

Sliding Injuries in College and Professional Baseball—A Prospective Study Comparing Standard and Break-Away Bases

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Abstract: Over 40 million individuals nationally participate in organized softball and baseball leagues playing an estimated 23 million games a year in the United States. It has also been estimated that softball and baseball injuries are two of the leading sports-related causes of Emergency Room visits in the United States. Previous studies have elucidated that sliding is responsible for over 70% of all recreational softball injuries. In addition, break-away bases which have been utilized in recreational softball leagues have resulted in 98% reduction in injuries and a 99% reduction in acute health care costs. An independent analysis has determined that the utilization of break-away bases has the potential of preventing 1.7 million injuries a year in the United States with a savings of \$2 billion a year nationally in health care costs. To date, utilization of break-away bases has not been explored within the highest echelon of competitive baseball. In this study, 19 teams within the National Collegiate Athletic Association (NCAA) and professional minor league baseball utilized break-away bases for two consecutive seasons. Four hundred ninety-eight games were played on stationary bases and ten sliding-related injuries were documented. Of the ten injuries, three injuries were sustained to the knee and seven injuries to the ankle. The same teams played 486 games on break-away bases with two sliding-related injuries. Therefore, one injury was documented every 243 games on break-away bases, which translates into 0.41 injuries every 100 games on break-away bases. In regard to the stationary base injuries, one injury occurred every 49.8 games which translates into 2.01 injuries every 100 games. Therefore, an 80% reduction ($p < 0.05$) was noted in the high-performance baseball population utilizing break-away bases. The use of break-away bases decreases the number and severity of baseball- and softball-related injuries, both at the recreational level and the high-performance level. Break-away bases are cost effective and safer than standard stationary bases. In the recreational and high-performance baseball populations, the use of break-away bases should be mandatory. **Key Words:** Baseball—Bases—Sliding injury rate. *Clin J Sport Med* 1993;3:78-81.

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It has been estimated by the National Electronic Injury Surveillance System of the United States Consumer Product Safety Commission that softball and baseball are two of the main sports leading to emergency room visits in the United States. Between 1983 and 1989, the Consumer Product Safety Commission documented 2,655,404 injuries sus-

tained by individuals playing either softball or baseball (6). Although this figure is an underestimate, because it does not include nonhospitalization physician visits, it does indicate the magnitude of the current problem. As the fitness consciousness level of recreational athletes across the United States has been raised, a large number of individuals continue to flock into softball and baseball, the most popular team sports in the United States. In fact, it has been estimated by the American Softball Association that 40 million individuals nationally participate in organized softball leagues playing an estimated 23 million games per year. It has also been estimated that several million children and young adults are involved in little league baseball, pony league baseball, Babe Ruth baseball, and high school baseball. In addition to the participation of individuals at a recreational level, a higher echelon of baseball has been developed. This higher echelon consists of individuals playing at the college and professional levels, which include minor and major league baseball. The National Collegiate Athletic Association (NCAA) has 712 teams involved in intercollegiate baseball. In addition, in the professional ranks there are 26 major and 168 minor league teams participating in the highest-skill level of baseball.

The cost of a sports-related injury, either recreational, semiprofessional, or professional can be categorized into short- and long-term expenditures. The short-term expenditures include acute medical care costs, time lost from work, and expenses related to the injured player's employer concerning replacement or lost production. Long-term expenditures include medical care costs, restriction of future athletic activities, permanent functional impairment, and escalating insurance premiums for the injured player, his employer, and the field owner and the softball or baseball league itself (5). These injuries, and their associated costs can be staggering; therefore, prevention is of utmost importance. The health-care cost containment aspect of various preventative techniques has been found to be significant.

In a previous retrospective study conducted by Janda et al. (2) analyzing sliding-related injuries in the recreational softball population, 71% of all softball-related injuries sustained were consequent to sliding. Wheeler et al. (7) determined the leading cause of missed days in team sports within the military to be softball injuries—a large percentage of which were related to sliding. In a previous biomechanical study of sliding by Corzatt et al. (1), sliding was analyzed kinematically. Four phases were identified; the sprint, attainment of the sliding position, the airborne phase, and the landing phase. The authors indicated that injuries occurred in the last phase, the landing phase, where a small area of the body was not only used to absorb the shock of impact, but also was subjected to high horizontal velocities as the bases were contacted. In various

organizations' rule books, it has been stated that stationary bases may be up to 5" in height and they must be secured to the ground. The standard stationary base, which is used throughout the United States, is bolted to a metal post that is sunk into concrete in the ground. It takes 3,500 foot-pounds of force to separate the white portion of the exposed base from its moorings. It should be noted that the common denominators of sliding-related injuries are poor musculoskeletal conditioning, poor technique, occasional alcohol consumption, and, above all, a late decision to slide (2). A follow-up investigation by Janda et al. (6), investigated preventative techniques in regard to the sliding injury scenario. Instructional courses were offered, but failed because of lack of attendance by the league participants. Instituting a no sliding rule failed because of participants' concerns that it would alter the game to a drastic degree. Utilizing recessed bases failed because umpires had difficulty making safe versus out calls. Finally, break-away bases were instituted. In this investigation, a 96% reduction in injuries was realized when break-away bases were utilized. The difference was statistically significant ($p < 0.001$). In addition, a 99% reduction in health care costs was determined (3). The Centers for Disease Control then performed an actuarial analysis on the data from the study performed at the University of Michigan and combined it with data from the Consumers Product Safety Commission and concluded that across the United States with the implementation of break-away bases, a potential reduction of 1.7 million injuries per year could be sustained with a savings in health care costs of \$2 billion per year nationally (4).

In a follow-up prospective study, Janda et al. (5) changed all fields over to break-away bases. One thousand thirty-five games were played by recreational softball athletes with two ankle sprains as the only two sliding injuries. Therefore, in this follow-up study a reduction of 98% of sliding-related injuries was realized (5).

To date, there has been no investigation of the utilization of break-away bases within the high-performance baseball population. This high-performance population would comprise the collegiate level as well as the professional level. It is the purpose of this study to investigate the effects of break-away bases within this high-performance population.

METHODS

The break-away base utilized in this study as well as in previous studies is anchored by receiving holes fitting into grommets on a rubber mat that is flush with the infield surface (Fig. 1). The rubber mat is anchored to the ground by means of a metal post similar to that used with standard stationary bases. Seven hundred foot-pounds of force or one-

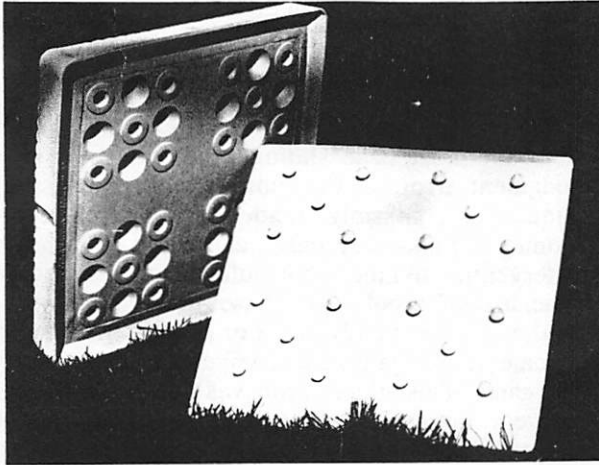


FIG. 1. The break-away base (left) is anchored by receiving holes that fit into grommets on a rubber mat (right) that is flush with the infield surface.

fifth of the force needed to dislodge a stationary base from its mooring, is required for the break-away portion of the base to release. Break-away bases were obtained for use on various collegiate and minor league baseball fields. The Rogers break-away base, which was utilized in this and previous studies, costs approximately \$400 for a set of three bases, which is less than twice the cost of a set of standard stationary bases. Over a 2-year period, 19 teams utilized break-away bases on their home field and the same 19 teams played on stationary bases during their away games. Before the start of each game the players were notified of the type of base being used. Seven teams were involved in the study during the first year; these included minor league teams from Fayetteville, North Carolina; Watertown, New York; St. Catharines, Ontario, Canada; Geneva, New York; London, Ontario, Canada; Dunedin, Florida; and LeMoyne College. Twelve teams were involved in the study the second year and included Bucknell University, Shippensburg State University, Swarthmore College, Elizabethtown College, LeMoyne College, Gettysburg College, Eastern Michigan University, and the minor league teams from Geneva, New York; Watertown, New York; London, Ontario, Canada; St. Catharines, Ontario, Canada; and Niagara Falls, New York. Teams from Fayetteville, North Carolina and Dunedin, Florida as well as college teams from the University of Michigan, Hofstra, and the University of San Diego, all utilized the bases; however, no data were kept. Four hundred eighty-six games were played on break-away bases and 498 on stationary bases by these teams. Base sliding injuries that occurred with these teams were recorded and documented by team physicians, athletic trainers, managers, and administrative staff from the teams or organizations themselves. An injury was defined as an event which led to a player being removed from competition. A χ^2 analysis with Yates correc-

tion was then utilized to determine statistical significance of the tabulated injury rates.

RESULTS

During the two seasons studied, a total of 2,028 slides were recorded on break-away bases. It was found that these bases broke away approximately 54 times during the slides. This translates into 3% of the slides. During the 486 games on break-away bases, two sliding injuries were documented (Table 1). One injury sustained was a shoulder contusion when the player slid head first into the base. The base did not release. This player did not miss any games consequent to his injury (Table 2). The second injury occurred as the individual slid and sustained an ankle fracture. It should be noted, however, the individual never made contact with the base. However, because the individual slid on a field equipped with break-away bases, his injury was added to the break-away base injury roster.

As stated previously, 498 games were played on stationary bases. Ten sliding injuries were documented (Table 1). All injured individuals impacted with the base. Of the ten injuries, three were to the knee and seven to the ankle. All seven ankle injuries were sprains and the average time missed from participation was 12 days (Table 2). Of the three knee injuries, one was a medial collateral ligament (MCL) sprain and 1 month was missed from the season. The two remaining knee injuries consisted of meniscus tears; both required surgery and were season-ending injuries (Table 2).

One injury was documented every 243 games on the break-away bases, which translates into 0.41 injuries every 100 games. In regard to the stationary base injuries, one injury occurred every 49.8 games which translates into 2.01 injuries every 100 games. A χ^2 analysis with Yates correction revealed a p value >0.05 . Therefore, an 80% reduction was noted in the high-performance baseball population utilizing break-away bases. In addition, when comparing the break-away base and the stationary base injuries the amount of time missed was significantly less with the break-away bases. It should be noted that surveys were taken of team players, managers, and administration staff of all schools and baseball

TABLE 1. Sliding related injuries

Types of injury	Number of injuries involving stat. bases	Number of injuries involving B-A bases
Ankle sprains	7	
Ankle fracture		1 ^a
Knee MCL sprain	1	
Knee meniscal tear	2	
Shoulder contusion		1
TOTAL	10	2

^a Player never reached base.

TABLE 2. Time missed due to injury

Type of injury	Average days missed of play
Shoulder contusion	0
Ankle sprain	12
Knee MCL sprain	30
Knee meniscal tear	Season-ending injuries

organizations involved in this study in regard to the utilization of the break-away bases. All teams were very positive about them, and all planned on continuing use of the bases. Further, it should be noted, that in Watertown, New York, in 1991, grommets had broken off the rubber mat during field maintenance procedures as the underneath portion of the base was dragged with a mat and the break-away portion of the base characteristics were altered and, therefore, the bases had to be replaced. It should also be noted that the umpires and managing staff alike determined that the utilization of break-away bases did not alter the game in an adverse manner. The umpires did not have any difficulty with judgment calls (safer versus out) when the bases released. For continuation of play circumstances, when the break-away portion did separate, the rubber mat that was flush with the infield surface was considered the base when determining whether the runner was safe or out.

DISCUSSION

This prospective study supports the concept that modifying the bases, in the high-performance baseball population, can alter the pattern and frequency of sliding-related injuries. An analysis of our injury rates revealed that one injury occurred every 243 games on break-away bases and every 49.8 games on stationary bases. The rate ratio was five injuries on stationary bases for every sliding-related injury on break-away base fields. Injuries will still occur and most will result from judgment errors by the runner, improper sliding technique, or poor timing. Break-away bases, however, may modify the outcome of these poor judgments and poor timing errors. The quick release feature of the break-away bases utilized in these studies decreased the impact load generated against the athlete's limb and subsequent trauma inflicted upon it. Sliding players come in all sizes and approach the base from all angles, so that no one preventative system can be completely fool proof. The forces generated by the trajectory athlete against the ground or other players may still be more than sufficient to result in severe injuries to the musculoskeletal system. The ratio of injury sustained with break-away bases in the recreational population, which was previously determined to be 0.3 injuries per 100 games is comparable to the ratio of 0.41 injuries per 100 games in the high-per-

formance baseball population utilizing break-away bases.

CONCLUSIONS

Injuries are inherent in any sport. In baseball and softball, most base sliding accidents result from judgment errors of the runners, poor sliding technique, and, possibly, inadequate physical conditioning. Break-away bases can serve as a passive intervention to modify the outcome of these factors. The use of break-away bases decreases injuries without player involvement or altering the play, excitement, entertainment, competition, or interest in the game. This intervention was also independent of players, umpires, weather, or time of day. Sports-related injuries are expensive to players, the employers, and insurance carriers. Economic costs are, of course, an important concern when the long-term health of the athlete is impaired by a sliding injury. The use of break-away bases decreases the number and severity of baseball and softball injuries both at the recreational and high performance levels. Break-away bases are cost effective and safer than standard stationary bases. In recreational and high-performance baseball populations, the use of break-away bases should be mandatory.

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