

The Use of Prophylactic Knee Orthoses at Iowa State University

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INTRODUCTION

Major knee injuries are a common concern to all people involved with the sport of football. At the college and interscholastic level, minimizing the numbers of knee injuries would allow the game to be played at its optimal level of skill and safety. This would save everyone involved with the sport much time, effort, and money. A successful program incorporating prophylactic knee orthoses could allow such injuries to occur less frequently.

PURPOSE

During the 1982 fall football season, Iowa State University initiated a protective knee orthosis program. This program was initiated with the cooperation of the coaches, orthopaedic surgeons, and trainers, together with the developers of the Iowa knee orthosis, which was previously used for athletes with collateral ligament instability. The target population consisted of offensive and defensive linemen, linebackers, and tight ends, because of their high incidence of knee injury (See Table 1). Some of the athletes had a documented history of knee instability. The purpose of the program was to see what effect prophylactic knee orthoses had on the prevention of serious knee injuries in a major

college football program, and to evaluate the problems associated with the implementation of such a device.

METHOD

Several commercially available knee orthoses had been used previously with players suffering from knee injuries, but none had been used in a prophylactic sense. That is, orthoses used previously were for athletes who already had knee injuries, in the hope of preventing further injury. This evaluation was also aimed at the normal knees which had no history of injury.

The device chosen for evaluation was an all plastic knee orthosis with polycentric hinges bilaterally and proximal, and distal cuffs made of a combination of polypropylene and polyethylene, prefabricated to models in four sizes (See Figure 1). Spray adhesive and tape were used to suspend the orthosis. The advantages of this prophylactic device were:

1. Bilateral support—medial and lateral uprights;
2. Polycentric joint construction providing a changing center of rotation;
3. Maximum length for maximum support (length of lever over thigh and leg);

**Major Knee Injuries (Grades 2 and 3)*
by Football Position
1979-1983**

	Quarter- Back	Running Back	Offensive Lineman	Defensive Lineman	Defensive Back	Line- Backer	Tight End	Wide Receiver	Total
1979 Spring			1	1				1	3
1979 Fall		1	1	1	1			1	5
1980 Spring						1			1
1980 Fall			1	5	1	1	1		9
1981 Spring			1	1	1	1			4
1981 Fall		3	4	1	2	1		2	13
1982 Spring			3	4	1		1		9
1982 Fall			2	3	3	1			9
1983 Spring						1			1
1983 Fall									

*Grade 2: Requires splinting or other immobilization.

Grade 3: Requires surgery.

Table 1.

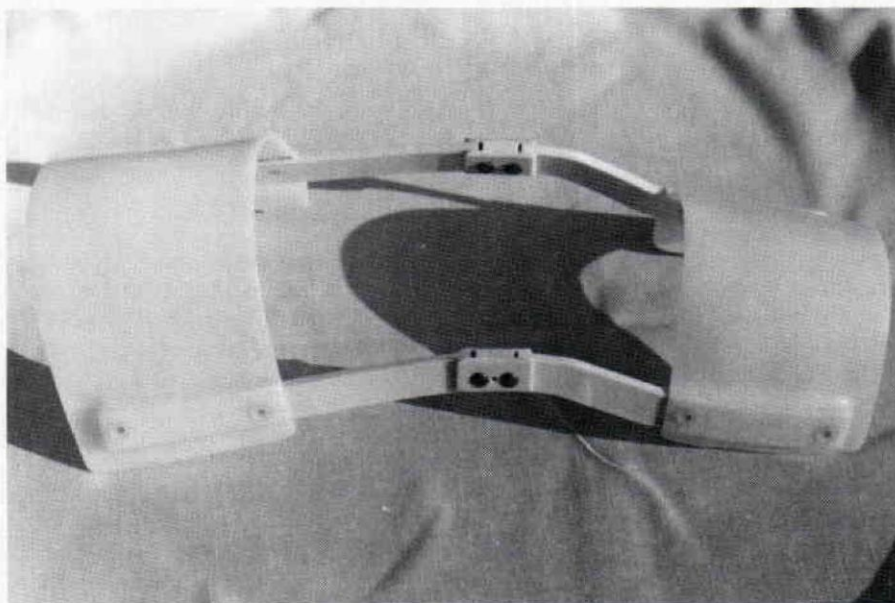


Figure 1: The prophylactic knee orthosis.

4. Semi-flexible (copolymer) cuffs on thigh and calf to give snug fit and comfort;
5. Lightweight joints (7 oz. per pair; overall 13.1 oz.);
6. Adjustable hinges to control range of motion (hyperextension to partial flexion).

The original device was fabricated in a manner consistent with that of the Iowa knee orthosis. After pouring a positive model, the orthosis was fabricated using the nylon polycentric joint. The proximal and distal cuffs were made of a fiberglass tape wrap. The orthoses were originally secured by using an elastic wrap around the thigh and calf cuff with no adhesive. Problems associated with this method and design were:

1. Irritation of skin by fiberglass;
2. Suspension;
3. The cuffs were undersized and added to the irritation of the skin, since the athletes were in a leaning position when casted, allowing musculature to sag.

Following the evaluation of the initial program, orthosis and materials, changes were made in response to problems. These changes included:

1. During casting the athlete stood upright with legs slightly flexed to get true muscle conformation of the thigh and calf;
2. All cuffs were cut to a minimum size and the material was changed from fiberglass wrap to copolymer;
3. Medical adhesive was utilized on the underside of the cuff for a tacky effect;
4. A tape anchor (tape rolled with adhesive mass out) was applied directly to the leg;
5. A closed spiral wrap was applied directly to the leg for suspension;
6. Three or four inch elastic tape was applied over the cuffs in a manner that would overlap the cuff and the underlying wrap to finally hold the orthosis in place.

RESULTS

Thirty-one athletes, taken from the first two teams, wore 62 orthoses. The 31 players, divided by position, included two quarterbacks, one linebacker, 11 offensive linemen, seven defensive linemen, two defensive backs, and two tight ends. Ten of 31, or 33 percent, had histories of previous knee injuries. During the spring of 1983, our records indicated only one significant knee injury occurred during 20 days of spring football. This may be compared to the nine injuries suffered the spring of the year before.

When considering any knee orthosis for use during game conditions, players and coaches question its effects on speed and agility. To help answer this question, some athletes were tested in a timed agility test around three cones with and without the orthosis. The results are listed in Table 2. Of those athletes tested, times revealed no change to .2 second slower with the orthoses on. The athletes who had previously injured knees had faster times with the brace on. This finding may indicate more confidence when cutting with the brace on than without. No data can be gathered from the fall 1982 trial, since the coaches were pessimistic toward the project, and less than six athletes finished the season wearing the devices. Only one of these six sustained a serious injury in the fall of 1982, during game conditions when he chose not to wear his orthosis.

DISCUSSION

The current coaching staff is very positive concerning protective devices for knees. In spring practice of 1983, only one major knee injury occurred. Several athletes who wore the brace had previously injured their knees. Their attitudes were positive toward the orthosis, and there were no new knee injuries in this group.

The double upright, plastic, prophylactic knee orthosis appears to be well tolerated by football players. With education of the athlete being a major concern, a positive attitude on the part of the coaching

**Comparison of Speed and Agility
With and Without Brace
by Football Position**

Position	Number Tested	Time in seconds		
		With	Change	Without
Quarterback	1	8.6	No change	8.6
Defensive Lineman	2	8.8	No change	8.8
Offensive Lineman	6	9.3	.1 Slower	9.2
Linebacker	2	8.7	.2 Slower	8.5
Defensive Back	2	8.8	No change	8.8

Table 2.

staff is very important. The greatest deterrent to the success of this program was the coaches' attitudes towards the orthosis, and peer pressure from the nonwearers. These negative comments directed toward other athletes wearing the prototypes in fall, 1982, resulted in a minimal number of consistent wearers. Coaches' attitudes toward the brace must be positive if the program is to be successful.

The lateral hinge appears to be the most stressed during useage. It might be that the medial ligaments are spared if the force comes from an oblique angle to the knee. Closer study of the field position of the athlete may clear up this interesting finding.

It is interesting to note that, as of this date, the players believe that this device is worth using, and is not detrimental to their abilities. Also of interest is that they tolerate the small amount of mechanical breakage and the occasional need to change joints and uprights or to alter the limits of the orthotic hinge by using stops.

Weight and bulkiness of the device has not been a problem. A pair of the nylon

joints without the plastic cuffs weighs only seven ounces. The device with the copolymer cuffs and the nylon joints weighs 13 ounces.

CONCLUSION

Based on a retrospective analysis of 31 football players at Iowa State University wearing 62 plastic, prophylactic knee orthoses, it appears that the wearing of such a device is tolerated by both coaches, trainers, and players. Additionally, the evidence of only one knee injury in this group during 20 days of spring practice demands that more study be given to this concept in order to determine statistically how valid the relationship is between injury and use of the orthosis.

AUTHORS

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