin 2000	0.376587	0.0620706	14	0.420159	0.0620706	21	100.0%	−0.69 [−1.38, 0.01]
Subtotal (95% CI)			**14**			**21**	**100.0%**	**−0.69 [−1.38, 0.01]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.93 (P = 0.05)								

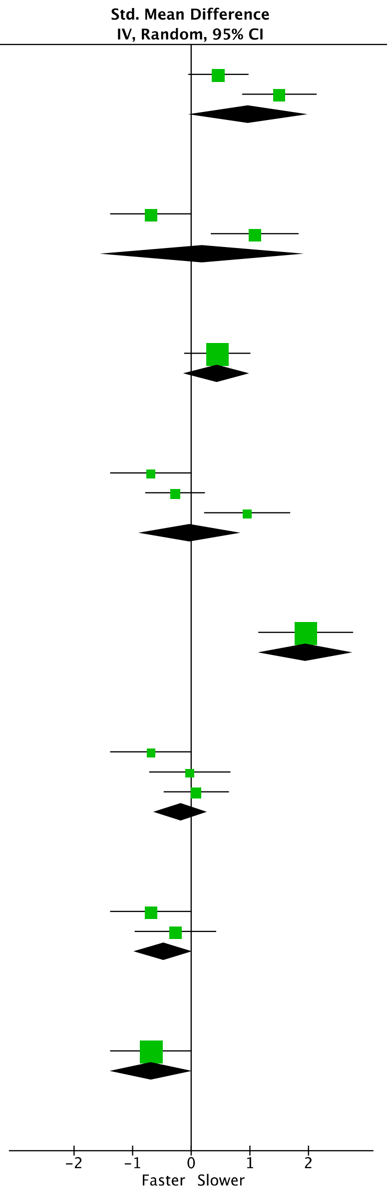
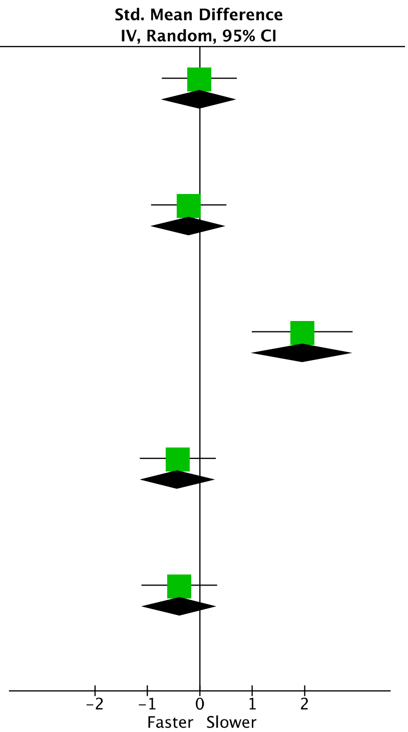


Fig 3. Pooled data and forest plot of right knee arthroscopy brake reaction times. $P < .05$ is considered statistically significant. It should be noted that Valentí et al.[24] reported brake reaction times between 4 and 6 weeks postoperatively. These data were averaged to "week 5" for the purposes of analysis and plotting data. (CI, confidence interval; IV, inverse-variance method; Post-op, postoperative; Pre-op, preoperative; SD, standard deviation; Std, standardized.)

pooled means had met or become faster than the preoperative or control values, and there was a trend of improving BRTs after this point. Side-specific analysis revealed similar findings (patients were able to return more quickly to driving after left knee arthroscopy, but these findings were not statistically significant), with pooled means showing improved BRTs after 6 weeks, as well as a trend of improvement in the right-sided group through week 10. Meta-analysis of all hip BRTs showed that pooled means had met or become faster than preoperative or control times at 4 weeks, with a trend of improving BRTs. It is interesting to note that side-specific analysis revealed that pooled means for right-sided procedures were faster than preoperative or control BRTs at 4 weeks whereas pooled means for left-sided procedures just met baseline values at 4 weeks. These findings are notable because a meta-analysis had not been performed on this subject previously, although the small data pool does suggest the need for further research to expand the pool for future meta-analysis.

When assessing BRT, patients' values in most studies included in the meta-analysis were compared with their preoperative values. This assumes that the patient was driving safely prior to the surgical procedure. However, a patient presenting with the need for arthroscopy presumably has an underlying pathology that requires

Study or Subgroup	Post-op Mean	Post-op SD	Post-op Total	Pre-op Mean	Pre-op SD	Pre-op Total	Weight	Std. Mean Difference IV, Random, 95% CI
2.1.1 Week 2								
Nguyen 2000	0.66	0.253	15	0.662	0.183	15	100.0%	−0.01 [−0.72, 0.71]
Subtotal (95% CI)			**15**			**15**	**100.0%**	**−0.01 [−0.72, 0.71]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.02 (P = 0.98)								
2.1.2 Week 4								
Nguyen 2000	0.625	0.157	15	0.662	0.183	15	100.0%	−0.21 [−0.93, 0.51]
Subtotal (95% CI)			**15**			**15**	**100.0%**	**−0.21 [−0.93, 0.51]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.58 (P = 0.56)								
2.1.3 Week 5								
Valenti 2018	0.37904	0.02075	13	0.33054	0.0269	13	100.0%	1.96 [0.99, 2.92]
Subtotal (95% CI)			**13**			**13**	**100.0%**	**1.96 [0.99, 2.92]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 3.99 (P < 0.0001)								
2.1.5 Week 6								
Nguyen 2000	0.589	0.157	15	0.662	0.183	15	100.0%	−0.42 [−1.14, 0.31]
Subtotal (95% CI)			**15**			**15**	**100.0%**	**−0.42 [−1.14, 0.31]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.13 (P = 0.26)								
2.1.6 Week 8								
Nguyen 2000	0.595	0.15	15	0.662	0.183	15	100.0%	−0.39 [−1.11, 0.33]
Subtotal (95% CI)			**15**			**15**	**100.0%**	**−0.39 [−1.11, 0.33]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.06 (P = 0.29)								



Test for subgroup differences: $Chi^2 = 18.60$, df = 4 (P = 0.0009), $I^2 = 78.5\%$

Fig 4. Pooled data and forest plot of left knee arthroscopy brake reaction times. $P < .05$ is considered statistically significant. It should be noted that Valentí et al.[24] reported brake reaction times between 4 and 6 weeks postoperatively. These data were averaged to "week 5" for the purposes of analysis and plotting data. (CI, confidence interval; IV, inverse-variance method; Post-op, postoperative; Pre-op, preoperative; SD, standard deviation; Std, standardized.)

surgical intervention. The presence of this pathology before surgery could lead to not only slower baseline BRTs but also a decreased ability to drive safely. In this instance, it would be difficult to determine, using BRT alone, whether a patient is able to safely return to driving after surgery. Future studies on BRTs might consider comparing postoperative BRTs with both preoperative values and the corresponding values of a healthy control group.

Both the study by Nguyen et al.[21] and the study by Hau et al.[20] had their participants perform sit-to-stand tests in the office and found that there was a significant correlation between performance on sit-to-stand testing and BRTs. This test potentially could be performed during follow-up appointments by surgical patients to assess their readiness to drive. Although BRT is a very important factor to be considered when making recommendations on the resumption of driving, many studies have noted the significance of factoring in other variables, such as cessation of opioid analgesics, strength of the surgical limb, and range of motion.[11]

An interesting consideration related to both preoperative and postoperative driving ability is joint proprioception, particularly related to knee arthroscopy and ACL reconstruction. The ACL itself helps with proprioception of the knee joint, containing many mechanoreceptors that respond to mechanical stimulation and help determine where one's limb is in space. Damage to the ACL before surgery leads to a decrease in proprioceptive ability not only in the surgical knee but also in the contralateral knee, as noted by previous studies.[32-34] If a patient continues driving, this could lead to an impaired driving ability and slower BRTs preoperatively. However, it is also important to note that reconstruction of the ACL does not lead to an immediate return of proprioceptive ability. Extensive and consistent physical therapy and kinesthetic exercises are needed to allow for the return of proprioceptive ability.[32-34] Additionally, because autografts (e.g., hamstring or patellar tendon) use tissue from the patients themselves, damage to the donor tissue could lead to a further decrease in proprioceptive ability.[35]

The type of surgical procedure also appeared to be related to the recommended resumption of driving. Studies that exclusively examined ACL reconstruction recommended resumption of driving at 6 weeks or between 4 and 6 weeks.[21,22,24,27] Studies that examined simple knee arthroscopy, such as those of Hau et al.[20] and Argintar et al.,[6] gave much earlier recommendations on the resumption of driving (approximately 1 week). This finding highlights that there is a clear difference between knee ligamentous and non-ligamentous surgery and advice should be given to patients accordingly. Likewise, Wasserman et al.[22] found that, regarding ACL

Study or Subgroup	Post-op Mean	Post-op SD	Post-op Total	Pre-op Mean	Pre-op SD	Pre-op Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
5.1.1 Week 1									
Hau 2000	0.92	0.519	30	0.736	0.191	30	51.7%	0.46 [−0.05, 0.98]	2000
Wasserman 2017	0.956571	0.216645	21	0.72	0.09	30	48.3%	1.51 [0.87, 2.14]	2017
Subtotal (95% CI)			**51**			**60**	**100.0%**	**0.97 [−0.05, 1.99]**	
Heterogeneity: Tau² = 0.45; Chi² = 6.24, df = 1 (P = 0.01); I² = 84%									
Test for overall effect: Z = 1.86 (P = 0.06)									
5.1.2 Week 2									
Gotlin 2000	0.436639	0.0186788	14	0.449751	0.0186788	21	33.7%	−0.69 [−1.38, 0.01]	2000
Nguyen 2000	1.503	0.954	16	0.738	0.198	16	32.9%	1.08 [0.33, 1.83]	2000
Nguyen 2000	0.66	0.253	15	0.662	0.183	15	33.4%	−0.01 [−0.72, 0.71]	2000
Subtotal (95% CI)			**45**			**52**	**100.0%**	**0.12 [−0.88, 1.12]**	
Heterogeneity: Tau² = 0.65; Chi² = 11.58, df = 2 (P = 0.003); I² = 83%									
Test for overall effect: Z = 0.24 (P = 0.81)									
5.1.3 Week 3									
Wasserman 2017	0.773256	0.149985	21	0.72	0.09	30	100.0%	0.44 [−0.12, 1.01]	2017
Subtotal (95% CI)			**21**			**30**	**100.0%**	**0.44 [−0.12, 1.01]**	
Heterogeneity: Not applicable									
Test for overall effect: Z = 1.54 (P = 0.12)									
5.1.4 Week 4									
Gotlin 2000	0.410807	0.0031412	14	0.413012	0.0031412	21	24.3%	−0.69 [−1.38, 0.01]	2000
Hau 2000	0.685	0.174	30	0.736	0.191	30	28.2%	−0.28 [−0.78, 0.23]	2000
Nguyen 2000	0.954	0.241	16	0.738	0.198	16	23.5%	0.95 [0.22, 1.69]	2000
Nguyen 2000	0.625	0.157	15	0.662	0.183	15	23.9%	−0.21 [−0.93, 0.51]	2000
Subtotal (95% CI)			**75**			**82**	**100.0%**	**−0.07 [−0.70, 0.56]**	
Heterogeneity: Tau² = 0.30; Chi² = 11.13, df = 3 (P = 0.01); I² = 73%									
Test for overall effect: Z = 0.22 (P = 0.83)									
5.1.5 Week 5									
Valenti 2018	0.4639	0.04171	18	0.3904	0.03113	18	100.0%	1.95 [1.14, 2.76]	2018
Subtotal (95% CI)			**18**			**18**	**100.0%**	**1.95 [1.14, 2.76]**	
Heterogeneity: Not applicable									
Test for overall effect: Z = 4.73 (P < 0.00001)									
5.1.6 Week 6									
Gotlin 2000	0.379869	0.0675765	14	0.427306	0.0675765	21	22.7%	−0.69 [−1.38, 0.01]	2000
Nguyen 2000	0.733	0.209	16	0.738	0.198	16	22.9%	−0.02 [−0.72, 0.67]	2000
Nguyen 2000	0.589	0.157	15	0.662	0.183	15	21.2%	−0.42 [−1.14, 0.31]	2000
Wasserman 2017	0.729927	0.139986	21	0.72	0.09	30	33.2%	0.09 [−0.47, 0.64]	2017
Subtotal (95% CI)			**66**			**82**	**100.0%**	**−0.22 [−0.58, 0.13]**	
Heterogeneity: Tau² = 0.02; Chi² = 3.46, df = 3 (P = 0.33); I² = 13%									
Test for overall effect: Z = 1.22 (P = 0.22)									
5.1.7 Week 8									
Gotlin 2000	0.379869	0.0329499	14	0.402999	0.0329499	21	34.1%	−0.69 [−1.38, 0.01]	2000
Nguyen 2000	0.686	0.177	16	0.738	0.198	16	34.2%	−0.27 [−0.97, 0.43]	2000
Nguyen 2000	0.595	0.15	15	0.662	0.183	15	31.7%	−0.39 [−1.11, 0.33]	2000
Subtotal (95% CI)			**45**			**52**	**100.0%**	**−0.45 [−0.86, −0.04]**	
Heterogeneity: Tau² = 0.00; Chi² = 0.72, df = 2 (P = 0.70); I² = 0%									
Test for overall effect: Z = 2.16 (P = 0.03)									
5.1.8 Week 10									
Gotlin 2000	0.376587	0.0620706	14	0.420159	0.0620706	21	100.0%	−0.69 [−1.38, 0.01]	2000
Subtotal (95% CI)			**14**			**21**	**100.0%**	**−0.69 [−1.38, 0.01]**	
Heterogeneity: Not applicable									
Test for overall effect: Z = 1.93 (P = 0.05)									
Test for subgroup differences: Chi² = 38.12, df = 7 (P < 0.00001), I² = 81.6%									

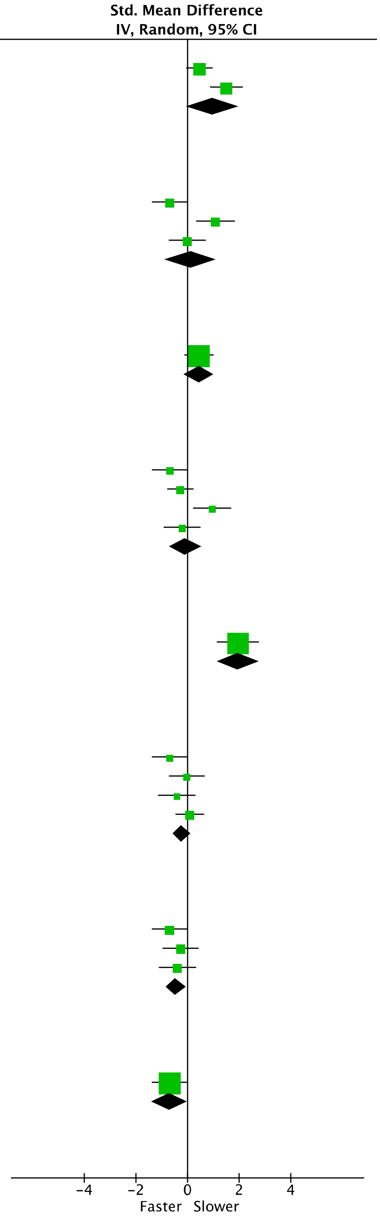


Fig 5. Pooled data and forest plot of all knee arthroscopy brake reaction times. $P < .05$ is considered statistically significant. It should be noted that Valentí et al.[24] reported brake reaction times between 4 and 6 weeks postoperatively. These data were averaged to "week 5" for the purposes of analysis and plotting data. (CI, confidence interval; IV, inverse-variance method; Post-op, postoperative; Pre-op, preoperative; SD, standard deviation; Std, standardized.)

reconstruction, the specific type of graft had a correlation with when postoperative BRTs met baseline values. On the basis of their results, they recommended resumption of driving at 6 weeks postoperatively after hamstring and bone−patellar tendon−bone autograft procedures and at 3 weeks postoperatively after tibialis anterior allograft procedures.[22] This provides an additional starting point for future research to explore more deeply.

Limitations

One notable limitation of this study was the small existing data pool from a limited number of studies. There is limited existing research regarding the resumption of driving after arthroscopic procedures specifically. Additionally, among the few available studies, there is considerable heterogeneity of data. For instance, the effect of ACL reconstruction on BRTs may not be comparable to the effect of meniscal repair or diagnostic arthroscopy on BRTs. Should the effects on BRTs be separated by type of procedure, given sufficient data, there may be different outcomes and, therefore, different recommendations than those noted in this article. There were also slight methodologic differences between studies, as well as varied outcome measures.

Study or Subgroup	Post-op Mean	Post-op SD	Post-op Total	Pre-op Mean	Pre-op SD	Pre-op Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
3.1.2 Week 2									
Vera 2017	0.608	0.168	11	0.604	0.148	11	29.2%	0.02 [−0.81, 0.86]	2017
Balazs 2018	0.688	0.15664	36	0.573	0.12265	36	35.6%	0.81 [0.33, 1.29]	2018
Momaya 2018	1.84	0.3	31	1.96	0.18	31	35.2%	−0.48 [−0.98, 0.03]	2018
Subtotal (95% CI)			**78**			**78**	**100.0%**	**0.13 [−0.74, 1.00]**	
Heterogeneity: Tau² = 0.49; Chi² = 13.21, df = 2 (P = 0.001); I² = 85%									
Test for overall effect: Z = 0.29 (P = 0.78)									
3.1.4 Week 4									
Vera 2017	0.566	0.118	11	0.604	0.148	11	25.2%	−0.27 [−1.11, 0.57]	2017
Balazs 2018	0.594	0.14482	36	0.573	0.12265	36	38.4%	0.15 [−0.31, 0.62]	2018
Momaya 2018	1.84	0.14	31	1.96	0.18	31	36.4%	−0.73 [−1.25, −0.22]	2018
Subtotal (95% CI)			**78**			**78**	**100.0%**	**−0.28 [−0.88, 0.32]**	
Heterogeneity: Tau² = 0.19; Chi² = 6.34, df = 2 (P = 0.04); I² = 68%									
Test for overall effect: Z = 0.90 (P = 0.37)									
3.1.5 Week 6									
Vera 2017	0.559	0.134	11	0.604	0.148	11	14.1%	−0.31 [−1.15, 0.54]	2017
Balazs 2018	0.569	0.13152	36	0.573	0.12265	36	46.7%	−0.03 [−0.49, 0.43]	2018
Momaya 2018	1.86	0.25	31	1.96	0.18	31	39.2%	−0.45 [−0.96, 0.05]	2018
Subtotal (95% CI)			**78**			**78**	**100.0%**	**−0.24 [−0.55, 0.08]**	
Heterogeneity: Tau² = 0.00; Chi² = 1.49, df = 2 (P = 0.47); I² = 0%									
Test for overall effect: Z = 1.46 (P = 0.14)									
3.1.6 Week 8									
Vera 2017	0.595	0.0955	11	0.604	0.148	11	27.0%	−0.07 [−0.91, 0.77]	2017
Momaya 2018	1.86	0.17	31	1.96	0.18	31	73.0%	−0.56 [−1.07, −0.06]	2018
Subtotal (95% CI)			**42**			**42**	**100.0%**	**−0.43 [−0.86, 0.00]**	
Heterogeneity: Tau² = 0.00; Chi² = 0.98, df = 1 (P = 0.32); I² = 0%									
Test for overall effect: Z = 1.94 (P = 0.05)									
Test for subgroup differences: Chi² = 1.37, df = 3 (P = 0.71), I² = 0%									

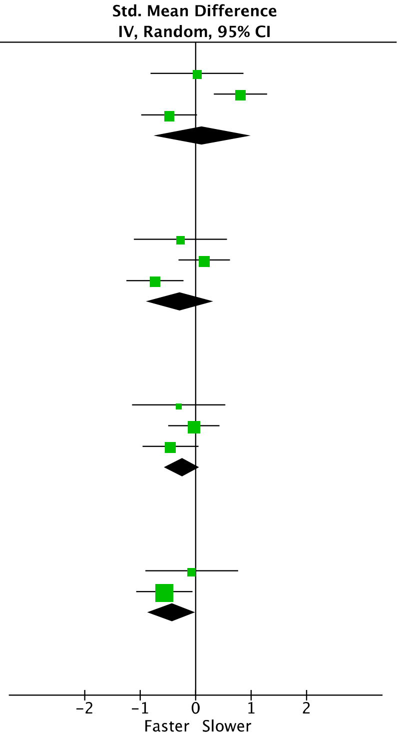


Fig 6. Pooled data and forest plot of right hip arthroscopy brake reaction times. $P < .05$ is considered statistically significant. (CI, confidence interval; IV, inverse-variance method; Post-op, postoperative; Pre-op, preoperative; SD, standard deviation; Std, standardized.)

An example of this is highlighted by the study of Valentí et al.,[24] which collected BRTs between 4 and 6 weeks postoperatively, as opposed to collecting them each week (week 4, week 5, and week 6) as other studies did. This proved to be a challenge when incorporating these data for comparison with data from other studies,

Study or Subgroup	Post-op Mean	Post-op SD	Post-op Total	Pre-op Mean	Pre-op SD	Pre-op Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
4.1.2 Week 2									
Vera 2017	0.567	0.143	8	0.598	0.121	8	23.4%	−0.22 [−1.21, 0.76]	2017
Balazs 2018	0.563	0.13121	26	0.566	0.12008	26	76.6%	−0.02 [−0.57, 0.52]	2018
Subtotal (95% CI)			**34**			**34**	**100.0%**	**−0.07 [−0.55, 0.41]**	
Heterogeneity: Tau² = 0.00; Chi² = 0.12, df = 1 (P = 0.73); I² = 0%									
Test for overall effect: Z = 0.29 (P = 0.77)									
4.1.4 Week 4									
Vera 2017	0.616	0.178	8	0.598	0.121	8	23.5%	0.11 [−0.87, 1.09]	2017
Balazs 2018	0.567	0.13369	26	0.566	0.12008	26	76.5%	0.01 [−0.54, 0.55]	2018
Subtotal (95% CI)			**34**			**34**	**100.0%**	**0.03 [−0.44, 0.51]**	
Heterogeneity: Tau² = 0.00; Chi² = 0.03, df = 1 (P = 0.86); I² = 0%									
Test for overall effect: Z = 0.13 (P = 0.89)									
4.1.5 Week 6									
Vera 2017	0.579	0.162	8	0.598	0.121	8	23.5%	−0.13 [−1.11, 0.86]	2017
Balazs 2018	0.55	0.12874	26	0.566	0.12008	26	76.5%	−0.13 [−0.67, 0.42]	2018
Subtotal (95% CI)			**34**			**34**	**100.0%**	**−0.13 [−0.60, 0.35]**	
Heterogeneity: Tau² = 0.00; Chi² = 0.00, df = 1 (P = 1.00); I² = 0%									
Test for overall effect: Z = 0.52 (P = 0.60)									
4.1.6 Week 8									
Vera 2017	0.523	0.0878	8	0.598	0.121	8	100.0%	−0.67 [−1.69, 0.35]	2017
Subtotal (95% CI)			**8**			**8**	**100.0%**	**−0.67 [−1.69, 0.35]**	
Heterogeneity: Not applicable									
Test for overall effect: Z = 1.29 (P = 0.20)									
Test for subgroup differences: Chi² = 1.54, df = 3 (P = 0.67), I² = 0%									

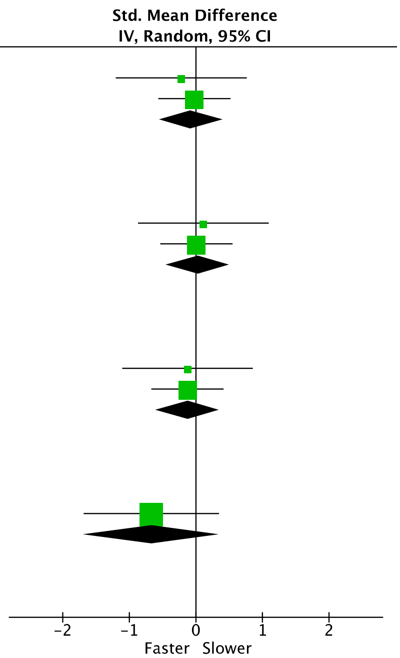
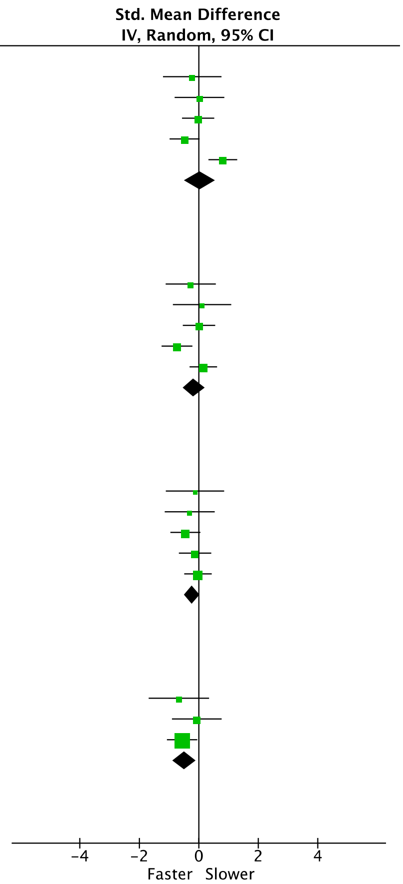


Fig 7. Pooled data and forest plot of left hip arthroscopy brake reaction times. $P < .05$ is considered statistically significant. (CI, confidence interval; IV, inverse-variance method; Post-op, postoperative; Pre-op, preoperative; SD, standard deviation; Std, standardized.)

Study or Subgroup	Post-op Mean	Post-op SD	Post-op Total	Pre-op Mean	Pre-op SD	Pre-op Total	Weight	Std. Mean Difference IV, Random, 95% CI	Year
6.1.1 Week 2									
Vera 2017	0.567	0.143	8	0.598	0.121	8	14.4%	−0.22 [−1.21, 0.76]	2017
Vera 2017	0.608	0.168	11	0.604	0.148	11	16.8%	0.02 [−0.81, 0.86]	2017
Balazs 2018	0.563	0.13121	26	0.566	0.12008	26	22.3%	−0.02 [−0.57, 0.52]	2018
Momaya 2018	1.84	0.3	31	1.96	0.18	31	23.0%	−0.48 [−0.98, 0.03]	2018
Balazs 2018	0.688	0.15664	36	0.573	0.12265	36	23.5%	0.81 [0.33, 1.29]	2018
Subtotal (95% CI)			**112**			**112**	**100.0%**	**0.05 [−0.48, 0.57]**	
Heterogeneity: $Tau^2 = 0.24$; $Chi^2 = 14.00$, df = 4 (P = 0.007); $I^2 = 71\%$									
Test for overall effect: Z = 0.17 (P = 0.86)									
6.1.3 Week 4									
Vera 2017	0.566	0.118	11	0.604	0.148	11	13.9%	−0.27 [−1.11, 0.57]	2017
Vera 2017	0.616	0.178	8	0.598	0.121	8	11.1%	0.11 [−0.87, 1.09]	2017
Balazs 2018	0.567	0.13369	26	0.566	0.12008	26	23.4%	0.01 [−0.54, 0.55]	2018
Momaya 2018	1.84	0.14	31	1.96	0.18	31	24.6%	−0.73 [−1.25, −0.22]	2018
Balazs 2018	0.594	0.14482	36	0.573	0.12265	36	27.0%	0.15 [−0.31, 0.62]	2018
Subtotal (95% CI)			**112**			**112**	**100.0%**	**−0.16 [−0.54, 0.21]**	
Heterogeneity: $Tau^2 = 0.08$; $Chi^2 = 7.29$, df = 4 (P = 0.12); $I^2 = 45\%$									
Test for overall effect: Z = 0.85 (P = 0.40)									
6.1.5 Week 6									
Vera 2017	0.579	0.162	8	0.598	0.121	8	7.2%	−0.13 [−1.11, 0.86]	2017
Vera 2017	0.559	0.134	11	0.604	0.148	11	9.8%	−0.31 [−1.15, 0.54]	2017
Momaya 2018	1.86	0.25	31	1.96	0.18	31	27.2%	−0.45 [−0.96, 0.05]	2018
Balazs 2018	0.55	0.12874	26	0.566	0.12008	26	23.4%	−0.13 [−0.67, 0.42]	2018
Balazs 2018	0.569	0.13152	36	0.573	0.12265	36	32.4%	−0.03 [−0.49, 0.43]	2018
Subtotal (95% CI)			**112**			**112**	**100.0%**	**−0.20 [−0.47, 0.06]**	
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.63$, df = 4 (P = 0.80); $I^2 = 0\%$									
Test for overall effect: Z = 1.50 (P = 0.13)									
6.1.7 Week 8									
Vera 2017	0.523	0.0878	8	0.598	0.121	8	15.5%	−0.67 [−1.69, 0.35]	2017
Vera 2017	0.595	0.0955	11	0.604	0.148	11	22.8%	−0.07 [−0.91, 0.77]	2017
Momaya 2018	1.86	0.17	31	1.96	0.18	31	61.7%	−0.56 [−1.07, −0.06]	2018
Subtotal (95% CI)			**50**			**50**	**100.0%**	**−0.47 [−0.87, −0.07]**	
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.16$, df = 2 (P = 0.56); $I^2 = 0\%$									
Test for overall effect: Z = 2.30 (P = 0.02)									



Test for subgroup differences: $Chi^2 = 2.58$, df = 3 (P = 0.46), $I^2 = 0\%$

Fig 8. Pooled data and forest plot of all hip arthroscopy brake reaction times. $P < .05$ is considered statistically significant. (CI, confidence interval; IV, inverse-variance method; Post-op, postoperative; Pre-op, preoperative; SD, standard deviation; Std, standardized.)

as the data of Valentí et al. had to be averaged to "week 5" for the purposes of plotting and statistical analysis. Because of this larger time frame for BRTs, the data could appear skewed: BRTs taken closer to the 4-week mark would appear faster than in actuality, whereas BRTs measured closer to the 6-week mark would appear slower than in actuality.

Our study also suggests the need for further research to expand the available data pool. Further research could more extensively explore BRT differences based on the side of surgery or type of surgical procedure, investigate the effects of non-modifiable factors such as sex and age, or consider additional measures of driving performance.

Conclusions

BRTs met baseline or control values and continued to improve after 6 weeks after knee arthroscopy and after 4 weeks after hip arthroscopy. On the basis of these results, it would be safe to recommend a return to driving at 6 weeks after knee arthroscopic procedures and 4 weeks after hip arthroscopic procedures.

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Appendix

Appendix Table 1. OVID, Embase, and Cochrane Database Search Protocols With Numbers of Results Identified From Search Strategy

Search	No. of Results
OVID	
1. "Knee arthroscopy" or "Hip arthroscopy" or "arthroscopic knee surgery" or "arthroscopic hip surgery" or "anterior cruciate ligament surgery" or "anterior cruciate ligament reconstruction" or "posterior cruciate ligament repair" or "posterior cruciate ligament reconstruction" or "medial patellofemoral ligament repair" or "medial collateral ligament repair" or "lateral collateral ligament repair" or "knee soft tissue repair" or "hip soft tissue repair" or "soft tissue injury" or "joint loose body" or "fibrocartilage" or "arthroscopy" or "arthroscopy rehabilitation" or "Femoroacetabular Impingement repair" or "Labral tear repair" or "chondroplasty" or "microfracture" or "synovectomy" or "Osteochondral Autograft Transfer System" or "mosaicplasty"	46,003
2. "total brake response time" or "reaction time" or "moving time" or "movement time" or "recovery of function"	171,452
3. "driving reaction" or "driving skill" or "driving ability" or "driving"	97,430
4. 2 or 3	266,893
5. 1 and 4	2,042
6. Limit 5 to English Language Articles	1,945
7. Exp Automobile Driving	183
8. 5 and 7	149
Embase	
1. "Knee arthroscopy" or "Hip arthroscopy" or "arthroscopic knee surgery" or "arthroscopic hip surgery" or "anterior cruciate ligament surgery" or "anterior cruciate ligament reconstruction" or "posterior cruciate ligament repair" or "posterior cruciate ligament reconstruction" or "medial patellofemoral ligament repair" or "medial collateral ligament repair" or "lateral collateral ligament repair" or "knee soft tissue repair" or "hip soft tissue repair" or "soft tissue injury" or "joint loose body" or "fibrocartilage" or "arthroscopy" or "arthroscopy rehabilitation" or "Femoroacetabular Impingement repair" or "Labral tear repair" or "chondroplasty" or "microfracture" or "synovectomy" or "Osteochondral Autograft Transfer System" or "mosaicplasty"	40,342
2. "total brake response time" or "reaction time" or "moving time" or "movement time" or "recovery of function"	119,340
3. "driving reaction" or "driving skill" or "driving ability" or "driving"	118,400
4. 2 or 3	235,595
5. 1 and 4	135
6. Limit to English Language Articles	130
Cochrane	
1. ("Knee arthroscopy" or "Hip arthroscopy" or "arthroscopic knee surgery" or "arthroscopic hip surgery" or "anterior cruciate ligament surgery" or "anterior cruciate ligament reconstruction" or "posterior cruciate ligament repair" or "posterior cruciate ligament reconstruction" or "medial patellofemoral ligament repair" or "medial collateral ligament repair" or "lateral collateral ligament repair" or "knee soft tissue repair" or "hip soft tissue repair" or "soft tissue injury" or "joint loose body" or "fibrocartilage" or "arthroscopy" or "arthroscopy rehabilitation" or "Femoroacetabular Impingement repair" or "Labral tear repair" or "chondroplasty" or "microfracture" or "synovectomy" or "Osteochondral Autograft Transfer System" or "mosaicplasty")	5,593
2. [AND] "total brake response time" or "reaction time" or "moving time" or "movement time" or "recovery of function" or "driving reaction" or "driving skill" or "driving ability" or "return to driving" or "returned to driving"	17,352
3. [AND] Automobile driving	814
4. 1, 2, and 3	9

Appendix Table 2. GRADE Analysis for Assessment of Quality of Evidence Used in Meta-analysis

Meta-analysis	Time Point of Subanalysis	Standardized Mean Difference	Confidence Interval	Design (0-2)	Quality (0-3, with −1 for Non-RCT)	Inconsistency (0-1)	Indirectness (0-1)	Imprecision (0-1)	Publication Bias (0-1)	Overall Quality (0-9)*
Knee arthroscopy										
TBRT right										
	1 wk	0.97	−0.05 to 1.99	Low (−2)	Moderate (−1)	Yes (−1)	No	Yes (−1)	Yes (−1)	Very low (3)
	2 wk	0.19	−1.54 to 1.93	Low (−2)	Moderate (−1)	Yes (−1)	No	Yes (−1)	Yes (−1)	Very low (3)
	3 wk	0.44	−0.12 to 1.01	Low (−2)	Moderate (−1)	NA	No	Yes (−1)	Yes (−1)	Low (4)
	4 wk	−0.02	−0.89 to 0.85	Low (−2)	Moderate (−1)	Yes (−1)	No	Yes (−1)	Yes (−1)	Very low (3)
	5 wk	1.95	1.14 to 2.76	Low (−2)	Moderate (−1)	NA	No	No	Yes (−1)	Low (5)
	6 wk	−0.18	−0.64 to 0.28	Low (−2)	Moderate (−1)	No	No	Yes (−1)	Yes (−1)	Low (4)
	8 wk	−0.48	−0.97 to 0.02	Low (−2)	Moderate (−1)	No	No	Yes (−1)	Yes (−1)	Low (4)
	10 wk	−0.69	−1.38 to 0.01	Low (−2)	Moderate (−1)	NA	No	Yes (−1)	Yes (−1)	Low (4)
TBRT left										
	2 wk	−0.01	−0.72 to 0.71	Low (−2)	Moderate (−1)	NA	No	Yes (−1)	Yes (−1)	Low (4)
	4 wk	−0.21	−0.93 to 0.51	Low (−2)	Moderate (−1)	NA	No	Yes (−1)	Yes (−1)	Low (4)
	5 wk	1.96	0.99 to 2.92	Low (−2)	Moderate (−1)	NA	No	No	Yes (−1)	Low (5)
	6 wk	−0.42	−1.14 to 0.31	Low (−2)	Moderate (−1)	NA	No	Yes (−1)	Yes (−1)	Low (4)
	8 wk	−0.39	−1.11 to 0.33	Low (−2)	Moderate (−1)	NA	No	Yes (−1)	Yes (−1)	Low (4)
Hip arthroscopy										
TBRT right										
	2 wk	0.13	−0.74 to 1.00	Low (−2)	Moderate (−1)	Yes (−1)	No	Yes (−1)	Yes (−1)	Very low (3)
	4 wk	−0.28	−0.88 to 0.32	Low (−2)	Moderate (−1)	Yes (−1)	No	Yes (−1)	Yes (−1)	Very low (3)
	6 wk	−0.24	−0.55 to 0.08	Low (−2)	Moderate (−1)	No	No	Yes (−1)	Yes (−1)	Low (4)
	8 wk	−0.43	−0.86 to 0.00	Low (−2)	Moderate (−1)	No	No	No	Yes (−1)	Low (5)
TBRT left										
	2 wk	−0.07	−0.55 to 0.41	Low (−2)	Moderate (−1)	No	No	Yes (−1)	Yes (−1)	Low (4)
	4 wk	0.03	−0.44 to 0.51	Low (−2)	Moderate (−1)	No	No	Yes (−1)	Yes (−1)	Low (4)
	6 wk	−0.13	−0.60 to 0.35	Low (−2)	Moderate (−1)	No	No	Yes (−1)	Yes (−1)	Low (4)
	8 wk	−0.67	−1.69 to 0.35	Low (−2)	Moderate (−1)	NA	No	Yes (−1)	Yes (−1)	Low (4)

NA, not applicable; RCT, randomised controlled trial; TBRT, total brake reaction time.

*Overall quality was rated as very low for scores of 0 to 3; low, 4 to 5; moderate, 6 to 7; or high, 8 to 9.