

# EXTRA-ARTICULAR RECONSTRUCTION ASSOCIATED WITH THE ANTERIOR CRUCIATE LIGAMENT IN BRAZIL

## RECONSTRUÇÃO EXTRA-ARTICULAR ASSOCIADA AO LIGAMENTO CRUZADO ANTERIOR NO BRASIL

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### ABSTRACT

**Objective:** To assess the knowledge and technical preferences of Brazilian knee surgeons in relation to the treatment of Anterior Cruciate Ligament (ACL) injuries using intra-articular reconstruction in combination with extra-articular reconstruction. **Methods:** A questionnaire consisting of 16 questions about intra-articular ACL reconstruction in combination with extra-articular procedures and about the Anterolateral Ligament (ALL) was applied at the 48<sup>th</sup> Brazilian Congress of Orthopedics. **Results:** One hundred thirty-seven surgeons answered the questionnaire. Most surgeons perform 10-30 ACL reconstructions per year, with the transtibial technique appearing as the most common. Most surgeons find some percentage of residual pivot-shift after reconstructions, but the minority performs extra-articular procedures on a routine basis. The main indications for extra-articular reconstruction are revision and profuse pivot-shift cases. Most surgeons consider the ALL a true ligament, but 46.7% with less biomechanical importance and 32.3% with greater importance in knee stability. However, 91.4% had a positive perception of the reconstruction of this structure. **Conclusion:** Although the preferred technique is still the transtibial procedure, combined anatomical reconstructions already make up more than 50% of cases. Extra-articular reconstructions associated with the ACL are still performed by the minority of Brazilian surgeons, but 91.4% of them report having had a positive perception with their reconstruction. **Level of Evidence III, Descriptive Study.**

**Keywords:** Anterior cruciate ligament. Anterolateral ligament. Knee joint. Joint instability.

### RESUMO

**Objetivo:** Avaliar o conhecimento e as preferências técnicas entre os cirurgiões de joelho brasileiros no tratamento das lesões do ligamento cruzado anterior, com reconstrução intra-articular associada à reconstrução extra-articular. **Métodos:** Foi aplicado questionário de 16 perguntas no 48<sup>o</sup> Congresso Brasileiro de Ortopedia acerca de reconstrução intra-articular do ligamento cruzado anterior associada a procedimentos extra-articulares e sobre o ligamento anterolateral. **Resultados:** Responderam o questionário 137 cirurgiões. A maioria faz entre 10 e 30 reconstruções de ligamento cruzado anterior por ano, sendo a técnica transtibial a mais realizada. A maioria encontrou alguma porcentagem de pivot-shift residual após as reconstruções, mas a minoria realizou procedimento extra-articular de rotina. As indicações principais de reconstrução extra-articular foram casos de revisão e pivot-shift exuberante. A maioria considera o ligamento anterolateral um ligamento verdadeiro, porém 46,7% o caracterizou com importância biomecânica menor e 32,3% com importância maior na estabilidade do joelho, mas 91,4% tiveram percepção positiva em relação à reconstrução dessa estrutura. **Conclusão:** Apesar da técnica de preferência ainda ser a transtibial, as reconstruções anatômicas combinadas já são mais de 50% dos casos. As reconstruções extra-articulares associadas ao ligamento cruzado anterior ainda são feitas pela minoria dos cirurgiões brasileiros, mas 91,4% deles referem ter tido uma percepção positiva com sua reconstrução. **Nível de Evidência III, Estudo Descritivo.**

**Descritores:** Ligamento cruzado anterior. Ligamento anterolateral. Articulação do joelho. Instabilidade articular.

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### INTRODUCTION

Anterior cruciate ligament (ACL) injuries are one of the most common knee injuries.<sup>1</sup> In the USA, for example, more than 200,000 ACL reconstructions are performed on average each year.<sup>2</sup> Techniques for

treating anterior knee instability have made considerable progress over the past 30 years, going from open to arthroscopic procedures, and from non-anatomical to more anatomical procedures.<sup>3</sup> Even with the advances in techniques, many surgeons have noted that a not inconsiderable group of patients continue to have residual

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knee instability, even after technically adequate surgery.<sup>4,5</sup> This instability can be measured objectively using the pivot-shift test, which ranges from minimal perceptible instability to an exacerbated degree, depending on the series used.<sup>6</sup> The positivity of the pivot-shift test in the postoperative period is correlated with worse functionality of these patients.<sup>28</sup>

Due to this residual instability, the focus has shifted back to the extra-articular area of the knee, particularly as of 2013, because of studies related to the Anterolateral Ligament, and procedures performed as monotherapy in the past are now being used in combination with intra-articular ACL reconstruction.<sup>7-9</sup>

Due to the high frequency of ACL injuries in sports, their social and economic impact, the considerable divergence between treatment types, and the importance of Brazilian literature, especially in articles related to the ALL and extra-articular reconstructions published in the last 5 years, it is pertinent to evaluate the perspectives and predilections of Brazilian surgeons in relation to this topic.<sup>10-13</sup>

Therefore, the aim of this study was to evaluate ACL reconstruction preferences among knee surgeons in Brazil, and to observe their knowledge and predilections with regards to extra-articular reconstructions and the Anterolateral Ligament.

## MATERIAL AND METHODS

This is a descriptive study with the application of a questionnaire for Brazilian knee surgeons. The questionnaire was developed by the authors of this study (Appendix 1). The questionnaire, which consists of 16 questions, was applied to 137 orthopedists who perform knee surgery at the 48<sup>th</sup> Brazilian Congress of Orthopedics. The questionnaire was answered voluntarily without the signing of an Informed Consent Form.

The questions were related to the number of ACL reconstructions per year, type of technique most commonly used, clinical observations such as percentage of residual pivot-shift, percentage of association of extra-articular techniques (including ALL reconstruction) with intra-articular ACL technique, level of knowledge of ALL related studies, incidence of ALL reconstruction and criteria for indication, graft types for both ACL and ALL reconstructions, and potential complications. The objective was to gain a better insight into the preferences and degree of knowledge of new extra-articular techniques, and to enable an understanding of the predilections and perceptions of the knee surgeons. We conducted a descriptive statistical analysis of the answers obtained, based on the questionnaire, in order to characterize the sample.

This research project was approved by the Scientific Committee of the Department of Orthopedics and Traumatology of the School of Medicine of Universidade de São Paulo at a meeting, under Research Protocol IOT No. 1321.

## RESULTS

The origin and age of the patients are shown in Tables 1 and 2. Of the 137 participants, 28.5% answered that they perform fewer than 10 ACL reconstructions per year; 29.1% perform between 10 and 30; 27.8% between 30 and 50; 12.4% between 50 and 100, and only 2.2% perform more than 100 ACL reconstructions per year (Table 1). The ACL reconstruction technique preferred by 40.9% of knee surgeons was the Single-Bundle Transtibial Technique; followed by the Single-Bundle Transportal Technique preferred by 32.1% of the participants; 18.3% prefer Single-Bundle Outside In Reconstruction; 7.3% prefer Double-Bundle Reconstruction, and the remaining 1.4% said they still perform Open ACL Reconstruction (Table 2). The incidence of residual instability determined by the pivot-shift test is described in Table 3.

**Table 1.** Number of Anterior Cruciate Ligament reconstructions performed per year by Brazilian surgeons who answered the questionnaire at the 48<sup>th</sup> Brazilian Congress of Orthopedics.

Number of Reconstructions/year	Number of surgeons	%
<10	39	28.5
Between 10 and 30	40	29.1
Between 30 and 50	38	27.8
Between 50 and 100	17	12.4
>100	3	2.2

**Table 2.** Preferred technique for Anterior Cruciate Ligament reconstructions of Brazilian surgeons who answered the questionnaire at the 48<sup>th</sup> Brazilian Congress of Orthopedics.

Preferred Technique for ACL reconstruction	No. of surgeons	%
Open	2	1.4
Arthroscopic Single-Bundle Transtibial	56	40.9
Arthroscopic Single-Bundle Transportal	44	32.1
Arthroscopic Single-Bundle Outside In	25	18.3
Double-Bundle Arthroscopic	10	7.3

ACL – Anterior Cruciate Ligament.

**Table 3.** Incidence of residual pivot-shift found in the post-anterior cruciate ligament reconstruction physical examination by Brazilian surgeons who answered the questionnaire at the 48<sup>th</sup> Brazilian Congress of Orthopedics.

Incidence of Residual Pivot-Shift following ACL Reconstruction	No. of Surgeons	%
Less than 5%	2	1.4
Between 5 and 10%	56	40.9
Between 10 and 15%	44	32.1
Between 15 and 20%	25	18.3
More than 20%	10	7.3

Regarding the combination of extra-articular reconstructions associated with ACL reconstruction, the majority of surgeons (73.7%) answered that they did not use this procedure in reconstructions. Among those who do, 21.2% only perform the procedure in selected cases; 1.4% use it routinely in revision cases, and 3.6% use the procedure routinely in primary and revision cases.

In an objective question about whether all the respondents were familiar with the ALL and its recent anatomical importance as well as surgical techniques for extra-articular reconstruction, 60.5% of respondents said they had only recently heard about the ALL; 32.1% said they had known about it for years, and 7.2% said they were not yet aware of the ligament.

Another question put to the surgeons concerned their opinion about the importance of the Anterolateral Knee Ligament. In the studied sample, 46.7% agree with the anatomical existence of the ligament, but believe it has little importance in the control of rotatory knee instability; only 32.3% consider the ALL important as an anatomical and functional structure in the control of rotatory instability; 9.4% regard the ALL as a lateral structure, but not a ligament, and 6.5% regard the ALL as a ligament, but without a functional role. 82.2% answered that they had not yet performed any ACL reconstruction in combination with ALL, and 17.8% had already performed the procedure at least once. Regarding the graft that would be chosen to perform Extra-articular ALL Reconstruction, 71.6% answered that they would use the Gracilis Tendon; 27.0% that they would use the Iliotibial Tract or Band, and 1.4% that they would only use Tissue Bank Tendons.

As concerns the fixation options for a potential ALL reconstruction, 55.5% said they use or would use Interference Screws; 33.5% said they prefer or would prefer to use Anchors; 5.8% would fix

the ligament using only soft tissue and transosseous sutures, and 5.2% would use Biotenodesis Screws or Anchors.

Regarding the surgical indications for ALL reconstruction, the question was open to more than one answer for the interviewees, so that 75.1% consider a high-grade pivot-shift test the main indication. The other responses are described in Table 4.

Regarding the fixation of the ALL graft, the surgeons were asked at which angle of flexion or extension they would fix this graft. 45.2% would fix it at 30° of flexion; 27.8% at 45° of flexion; 19.7% would fix the graft in extension and 4.3% would fix it at 60° of flexion. Regarding the use of a brace in extension in the postoperative period, 75.6% would not use it while 24.4% said they would. The complications found are described in Table 5. Participants could answer none, only one, or more than one complication.

Finishing with a subjective question, 91.4% answered that they had a positive perception after performing ALL reconstruction, while 8.6% answered that on the contrary, they would give the procedure a negative feedback.

**Table 4.** Possible indications of Anterolateral Ligament reconstruction in combination with Anterior Cruciate Ligament reconstruction by Brazilian surgeons who answered the questionnaire at the 48th Brazilian Congress of Orthopedics.

Indications for all reconstruction	%
Acl revision	63.5
High-grade pivot-shift	75.1
Sports with rotation movements	38.6
Ligament hypermobility	5.1
Age <18 years	3.6
Professional athletes	5.8
Chronic acl injuries	24.0
Lateral femoral notch	11.6
Segond fracture	36.4

**Table 5.** Possible complications of Anterolateral Ligament reconstruction in combination with Anterior Cruciate Ligament reconstruction found by Brazilian surgeons who answered the questionnaire at the 48th Brazilian Congress of Orthopedics.

Complications found in ALL reconstruction	%
Joint stiffness/difficulty gaining ROM	31.6
Lateral pain	33.7
Degenerative abnormalities	31.7
Postoperative infection	2.0
Problems with synthesis material	1.0

## DISCUSSION

The main finding of this study is that there is still no consensus as to whether there is a need for extra-articular reconstruction combined with intra-articular reconstruction of the ACL, or on the best technique for this potential reconstruction among Brazilian knee surgeons. This controversy is also present in international literature, with groups advocating opposing viewpoints on the ALL.<sup>14-17</sup> Nevertheless, recent studies have shown a tendency to support the use of combined extra-articular reconstruction in selected cases.<sup>18,19</sup>

As regards the population that answered the questionnaire, the vast majority is in southeast Brazil, where most of the services accredited by the Brazilian Society of Knee Surgery are also located. Only about 1/6 of the sample performs more than 50 ACL reconstructions per year, a number similar to that found by Arliani et al.<sup>20</sup> in a study

published 5 years ago, showing that few surgeons in Brazil handle a large volume of ACL reconstructions.

The transtibial isometric technique continues to be the preferred technique of most Brazilian surgeons on an individual basis, although so-called anatomical reconstructions, if analyzed in a combined manner, together with transportal and outside in reconstructions, amount to more than 50% of cases. These data show the tendency towards a change of technique in Brazil, as is the case at other international centers, albeit more slowly.

Regarding residual instability measured by the pivot-shift test, only 19.7% reported having observed this phenomenon in a few patients, which shows that it is a fairly common situation in the postoperative period. The presence of residual pivot-shift denotes some degree of rotatory instability and is related to poorer post-ACL reconstruction functional outcomes.<sup>21</sup> One of the advantages of extra-articular reconstruction is that it eliminates this instability. Clinical studies have already shown that the use of combined extra-articular reconstruction is able to reduce pivot-shift and the retear rate.<sup>18,22</sup> Rezende et al.<sup>10</sup> showed, in a systematic review, that the addition of extra-articular reconstruction improves both pivot-shift and anteroposterior instability in patients. Along the same lines, Ibrahim et al.<sup>23</sup> showed lower KT-1000 in patients who had undergone combined reconstruction.

In the questions specifically focusing on extra-articular reconstructions, the vast majority of surgeons do not perform the procedure, while those who do only perform a very limited number of procedures. Only about 5% use this practice routinely, either in primary or revision reconstructions, and only 17.8% have performed ALL reconstruction at least once. Although countries such as Italy and France use lateral reinforcement routinely, American surgeons stopped using this technique in the late 1980s, which influenced much of the world. Specifically with regards to the ALL, most surgeons appeared to have heard of this structure only recently, which is acceptable since anatomical studies focused on this structure began in 2012 with Vincent et al.,<sup>24</sup> and increased significantly in 2013 after the studies by Claes et al.<sup>7</sup> and Helito et al.<sup>9</sup> Only a third of interviewees, however, believe that the ALL is of significant relevance in rotatory stability of the knee. Biomechanical studies have presented considerable controversy regarding its role, without a clear consensus in the literature to date, although with a tendency to consider the ALL significant after the latest studies by Rasmussen et al.,<sup>25</sup> Nitri et al.<sup>26</sup> and Sonnery-Cottet et al.<sup>18</sup>

Regarding fixation techniques, most surgeons opted for the use of the gracilis tendon as a graft and fixation with interference screws in primary reconstructions, which is also the preferred technique of Sonnery-Cottet et al.<sup>18</sup> in the most extensive series published to date on ALL reconstruction and of the author of this article. Nevertheless, the iliotibial tract graft may be used in revision cases, especially in combination with ACL reconstruction using patellar tendon.

The indications for reconstructions presented are also consistent with the current literature.<sup>16</sup> Cases of reconstruction revision and patients with grosser instability based on the pivot-shift test were the most frequent indications found. Limited consensus was also achieved with respect to the fixation angle, with the majority choosing to fix at 30 and 45 degrees of flexion. Although biomechanical studies have shown that the fixation of a Lemaire tenodesis can be performed between 0 and 60 degrees without alterations in knee biomechanics, Inderhaug et al.<sup>27</sup> showed that ALL reconstructions should be fixed in extension.

Despite the lack of consensus among Brazilian surgeons on the vast majority of questions presented, this is also a worldwide trend in this field, with some lines of research advocating extra-articular reconstruction and others supporting only isolated intra-articular reconstruction. Knowing national trends is important to understand where we can focus our lines of research and how to guide our patients.

## CONCLUSION

Although the preferred technique of the highest number of Brazilian knee surgeons (40.9%) is still the transtibial procedure, so-called combined anatomical reconstructions already represent more

than 50% of cases. Combined intra- and extra-articular ACL reconstruction is still performed by the minority of Brazilian surgeons, but 91.4% of these report having had a positive perception with ALL reconstruction.

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**Appendix 1. Questionnaire Applied to Knee Surgeons.**

<b>Anterolateral Ligament -48<sup>th</sup> CBOT congress</b>	
<p>1 – Which is your area of activity?                      a) North                      b) Northeast                      c) Midwest                      d) Southeast                      e) South</p> <p>2 – How old are you?                      a) under 35                      b) 35 to 45                      c) 45 to 55                      d) 55 to 65                      e) over 65</p> <p>3 – How many ACL reconstructions do you perform per year?                      a) fewer than 10                      b) between 10 and 30                      c) between 30 and 50                      d) between 50 and 100                      e) more than 100</p> <p>4 – What is your preferred technique for the ACL?                      a) Open reconstruction                      b) Arthroscopic single-bundle transtibial reconstruction                      c) Arthroscopic single-bundle transportal reconstruction                      d) Arthroscopic single-bundle outside in reconstruction                      e) Arthroscopic double-bundle reconstruction</p> <p>5 – How often do you observe residual pivot-shift after reconstructions?                      a) less than 5%                      b) between 5 and 10%                      c) between 10 and 15%                      d) between 15 and 20%                      e) more than 20%</p> <p>6 – Do you perform extra-articular ACL reconstruction in combination with intra-articular reconstruction?                      a) No                      b) Rarely in selected cases                      c) I use it routinely, more often in revision cases                      d) I use it routinely, in primary and revision cases                      e) I always use it in all cases</p> <p>7 – Have you ever heard of the Anterolateral Ligament of the knee?                      a) No                      b) YES, I have know about it for several years                      c) YES, but only recently</p> <p>8 – What is your opinion of the Anterolateral Ligament of the knee?                      a) I don't think it exists                      b) I think it is a structure in the lateral region, but not a ligament                      c) I think it is a ligament, but with negligible function                      d) I think it is a ligament, with a minor role in controlling anterolateral knee instability                      e) I think it is a ligament, with an important role in controlling anterolateral knee instability,</p>	<p>9 – Have you performed any anterolateral ligament reconstructions?                      A) Yes                      b) No</p> <p>10 – With which graft did you or would you perform your reconstruction?                      a) Iliotibial tract                      b) Gracilis                      c) Only with tissue bank tendon                      d) Other (please specify _____)</p> <p>11 – With which material did you or would you perform the fixation of your reconstruction?                      a) I would perform fixation only with soft tissue or transosseous sutures                      b) anchors                      c) Interference screws                      d) Biotenodesis screws/anchors</p> <p>12 – Which would be your indications for Anterolateral Ligament reconstruction (mark all those you consider pertinent)                      a) reconstruction revision                      b) high-degree pivot-shift upon physical examination                      c) sports that involve knee rotation/pivoting movements                      d) Ligament hypermobility                      e) Age under 18 years                      f) Professional athletes                      g) Chronic ACL injuries                      h) Lateral femoral notch sign ("Hill-Sachs lesion of the knee")                      i) Segond fracture</p> <p>13 – At how many degrees of knee flexion would you perform the fixation of the anterolateral ligament graft?                      a) full extension                      b) 30 degrees of flexion                      c) 45 degrees of flexion                      d) 60 degrees of flexion                      e) 90 degrees of flexion</p> <p>14 – Would you tend to use a brace after combined ACL/anterolateral ligament reconstruction?                      a) Yes                      b) No</p> <p>15 – Which complications have you experienced in anterolateral ligament reconstruction (mark all those you consider pertinent)                      a) joint stiffness/difficulty gaining range of motion                      b) lateral pain                      c) degenerative abnormalities in the knee                      d) infection                      e) problems with synthesis material</p> <p>16 – Generally speaking, what was your personal perception about the patients on whom you performed this procedure?                      a) positive                      b) negative</p>