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# Incidence, Positional Distribution, Severity, and Time Missed in Medial Collateral Ligament Injuries of the Knee in NCAA Division I Football Athletes

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## Abstract

**Introduction:** We studied injury to the medial collateral ligament (MCL) in National Collegiate Athletic Association (NCAA) Division I football players, their incidence, magnitude of injury, distribution by position, and missed time, which has not previously been described in a consecutive series.

**Methods:** The knee injuries sustained in 163 consecutive NCAA Division I collegiate football players at our institution were evaluated over a span of 6 years.

**Results:** The incidence of MCL injuries with any knee injury was 29% (47 of 163). Of 47 MCL injuries, 34% occurred in defensive linemen and 29% in offensive linemen. The average days missed by linemen were 14.65 compared with 4.5 by nonlinemen ( $P = 0.07$ ). The MCL injuries in linemen were more severe than nonlinemen (0.018).

**Discussion:** MCL injuries occur most commonly in linemen in whom the magnitude of injury is also more significant than nonlinemen. Linemen miss more days than do nonlinemen to MCL injury.

**Study Design:** Descriptive Epidemiology Study.

Ligamentous injury of the knee is common in contact sports, including collegiate football. The most frequently injured ligament about the knee is the medial collateral ligament (MCL), accounting for up to 43% to 52% of knee injuries.<sup>1-3</sup> Excessive lateral valgus stress applied to the knee joint can overwhelm the tensile strength of knee ligaments and their attachments and result in isolated damage to the MCL, sometimes in association with injury to the anterior cruciate ligament (ACL).<sup>4</sup> Although isolated MCL injuries typically do

not cause permanent disability, they can cause significant morbidity in the form of pain and instability and may result in significant lost practice and playing time for athletes.

Previous literature on MCL injury has primarily focused on the effectiveness of prophylactic knee bracing in injury prevention and management strategies.<sup>5</sup> Successful nonoperative management of MCL injuries in athletes has been documented in the literature for some time. High-success rates have been demonstrated with conservative management of grade I

and II injuries involving early mobilization, quadriceps muscle rehabilitation, and, often, supportive bracing.<sup>6-9</sup> Evidence also demonstrates that isolated grade III and complete disruption injuries can be successfully managed with the modalities described above, with return to full contact play ranging from 5 to 9 weeks.<sup>10-14</sup> The goal-oriented rehabilitation program, along with use of a lateral knee hinged brace, has facilitated an early and progressive reentry into sport among athletes.<sup>15,16</sup> The use of MRI increases precision in locating the MCL injury and associated injuries, which can be used to rule out the need for operative management. Surgery is recommended when injury is over the whole length of the superficial layer of the MCL or when there is injury to both the superficial and deep layers of the MCL.<sup>17-19</sup>

This investigation aims to provide an objective analysis of the patterns and positional distribution of MCL injury occurring in a Division I collegiate football program and to determine the impact of those injuries in terms of missed practices and games.

## Methods

Institutional review board approval was obtained through the Office for the Protection of Research Subjects at our institution. With this clearance, we retrospectively reviewed all knee injuries occurring in players of a Division I college football team from August 2001 to May 2007. Power analysis was performed with an alpha value of 0.05, and 80% power resulted in a sample size of 138 patients. This sample size was obtained from the time span studied. The study was

conducted to examine the percentage and patterns of knee injuries involving the superficial MCL. For this study, a knee injury was considered an MCL injury when the athlete was evaluated and diagnosed by the team physician through history, physical examination, and knee radiographs. Also, in order to be considered a significant knee injury, the player must have missed at least one practice session after this injury. When players were determined to have sustained the injury, information including mechanism of injury, football position played, range of motion, laxity, grade of injury, and radiographically documented associated ligamentous or meniscal injury was recorded. A grade I MCL injury is defined as stretching with tearing of a minimal amount of MCL fibers, with tenderness over the MCL and no gapping with valgus stress. Grade II injury is a partial tear of the MCL and joint laxity with valgus stress. Grade III injury is a complete rupture of the MCL with significant instability and medial gapping with valgus stress.<sup>10</sup>

An assessment of recovery was made by reviewing the serial physical examinations performed by a staff orthopaedic surgeon. The missed days, time required for return to practice, and time required to return to play were also documented as an assessment of recovery. Return to play was noted as the number of days from injury to first full practice. Follow-up for patients was continued for at least 1 year after the original injury.

With the collected data, a chi-square statistical evaluation was performed to assess the significance with respect to severity of MCL injury in linemen compared with nonlinemen. Also, an analysis of variance test was per-

formed to assess whether grade of injury correlated with time missed in the form of training days, practice days, or game days. Our criterion for statistical significance was  $P < 0.05$ .

## Results

There were a total of 163 knee injuries during the inclusion period of this study. Of these injuries, 47 (28.8%) were MCL injuries, 11 (6.8%) were ACL injuries, and 3 (1.8%) were injuries to the posterior cruciate ligament. Of the 47 injuries affecting the MCL, 46 (98%) were grade I or II injuries. Twenty-six (55%) of the injuries occurred on the right side and 21 (45%) occurred on the left knee. The majority, 39 (83%), of the injuries were contact injuries occurring with valgus impact to the affected knee. The remaining 8 (17%) athletes sustained reagravation of a previous MCL injury. In addition to isolated injuries of the MCL, there was one combined ACL with grade II MCL injury and one PCL with grade II MCL injury. Those with combined injuries were included because associated MCL injuries are relevant in regard to time missed. One player had a prior history of recurrent laxity and injury requiring advancement of the posterior oblique ligament. The rate of injury varied by the position played. The defensive linemen had the highest risk of injury, with 16/47 (34% of total knee injuries) compared with a 12/47 (26%) rate of injury in offensive linemen. Running backs and linebackers had less likelihood of MCL injury with 7 and 5 MCL injuries, respectively. The average number of days missed for linemen (14.65) was greater than the average

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Table 1

Average Number of Days, Practices, and Games Missed			
No. of Missed	Grade I Injury	Grade II Injury	P
Days	10.06	35.07	<0.05
Practices	3.77	4.79	0.53
Games	0.29	0.79	0.16

number of days missed for nonlinemen (4.5) and approached statistical significance ( $P = 0.07$ ). In addition, the injuries occurring in linemen were more severe than those in nonlinemen ( $P = 0.018$ , by the chi-square test) (Table 1).

Comparison of grade I injuries and grade II injuries is shown in Table 2. The average number of days missed for grade I injuries was 10 days and increased to 35 days for grade II injuries. Practices missed were more variable because some injuries occurred in different points of the season where practices were not consistent.

Surgical treatment for MCL or other ligamentous injuries and the use of supportive bracing were also recorded. Patients were managed with non-operative treatment in nearly all cases. The treatment of all patients included initial rest, cryotherapy, and pain management. Subsequently, strengthening exercises, graded physical therapy, and drills were used.

## Discussion

Most of the recent studies regarding MCL injuries address prophylactic bracing to prevent MCL injuries in collegiate athletes. Our study seeks to discuss the distribution of MCL injuries in collegiate football players and statistics regarding their return to play. In our retrospective review of all collegiate football-related knee injuries at a major Division I Pacific-10 Conference institution, we found 163 knee injuries within a nearly 6-year span. Of

these injuries, those to the MCL were most common, at 28.8%. All but one of these injuries was either grade I or II. We also found that the player position most commonly shown to have an MCL injury was the defensive lineman, comprising 34% of the injured group. We have also found that the ratio of grade II injuries to grade I injuries of the MCL is significantly higher in linemen compared with players in other positions.

There is a significant increase in missed days of practice in all athletes who sustain higher-grade MCL injuries. Grade I injuries resulted in an average of 10 days of missed training time, whereas grade II injuries resulted in an average of 35 days of missed practice time. Also noteworthy in our study is that, among our population, there was no significant difference in the number of formal practices and games missed between players who had grade I injuries versus players with grade II injuries. All patients with grade I and II injuries in our study were able to return to play, reinforcing the fact that, aside from several missed days of training, fewer missed practices, and possibly a missed game, MCL injuries are relatively benign injuries that can be successfully addressed nonoperatively.

The strength of this study is that it is a series of homogenous data collected consecutively over a significant time span and evaluated by the same team physicians. This consecutive series allows a more accurate representation of the incidence and distribution of MCL injuries among all knee injuries

Table 2

Number of Injuries by Position ( $P = 0.44$ [Chi Square])		
Grade of Injury	I	II
Linemen	17	10
Nonlinemen	14	5

in collegiate football players. Jones et al<sup>13</sup> described management of grade III injuries in high school football athletes, who demonstrated an average return to play of 29 days. Swenson et al<sup>20</sup> described high school athletes of all sports and showed that knee injuries were most common in football athletes (36.1%). MCL injury studied in regard to professional soccer showed an average lay-off of 23 days.<sup>21</sup> Our study illustrates the epidemiology of collegiate Division I football athletes because the distribution of their injuries likely differs from other levels of play and different sports.<sup>20</sup> However, it is limited in that the data were gathered retrospectively. Furthermore, a larger sample size may have yielded statistical significance to the number of practices and games missed after grade I and grade II injuries.

## References

- Albright JP, Powell JW, Smith W, et al: Medial collateral ligament knee sprains in college football effectiveness of preventive braces. *Am J Sports Med* 1994;22:12-18.
- Sitler M, Ryan J, Hopkinson W, et al: The efficacy of a prophylactic knee brace to reduce knee injuries in football: A prospective, randomized study at West Point. *Am J Sports Med* 1990;18(3):310-315.
- Sitler M, Ryan CJ, Hopkinson LW, et al: The efficacy of a prophylactic knee brace to reduce knee injuries in football: A prospective, randomized study at West Point. *Am J Sports Med* 1990;18:310-315.
- Schub D, Saluan P: Anterior cruciate ligament injuries in the young athlete: Evaluation and treatment. *Sports Med Arthrosc* 2011;19:34-43.
- Miyamoto RG, Bosco JA, Sherman OH: Treatment of medial collateral ligament

- injuries. *J Am Acad Orthop Surg* 2009;17: 152-161.
6. Derscheid GL, Garrick JG: Medial collateral ligament injuries in football: Nonoperative management of grade I and grade II sprains. *Am J Sports Med* 1981;9: 365-368.
  7. Ellsasser JC, Reynolds FC, Omohundro JR: The non-operative treatment of collateral ligament injuries of the knee in professional football players: An analysis of seventy-four injuries treated non-operatively and twenty-four injuries treated surgically. *J Bone Jt Surg Am* 1974;56:1185-1190.
  8. Duffy PS, Miyamoto RG: Management of medial collateral ligament injuries in the knee: An update and review. *Phys Sportsmed* 2010;38:48-54.
  9. Lundberg M, Messner K: Long-term prognosis of isolated partial medial collateral ligament ruptures: A ten-year clinical and radiographic evaluation of a prospectively observed group of patients. *Am J Sports Med* 1996;24: 160-163.
  10. Ballmer PM, Jakob RP: Instability of the medial collateral ligament: Operative or Nonoperative treatment? *Knee Cruciate Ligaments* 1992;1:321-324.
  11. Ballmer PM, Jakob RP: The non operative treatment of isolated complete tears of the medial collateral ligament of the knee. *Arch Orthop Trauma Surg* 1988;107: 273-276.
  12. Indelicato PA, Hermansdorfer J, Huegel M: Nonoperative management of complete tears of the medial collateral ligament of the knee in intercollegiate football players. *Clin Orthop Relat Res* 1990;256:174-177.
  13. Jones RE, Henley MB, Francis P: Nonoperative management of isolated grade III collateral ligament injury in high school football players. *Clin Orthop Relat Res* 1986;213:137-140.
  14. Meyers MC, Barnhill BS: Incidence, causes, and severity of high school football injuries on FieldTurf versus natural grass a 5-year prospective study. *Am J Sports Med* 2004; 32:1626-1638.
  15. Reider B, Sathy MR, Talkington J, Blyznak N, Kollias S: Treatment of isolated medial collateral ligament injuries in athletes with early functional rehabilitation: A five-year follow-up study. *Am J Sports Med* 1994;22: 470-477.
  16. Reider B: Medial collateral ligament injuries in athletes. *Sport Med* 1996;21: 147-156.
  17. Phisitkul P, James SL, Wolf BR, Amendola A: MCL injuries of the knee: Current concepts review. *Iowa Orthop J* 2006;26:77.
  18. Nakamura N, Horibe S, Toritsuka Y, Mitsuoka T, Yoshikawa H, Shino K: Acute grade III medial collateral ligament injury of the knee associated with anterior cruciate ligament tear: The usefulness of magnetic resonance imaging in determining a treatment regimen. *Am J Sports Med* 2003;31: 261-267.
  19. Wilson TC, Satterfield WH, Johnson DL: Medial collateral ligament "tibial" injuries: Indication for acute repair. *Orthopedics* 2004;27:389-393.
  20. Swenson DM, Collins CL, Best TM, Flanigan DC, Fields SK, Comstock RD: Epidemiology of knee injuries among US high school athletes, 2005/06-2010/ 11. *Med Sci Sports Exerc* 2013;45: 462-469.
  21. Lundblad M, Waldén M, Magnusson H, Karlsson J, Ekstrand J: The UEFA injury study: 11-year data concerning 346 MCL injuries and time to return to play. *Br J Sports Med* 2013;47: 759-762.