

# AMERICAN ACADEMY OF PEDIATRICS

Thomas J. Martin, MD, and the Committee on Sports Medicine and Fitness

## Technical Report: Knee Brace Use in the Young Athlete

**ABSTRACT.** This statement is a revision of a previous statement on prophylactic knee bracing and provides information for pediatricians regarding the use of various types of knee braces, indications for the use of knee braces, and the background knowledge necessary to prescribe the use of knee braces for children.

### BACKGROUND

Pediatricians are appropriately becoming more involved in the care of young athletes. The knee is one of the most commonly injured joints in athletes. The correct care of knee injuries is an important part of any sports medicine or general pediatrics practice and may include the use of braces. Therefore, the pediatrician should be knowledgeable about knee bracing. This statement is an update of a previous statement on prophylactic knee bracing<sup>1</sup> and includes information for pediatricians regarding the use of various types of knee braces, indications for the use of knee braces, and the background knowledge necessary to prescribe the use of knee braces for children.

Acute and overuse injuries to the knee are seen as a result of participation in virtually all athletic activities. Injuries to the ligamentous structures of the knee in the young athlete are becoming more common. The medial collateral and anterior cruciate ligaments are prime stabilizers of the knee and can be injured when direct or indirect forces are applied to the knee. In a growing child, the distal femoral physis is subject to these same forces and may also be injured. In the skeletally immature child, acute trauma to the knee is most likely to cause injury to these 2 ligaments and/or to the distal femoral physis. Patella subluxation, dislocation, or tracking abnormalities can occur as a result of mechanical predisposition as well as direct or indirect stress to the knee. Cumulative microtrauma or overuse can lead to patellofemoral disorders or apophysitis of the tibial tuberosity (Osgood-Schlatter disease), which are common in adolescents.

### TYPES OF KNEE BRACES

Various types of braces have been designed to provide symptomatic relief and diminish the effects of injury to the knee. The 4 categories of knee braces are knee sleeves, prophylactic knee braces, functional knee braces, and postoperative or rehabilitative knee

braces (Table 1).<sup>2,3</sup> Although patients often report benefits from wearing braces,<sup>4,5</sup> these benefits have not been verified by scientific investigation.<sup>2,4</sup>

The ideal knee brace in any of the 4 categories would produce a synergism with the inherent knee stabilizers, both muscular and ligamentous, throughout the normal range of motion. It would increase resistance to injury from valgus, varus, rotational, or anterior-posterior translation forces. The ideal brace would not interfere with normal knee function or increase the risk of injury to other parts of the lower extremity or to other players.

### Knee Sleeves

Knee sleeves are expandable, slip-on devices usually made of neoprene with a nylon cover. They increase warmth, provide even compression, and may enhance proprioception.<sup>6</sup> Knee sleeves may provide a feeling of support to the knee. Plain knee sleeves may be used to treat postoperative knee effusions<sup>6</sup> and patellofemoral syndrome.<sup>6</sup> Used in this capacity, the purpose of a knee sleeve is to decrease knee pain.<sup>7,8</sup> When a knee pad is added, it provides protective cushioning to the patella and anterior knee.

The knee sleeve may be modified to include an opening for the patella, 1 or more movable straps, or a buttress. The buttress may be circular, C-shaped, J-shaped, or H-shaped. With these modifications, the knee sleeve is often referred to as an extensor mechanism counterforce brace and is used to treat patellofemoral joint disorders, including patella subluxation, patella dislocation, and patellofemoral syndrome, all of which are very common in athletes.<sup>9</sup> The pathophysiology of patellofemoral syndrome is unclear,<sup>10</sup> but it has been postulated to occur as a result of abnormal tracking of the patella on the femoral trochlear groove.<sup>2,6</sup> The knee sleeve helps compress the tissue and limits patella movement.<sup>6</sup> The extensor mechanism braces are designed to apply a medially directed force to the lateral patella, thereby improving patellofemoral tracking and decreasing the likelihood of lateral patella subluxation or dislocation. Used in this capacity, they may be of benefit in the athlete with an unstable patella.<sup>11</sup> These braces may also contain a lateral hinge that incorporates an extension stop.<sup>2,5,7</sup>

When a strap is placed inferior to the patella, it may be used to treat Osgood-Schlatter disease and patellar tendonitis.<sup>6</sup> This infrapatellar band is used to decrease the traction forces at the tibia tuberosity for patients with Osgood-Schlatter disease and on the patellar tendon for patients with patellar tendonitis.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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Table 1. Knee Braces and Indications for Use in the Young Athlete\*

Brace Category	Indication	Comments
<b>Knee Sleeves†</b>		
 <p>Plain sleeve</p>	Postoperative knee effusions; patellofemoral syndrome	Insufficient for treatment of an unstable knee. Should only be worn during sports activities if swelling occurs. Simple to fit and inexpensive.
 <p>Sleeve with knee pad</p>	Protection and padding of the anterior knee	
 <p>Sleeve with buttress</p>	Patella subluxation, patella dislocation; patellofemoral syndrome	Improves patellofemoral tracking.
 <p>Sleeve with strap</p>	Osgood-Schlatter disease; patella tendonitis	Decreases traction forces on the tibia tuberosity and patella tendon.
<b>Knee Braces</b>		
 <p>Prophylactic brace</p>	Protect medial collateral ligament and anterior cruciate ligament, especially in contact sports	Insufficient evidence to use in the young athlete.
 <p>Functional brace†</p>	Tears of anterior cruciate, posterior cruciate, medial collateral, and lateral collateral ligaments	Intended to prevent reinjury. Not to be used prophylactically.
 <p>Postoperative or rehabilitative brace†</p>	Nonsurgical injury to and after surgical repair of anterior cruciate, posterior cruciate, medial collateral, lateral collateral ligaments, medial and lateral meniscus; or nondisplaced epiphyseal fracture	Can be adjusted for swelling, removed for examinations or icing, and adjusted to allow movement in a controlled range.

\*Knee brace images reprinted with permission from djOrthopedics, LLC.

†The use of knee sleeves and functional and postoperative or rehabilitative braces has been accepted clinically on the basis of subjective experience and has not been supported by scientific evidence.

It is important to remember that knee sleeves do not provide ligamentous support and, therefore, are insufficient for the treatment of an unstable knee.<sup>11</sup> Knee sleeves can cause swelling by retaining heat around the knee or by obstructing venous and lymphatic return below the sleeve. They should only be worn during sports activities if these complications occur.<sup>11</sup> The use of these sleeves should be combined with quadriceps and hamstring flexibility, stretching, and strengthening exercises as well as correction of biomechanical dysfunction of the hip, ankle, or foot and improved sports technique.<sup>6,7,9</sup> Scientific evidence of benefits of the knee sleeve is lacking<sup>3,10,12-14</sup>; however, patients report benefits that exceed objective effects noticed by researchers.<sup>2-4</sup> Knee sleeves are relatively simple to fit and inexpensive.<sup>6</sup>

### Prophylactic Knee Braces

Prophylactic knee braces<sup>15-17</sup> are braces with unilateral or bilateral bars, hinges, and adhesive straps. The deformable metal of these braces can absorb some of the impact and decrease the force applied to the medial collateral ligament by 10% to 30%.

Prophylactic knee braces are intended to protect (prevent or reduce the severity of injury to) the medial collateral ligament from valgus stress applied to the lateral aspects of the extended weight-bearing leg during contact sports. Some studies indicate they may also protect the anterior cruciate ligament from rotational stress in the same situation. In football, offensive linemen, defensive linemen, linebackers, and tight ends most commonly wear lateral knee stabilizers. Despite anecdotal reports of success, scientific studies have not universally shown that prophylactic knee braces significantly reduce knee injuries.<sup>15-18</sup> Thus, there is insufficient evidence to recommend prophylactic knee bracing in the young athlete.<sup>1-3,7,15-18</sup>

### Functional Braces

Functional braces are generally made from a metallic plastic composite with medial and lateral vertical hinges and a variable stop to limit hyperextension. There are 2 types of functional braces: the hinge-postshell and hinge-poststrap models. The rigid shell or straps and hinges provide resistance to deformation. Hinges may be polyaxial to mimic the changing center of motion of the flexing knee. The hinge-postshell model theoretically provides improved tibial displacement control, greater rigidity, enhanced durability, and better soft tissue contact.<sup>7</sup> The upright of a functional brace should be the maximum length comfortable to the athlete.<sup>7,19</sup>

A functional brace is designed to enhance the stability of an unstable knee (usually after an anterior cruciate ligament injury with or without other injuries to the menisci, collateral ligaments, or bone contusion) when rotational and anteroposterior forces are applied. They may be used for 6 to 12 months after anterior cruciate ligament reconstruction<sup>19</sup> to reduce the strain on an anterior cruciate ligament graft.<sup>7,20,21</sup> They are intended to reduce the risk of future injuries without significantly impairing function.

Functional braces are most commonly used by the skeletally immature athlete with an anterior cruciate-deficient knee (awaiting skeletal maturation), the anterior cruciate-deficient athlete who is awaiting surgical reconstruction, and the anterior cruciate-deficient athlete who is not a surgical candidate. This type of brace may also be used during the healing phase of a medial or lateral collateral ligament injury or as a supplement to surgery<sup>21</sup> and rehabilitation to prevent reinjury. Functional anterior cruciate ligament braces may prevent hyperextension; however, their control of rotational forces is less efficient,<sup>2,11,21</sup> so the unstable knee is still at risk of subluxation or shifting, which may lead to meniscal or chondral injury.

There is a lack of scientific evidence that these braces are helpful at the level required for athletic participation.<sup>2,7,19,22-25</sup> However, patients report a positive subjective response, claiming an increase in knee stability, pain attenuation, performance enhancement, and confidence during athletics with brace use.<sup>2,7,22-24</sup> There is probably no difference in effectiveness between off-the-shelf models and custom-made braces.<sup>9,18,23,26</sup> Brace wearers have higher energy expenditures than do nonwearers.<sup>22</sup> Current experimental evidence suggests that functional knee braces do not significantly affect performance.<sup>27</sup>

Lower extremity muscle strengthening, flexibility, and ultimately, improvement and refinement of athletic techniques are more important than functional bracing in treating ligamentous knee injuries.<sup>7,20</sup> Functional braces will never substitute for proper rehabilitation and surgical procedures when necessary.<sup>9</sup>

### Postoperative or Rehabilitative Braces

The postoperative or rehabilitative knee brace consists of foam liners that surround the calf, thigh, and knee; full-length medial and lateral rigid bars with hinges at the knee that can be adjusted to allow a controlled range of motion; and 6 to 8 nonelastic straps that hold the brace in place. These braces are prefabricated (off-the-shelf) and adjustable in size.

The postoperative or rehabilitative brace can be used to protect injured ligaments and control knee flexion and extension angles during the initial healing period<sup>2</sup> as part of the treatment program for an injured anterior cruciate ligament, posterior cruciate ligament, medial collateral ligament, lateral collateral ligament, or medial or lateral meniscus. These are most often used during crutch-assisted ambulation immediately after meniscal and/or cruciate ligament injury or surgery. They are used for a short period of time (2-8 weeks) after the acute injury or surgery. The value of a rehabilitative brace as opposed to a cast or splint includes the ability to adjust the brace for swelling, the ability to remove the brace for serial examinations or icing, and the ability to allow for movement in a controlled range of motion.

Pediatricians may order a postoperative brace for the treatment of nonsurgical ligamentous injuries or nondisplaced epiphyseal fractures. There are very little data on the clinical performance of rehabilita-

tive braces.<sup>2,20,28-30</sup> They are accepted clinically on the basis of their subjective performance.

### PRESCRIBING KNEE BRACES

Prescribing any knee brace requires an accurate diagnosis of the injury, an appreciation and knowledge of the benefits and limitations of a brace, and an understanding of the physical demands and risks of the given sport. Knee sleeves with or without straps and buttresses can be prescribed for problems with patellar instability, patellofemoral pain, patellar tendonitis, or Osgood-Schlatter disease. Because prophylactic knee braces have not been proven to be cost-effective, pediatricians should not prescribe them. Functional braces may help prevent further injuries to a previously injured knee and may help protect a surgically repaired knee. Functional braces are not recommended for prophylaxis. Postoperative or rehabilitative braces are generally used for acute knee ligament or growth plate injuries or after surgical repair of an anterior cruciate ligament or meniscus.

Even when use of a knee brace is indicated, the brace alone is not sufficient to treat or protect the injured knee. The brace is only 1 component of injury rehabilitation, along with therapeutic exercises, such as flexibility, joint mobilization, strengthening, and proprioceptive retraining.

Brace designs will continue to evolve with lighter and stronger materials, more physiologic and durable hinges, and attachment systems that do not excessively compress the musculature or irritate the skin. Better ability to test the effectiveness of these braces will be rewarding.

### SUMMARY

When prescribing the use of knee braces, pediatricians should establish an accurate diagnosis of the injury, consider the spectrum of treatment options, and understand the classifications, benefits, limitations, indications, and cost of any brace prescribed.

There is insufficient scientific evidence to recommend the use of prophylactic knee braces for the pediatric athlete, and available studies do not support the prescribing of most knee braces. However, the use of knee sleeves, functional braces, and postoperative braces has been accepted clinically on the basis of subjective performance. If used, knee braces should complement, rather than replace, rehabilitative therapy and required surgery.

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## ERRATUM

In "Counseling Families Who Choose Complementary and Alternative Medicine for Their Child With Chronic Illness or Disability" by the AAP Committee on Children With Disabilities, Virginia Randall, MD, was omitted from the list of consultants due to an oversight. The statement was published in the March 2001 issue of *Pediatrics*. (*Pediatrics.* 2001;107(3):598-601.)

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