Knee Injuries and Alpine Skiing
Treatment and Rehabilitation

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Summary
Alpine skiing is an increasingly popular recreational sport worldwide. While the overall injury rate has declined and the pattern of injury changed over the years, the incidence of knee injuries has not changed substantially and accounts for 20 to 30% of all alpine skiing injuries.

Medial collateral ligament (MCL) injuries are the most common in skiing, accounting for 15 to 20% of all skiing injuries and 60% of knee injuries in skiers. Tears are commonly isolated, but may occur in association with other ligamentous injuries. Associated meniscal pathology is rare. Isolated MCL injuries are treated nonoperatively with a programme of initial immobilisation, early range-of-motion, and isometric quadriceps strengthening exercises. When full range of motion is achieved, a programme of progressive resistance exercises, isokinetic and closed chain exercises, and functional rehabilitation is instituted. Good results with return to skiing can be expected in most cases.

Isolated lateral collateral ligament (LCL) injuries are rare in skiers. There is usually associated cruciate or arcuate ligament complex. Careful physical examination is essential to rule out associated ligament injuries and more complex instability patterns. In the rare case of isolated LCL injury, a similar approach to isolated MCL injury should be instituted.

Anterior cruciate ligament (ACL) injuries have become increasingly common in skiers. This may reflect a true increase in the incidence or an improved awareness and ability to diagnose ACL injury. Physical examination and arthrometric analysis are important in assessing the integrity of the ACL. Radiographic and magnetic resonance imaging (MRI) evaluation may be helpful in assessing associated meniscal pathology. Treatment of the ACL-deficient knee is usually surgical. However, prior to reconstruction, a programme aimed at reducing effusion and regaining a full, pain-free range of motion is recommended. Surgical reconstruction is usually with the central third of the patella tendon using a bone-tendon-bone autograft. Postoperative rehabilitation employs a functional staged approach, requiring vigilant supervision by the surgeon.
Isolated posterior cruciate ligament (PCL) injury is rare in skiing, constituting less than 1% of all knee injuries in most series. Careful physical examination must be employed to rule out associated arcuate ligament complex injury and more complex patterns of instability. Most isolated PCL injuries are treated nonoperatively with a programme of initial immobilisation in extension, ice, protected weight-bearing, early range-of-motion exercises and progressive isometric strengthening. When pain-free motion is obtained, a functional programme of progressive strengthening and return to activity is recommended. Surgical reconstruction is undertaken only in the rare case of a high performance athlete with severe posterior laxity or in cases of posterolateral instability.

Isolated meniscal injuries are uncommon in skiers, accounting for less than 10% of all knee injuries. Meniscal tears are more commonly associated with ACL tears. Physical examination is helpful in suspected meniscal pathology. MRI is extremely helpful in evaluating meniscal pathology with an overall accuracy of up to 98%. Treatment is based on symptoms and the pattern of the meniscal tear. Small, stable tears are treated with arthroscopic rasping of the edges to promote a healing response. Large peripheral tears are treated with meniscal repair in most cases, although subtotal meniscectomy may be indicated in older patients. Complex and/or central tears are treated with partial meniscectomy. Postoperative rehabilitation focuses on regaining range of motion and strength. Following meniscal repair, the patient is allowed to weight bear as tolerated with the knee in full extension for 6 weeks. Passive range-of-motion exercise is initiated early. Progressive strengthening and a functional return to activity is begun at 6 weeks postoperation.

Alpine skiing is an increasingly popular recreational sport worldwide. It is estimated that there are between 5 and 14 million alpine skiers in North America alone and millions more in Europe, Japan, Australia and New Zealand (Ellison 1977, 1973; O'Malley 1978; Trevino & Alvarez 1982). Alpine skiing is a sport in which injuries commonly occur. Estimates of the number of injuries that occur annually in the US alone range from 15 000 to 600 000 (Davis et al. 1977; Ellison 1977; Gutman et al. 1974; Trevino & Alvarez 1982). Prior to 1970 the injury rates in the US were estimated at 4 to 8 injuries per 1000 skier days (Ellison 1977; Gutman et al. 1974; Johnson et al. 1974; O'Malley 1978; Tappert 1978). Prior to 1970 the injury rates in the US were estimated at 4 to 8 injuries per 1000 skier days (Ellison 1977; Gutman et al. 1974; Johnson et al. 1974; O'Malley 1978; Tappert 1978). Garrick and Kurland (1971) suggested that the true rate might be higher due to unreported accidents.

More recently, many investigators worldwide have reported a decline overall injury rate (Blankstein et al. 1985; Gutman et al. 1974; Haddon et al. 1962; Howe & Johnson 1982; Johnson & Pope 1991; Johnson et al. 1980; O'Malley 1978; Sherry & Fenlon 1991; Tappert 1978; Young et al. 1976). Tapper (1978) reported a decline from 7.4 injuries per 1000 skier days in 1960 to 1961, to 2.6 per 1000 skier days in 1975 to 1976. Young et al. (1976) reported a decline of the overall injury rate from 4.2 to 2.8 per 1000 skier days in 1966 through to 1973. Gutman et al. (1974) reported a drop from 5.9 to 3.4 per 1000 skier days from 1960-61 and 1972-73, respectively. The reasons for the decline in the overall injury rate have been attributed to improvements in skier equipment, ski instruction, snow-making and slope grooming, and area safety management. Although intuitively these factors seem likely, no hard data have been presented to confirm these factors.

In addition to a decline in the overall injury rate, there has been a dramatic shift in the patterns of injury. In most series, lower extremity injuries still account for the majority of injuries. However, some studies (Gutman et al. 1974; Johnson et al. 1974; Tapper 1978) have reported a trend toward a similar incidence of upper and lower extremity injuries. Specifically, the incidence of ankle injuries and lower extremity fractures has declined dramatically. Moritz (1959) reported that, in 1942, 49%