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ACL reconstruction in 11 children using the Clocheville surgical technique: Objective and subjective evaluation



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ABSTRACT

Introduction: The over-the-top position of the femoral metaphyseal tunnel during extraphyseal ligament reconstruction of the anterior cruciate ligament (ACL) according to Clocheville may be responsible for negative anisometry. Until now, the follow-up of children operated using this pediatric technique was limited to screening for iatrogenic epiphysiodesis and the search for postoperative clinical instability. The objective of this study was to measure residual laxity using objective tests, to quantify muscle recovery, and to evaluate the quality of life of these patients in terms of the sports activities.

Material and methods: Eleven patients with a mean age of 13.5 years were seen at a mean 2.1 years of follow-up. They underwent objective clinical tests (GNRB® arthrometer and CON-TREX® dynamometer) as well as subjective questionnaires (IKDC and KOOS).

Results: No significant difference was found between the healthy knee and the operated knee for either the GNRB® at 134 N ($P=0.79$) or at 200 N ($P=0.98$). The CON-TREX® system allowed us to measure a median percentage of quadriceps recovery of 80.7% (range, 52.2–114.5) in terms of muscle power (60°/s) and 81.2% (range, 51.6–109.6) for muscle response (180°/s). The median subjective IKDC score was 94.73/100 (range, 73.68–98.93); 72.7% of the patients resumed competitive sports.

Discussion: This study's lack of statistical power did not show a significant difference in terms of residual laxity at rest of GNRB® transplants, while a mean differential of +0.4 mm was observed. Although pediatric transphyseal ligament reconstruction techniques are increasingly used, the Clocheville technique remains, in our opinion, an attractive surgical alternative in the youngest subjects, with no major risk of iatrogenic epiphysiodesis even though it is theoretically anisometric.

Level of evidence: IV.

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1. Introduction

The incidence of anterior cruciate ligament (ACL) tears in children with open growth cartilage is estimated at 350–400 new cases per year in France [1]. The development of new sports activities and the demands of high-performance sports could be the source of this increase [2]. The determinism of the ACL lesion depends on age, with 90% of intracorporeal ACL lesions occurring after the age of 12 years [1,3]. While conservative treatment remains debatable [4,5], the presence of subjective instability, clinical laxity, and/or meniscal damage requires early surgery [6,7]. For more

than 15 years, many teams have proposed reconstructions using transphyseal techniques, with pediatric modalities consisting of constructing centered [8,9], vertical [10,11], and small-diameter [12] tunnels. They have found low to moderate growth disturbance, but in studies with small numbers of patients [13–16]. There have been no studies attempting to objectively and very accurately assess anteroposterior residual laxity in these ligament reconstructions, a major prognostic factor of irreversible cartilage and meniscus lesion onset. The objective of this study was to assess the functional recovery of patients who underwent Clocheville ligament reconstruction using subjective questionnaires, to measure residual laxity, and to quantify muscle recovery, hypothesizing that laxity in the operated knees was greater than that in the contralateral knees because of the anisometry of the transplant.

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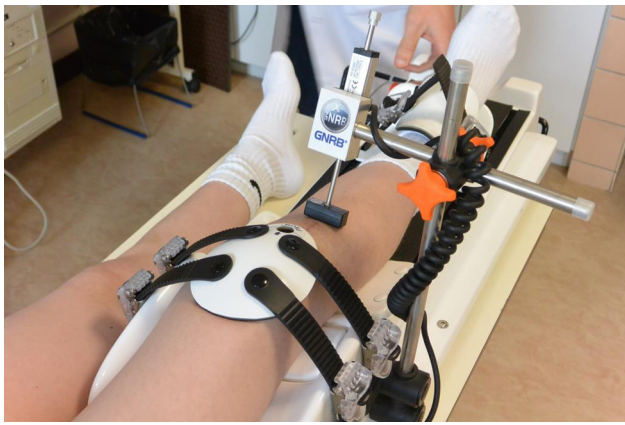


Fig. 1. Measurement of bilateral laxity with the GNRB® anthrometer beginning with the operated knee so as to reduce the feedback effect.

2. Material and methods

Eleven patients were included in this retrospective study out of 12 who underwent surgery between January 2008 and December 2013. During this period, all children presenting ACL tear with open growth cartilage were operated on with the Clocheville extraphyseal ligament reconstruction technique [17]. Postoperative care included immobilization in a long-leg cast for 45 days, providing union of the epiphyseal tibial portion, guaranteeing good primary stability. Rehabilitation began the 6th week and sports were authorized beginning in the 6th month. In case of physiological recurvatum, orthotics blocking hyperextension were prescribed during the ligamentization phase.

These patients were assessed for function using subjective scores (the pediatric International Knee Documentation Committee [IKDC] and the Knee injury and Osteoarthritis Score [KOOS]), the objective measurement of residual laxity (GNRB® arthrometer), as well as muscle recovery using isokinetic tests (CON-TREX® dynamometer).

The GNRB® [18] is a device that measures sagittal displacement of the tibia in the Lachmann position at 20° flexion (Fig. 1). A displacement sensor (accuracy, 0.1 mm) records the anterior translation of the anterior tuberosity of the tibia in relation to the femur. The examination is systematically begun on the operated knee (OK) to rule out the feedback effect of the hamstring and quadriceps reflex contraction as much as possible.

Muscle recovery was evaluated with isokinetic tests using the CON-TREX MJ® human kinetics dynamometer [19] (Fig. 2). This

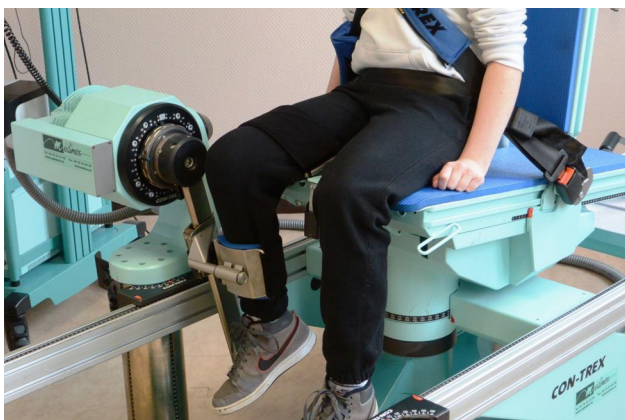


Fig. 2. CON-TREX MJ human kinetics® dynamometer with comparison of muscle power recovery at 60°/s and muscle response at 180°/s.

device measures the strength deficit in extension and flexion by comparing the healthy knee and the operated knee. Two different speeds were required, one at 60°/s to obtain the muscle power curves and the other at a higher kinetics (180°/s) to quantify muscle response (or the capacity to quickly recruit muscle fibers). Mean comparative statistics between the operated knee and the healthy knee were calculated using the Wilcoxon rank sum test for paired samples.

The central epiphysiodeses were screened using long-leg standing films. Bilateral AP and lateral X-rays were used to check for peripheral epiphysiodesis that could result in genu varum, valgum, and recurvatum during rostral epiphysiodesis, or endofemoral flossum caused by a teno-epiphysiodesis effect related to excessive tension of the transplant.

3. Results

The cohort included ten boys and one girl with a mean age of 13.5 years (range, 11.5–16.2 years). The mean follow-up after surgery was 2 years and 1 month (range, 9 months to 5 years 11 months). The children were operated on between the 9th and the 20th week after ACL tear.

The MRI performed at diagnosis showed meniscal lesions in four out of the 11 patients (36.4%), with three on the medial meniscus and one on the lateral meniscus. A single case required suturing using the all-inside technique (Fast-fix®) for an internal meniscus lesion in the middle segment. All other lesions were stable in the peripheral area and did not require surgery.

The mean subjective IKDC score was 94.7 (range, 73.68–98.93). The median scores for the KOOS questionnaire were 96.4 (range, 71.43–96.57) for symptoms, 97.2 (range, 88.89–100) for pain, 98.3/100 (range, 92.65–100) for function in daily living, and 90.6/100 (range, 75–100) for sports and recreation (Fig. 3). A total of eight patients (72.7%) returned to competitive sports.

The median tibial translations found on the GNRB® (Fig. 4) with 134 N pressure were 5.5 mm on the operated knee (range, 3.9–8.9 mm) versus 5.1 mm on the healthy knee (range, 3.2–8.3 mm). The last pressure level at 200 N showed a median at 8 mm for the operated knee (range, 4.7–11.3 mm) versus 7.6 mm for the healthy knee (range, 3.7–10.6 mm). No statistically significant difference was found for residual laxity between the healthy knee and the operated knee for the GNRB® at 134 N ($P=0.79$) or for pressure at 200 N ($P=0.98$).

For the isokinetic tests with the CON-TREX® dynamometer (Fig. 5), the median percentage of recovery at 60°/s, demonstrating

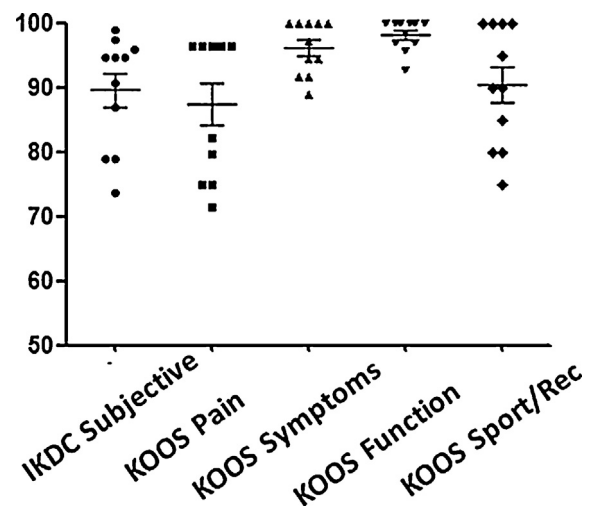


Fig. 3. Histogram of subjective evaluation scores (pediatric IKDC and KOOS score).

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