A COMPARISON OF ARTIFICIAL AND REGULAR TURFS IN REGARD TO ANKLE AND KNEE INJURIES

by

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Professor Raymond A. Wauthier, Chairman

Professor T. M. Evans

Dr. Fred A. Teague

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INTRODUCTION

The game of football has made tremendous progress since the first game played between Princeton and Rutgers in 1869. It has developed into one of America's most popular and colorful sports attractions.

One phase of the sport that has witnessed drastic changes through the years, is the equipment and it's effect on the players' safety. Early football teams played without helmets and protective pads. This was a drastic difference from the highly elaborate and safety emphasized equipment worn by athletes today.

With the emphasis placed by our present day society on safety, sporting goods companies each year try to outdo their competitor by researching and improving their equipment to the best of their ability. This has had a definite effect on the reduction of football injuries through the years.

Today, one of the most popular topics of discussion among people involved in athletics is concerned with what effect artificial turf has on the athlete's safety. When this topic is brought up, the question usually arises, "Which gives the athlete the greatest amount of protection, artificial or regular turf?".

PURPOSE

The purpose of this report was to determine whether there was any difference between artificial and regular turfs in regard to their effect upon knee and ankle injuries.

All coaches should be interested in the safety of the men playing for them, and it was hoped that this report would provide useful information concerning this matter.

This report may also prove to be a valuable source to other interested people who are surveying the pros and cons with regard to the possibilities of installing artificial turf, in the hope of improving existing facilities.

LIMITATIONS OF STUDY

As previously mentioned, the report dealt only with knee and ankle injuries during game competition. It was felt that it would be difficult to include practice injuries because of the following two reasons:

(1) Practice sessions varied greatly from day to day. One practice may include numerous contact drills while the next practice could include very little or none. One team may rely upon contact drills, making them more susceptible to injury than the team that does not depend as much on contact. Because of the before mentioned facts, game competition gives a much more reliable source of information to follow as basis for a report, since physical activity and contact fluctuates very little from one game to the next, especially when one is trying to determine the number of injuries occurring per activity.

(2) Very few teams practice on aritficial turf. Because of this, data concerning practice sessions was not compiled. According to information received from the companies producing artificial turf, the Universities of Alabama and Texas are the only schools that have their practice areas covered with artificial turf.

Also, due to a lack of time, this study dealt only with 1969 statistics. The reliability of the study would obviously improve if it was continued over more than one season.

REVIEW OF RELATED LITERATURE

Due to the newness in the use of artificial turf in football, very little revealing information was uncovered in the review of literature. Monsanto, Minnesota Mining and Manufacturing Company, and American Biltrite, producers of the three types of artificial turf, were the only sources of information.

Monsanto, producer of Astroturf, published a survey of 1967 football knee and ankle injuries. The rates of injury occurrences for Astroturf and natural turf were compared. The data for the performances was subjected to statistical test of significance (chi square test). Based on the data received, it was estimated that if the 1,850 games played by reporting schools had been played on Astroturf, the total number of serious knee and ankle injuries would have only been 107 as compared to the 670 that were reported. It was felt that the probability of a serious knee or ankle injury for a boy playing on Astroturf was reduced to 1 in 67 players in any given year as compared to the one in 8 players calculated for the participating schools. The total number of serious knee and ankle injuries per school on Astroturf were about 1.6 per year as compared to the experience of 9.6 by the reporting schools. In overall injuries, it was concluded that there were approximately 6 natural turf injuries to each Astroturf injury.[1]

In a letter from Dr. Timothy B. Jensen, Product Research Supervisor for the Minnesota Mining and Manufacturing Company's Tartan Turf, it was reported that the company was in the process of collecting and analizing data so that they could reach a meaningful conclusion. However, he felt that it was generally believed by the users of their turf that injuries were reduced on artificial turf. The Minnesota Mining and Manufacturing Company Medical Department had advised that no claims as to injury reduction be made until their study is completed.

American Biltrite, the newest of the artificial turf manufacturers, was also in the process of obtaining information in regard to the safety of their Poly-Turf. Larry Warnalis, General Sales Manager for Poly-Turf, discussed in his letter that their turf was especially designed to reduce knee and ankle injuries caused by cleats catching in natural sod. Mr. Warnalis also mentioned that they would not make any official claim as to the reduction of injuries until all their data had been compiled.

Due to the lack of available information in the use of artificial turf, it was immediately recognized that more research was necessary before any decisions as to the reliability of the alleged safety can be made. With the boom of artificial turfs at the college level, it will be possible to discover the "true colors" of artificial turf in the very near future.

METHOD OF STUDY

For this report a questionnaire was designed to collect information pertaining to football knee and ankle injuries in regard to the type of turf on which they occurred. The questions dealt mainly with the number of injuries and their severity.

The questionnaire was condensed into a one page form and it requested numerical answers. By requesting objective answers, it was intended to make it possible for each athletic trainer to spend a minimum amount of time in completing the questionnaire.

A questionnaire was sent to the 21 universities that used artificial turf during the 1969 season. The list of schools using artificial turf was made available by Monsanto, Minnesota Mining and Manufacturing Company, and American Biltrite.

An equal number of schools that played their home games on regular turf were also mailed questionnaires. They were chosen randomly from the National College Coaches Blue Book 1969-'70.

For the convenience of each trainer, a self-addressed, stamped envelope was included for the return of each questionnaire.

The results of the questionnaire were as follows:

Questionnaires mailed	42
Questionnaires returned	31
Percentage of returns	74

RESULTS AND DISCUSSION

Question 1.

How many knee injuries occurred during game competition?

TABLE I

TOTAL NUMBER OF KNEE INJURIES

Types Of Turf	Number Of Games	Number Of Injuries	Injuries Per Game	Rate Of Occurrence
Artificial	113	70	.62	1.6
Regular	218	124	.57	1.8

There were 113 games played on artificial turf with 70 knee injuries occurring at a rate of .62 injuries per game. On regular turf there were 218 games played with 124 knee injuries occurring at a rate of .57 injuries per game. One knee injury occurred every 1.6 games on artificial turf while the rate on regular turf was one injury per 1.8 games.

Question 2.

How many knee injuries required surgery?

TABLE II

KNEE INJURIES REQUIRING SURGERY

Types Of Turf	Number Of Games	Number Of Injuries	Injuries Per Game	Rate Of Occurrence
Artificial	113	19	.17	5.9
Regular	218	43	.20	5.1

There were 113 games played on artificial turf with 19 knee injuries that required surgery. The injuries occurred at a rate of .17 injuries per game. On regular turf there were 218 games played with 43 knee injuries occurring at a rate of .20 injuries per game. One knee injury requiring surgery occurred every 5.9 games on artificial turf while the rate on regular turf was one injury every 5.1 games.

Question 3.

How many injuries did not require surgery, but were sidelined more than one week?

TABLE III

SIDELINED OVER ONE WEEK WITHOUT SURGERY

Types Of Turf	Number Of Games	Number Of Injuries	Injuries Per Game	Rate Of Occurrence
Artificial	113	23	.20	4.9
Regular	218	34	.16	6.4

Of the 113 games played on artificial turf there were 23 knee injuries that occurred which sidelined the individuals over one week without surgery being necessary. They happened at a rate of .20 injuries per game. On regular turf there were 218 games with 34 injuries of this type occurring at a rate of .16 injuries per game. One knee injury of this severity occurred every 4.9 games on artificial turf while the rate on regular turf was one injury per 6.4 games.

Question 4.

How many missed one practice, but no more than one week?

TABLE IV

MISSED ONE DAY TO ONE WEEK OF PRACTICE

Types Of Turf	Number Of Games	Number Of Injuries	Injuries Per Game	Rate Of Occurrence
Artificial	113	28	.25	4.0
Regular	218	47	.22	4.6

There were 113 games played on artificial turf with 28 knee injuries occurring that sidelined the player between one day and one week. They occurred at a rate of .25 injuries per game. On regular turf there were 218 games with 47 knee injuries occurring at a rate of .22 injuries per game. One knee injury of this degree occurred every 4.0 games on artificial turf while the rate on regular turf was one injury per 4.6 games.

Question 5.

How many ankle injuries occurred during game competition?

TABLE V

TOTAL NUMBER OF ANKLE INJURIES

Types Of Turf	Number Of Games	Number Of Injuries	Injuries Per Game	Rate Of Occurrence
Artificial	113	71	.63	1.6
Regular	218	85	.39	2.6

There were 113 games played on artificial turf with 71 ankle injuries occurring at a rate of .62 injuries per game. On regular turf there were 218 games played with 85 ankle injuries occurring at a rate of .57 injuries per game. One ankle injury occurred every 1.6 games on artificial turf compared to regular turf's rate of one injury per 2.6 games.

Question 6.

How many ankle injuries required surgery?

TABLE VI

ANKLE INJURIES REQUIRING SURGERY

Types Of Turf	Number Of Games	Number Of Injuries	Injuries Per Game	Rate Of Occurrence
Artificial	113	5	.04	22.6
Regular	218	6	.02	36.3

There were 113 games played on artificial turf with 5 ankle injuries that required surgery occurring at a rate of .04 injuries per game. On regular turf there were 218 games played with 6 ankle injuries occurring at a rate of .02 injuries per game.

One ankle injury requiring surgery occurred every 22.6 games on artificial turf while the rate on regular turf was one injury per 36.3 games.

Question 7.

How many injuries did not require surgery, but were sidelined more than one week?

TABLE VII

SIDELINED OVER ONE WEEK WITHOUT SURGERY

Types Of Turf	Number Of Games	Number Of Injuries	Injuries Per Game	Rate Of Occurrence
Artificial	113	24	.21	4.8
Regular	218	29	.13	7.5

There were 113 games played on artificial turf with 24 ankle injuries occurring that sidelined the individuals over one week without the necessity of surgery. They occurred at a rate of .21 injuries per game. On regular turf there were 218 games with 29 ankle injuries occurring at a rate of .13 injuries per game. One ankle injury of this severity occurred every 4.8 games on artificial turf while the rate on regular turf was one injury per 7.5 games.

Question 8.

How many missed one practice, but no more than one week?

TABLE VIII

MISSED ONE DAY TO ONE WEEK OF PRACTICE

Types Of Turf	Number Of Games	Number Of Injuries	Injuries Per Game	Rate Of Occurrence
Artificial	113	42	.37	2.7
Regular	218	50	.23	4.4

There were 113 games played on artificial turf with 42 ankle injuries occurring that sidelined the player between the period of one day and one week. They occurred at a rate of .37 injuries per game. On regular turf there were 218 games with 50 ankle injuries occurring at a rate of .23 injuries per game. One ankle injury of this severity occurred every 2.7 games on artificial turf while the rate on regular turf was one injury per 4.4 games.

SUMMARY AND CONCLUSIONS

Questionnaires were mailed to athletic trainers at 42 universities. Thirty-one trainers answered and returned the questionnaire.

The total number of knee injuries that were reported on artificial turf occurred at a rate of .62 injuries per game, while the rate of the injury on regular turf was .57 injuries per game. This indicated that the injury rate on artificial turf was .05 per game higher than that of regular turf. This report also revealed that one knee injury occurred every 1.6 games on artificial turf while on regular turf a knee injury occurred at a slightly lower rate of one every 1.8 games.

Knee injuries requiring surgery was the only area of the questionnaire that resulted in a higher rate of injury occurrence on regular turf. The rate of injuries per game on regular turf was .20 while that of artificial turf was .17 per game. For every 5.1 games played on regular turf, one injury requiring surgery occurred whereas on artificial turf these injuries happened at a slightly slower rate of one every 5.9 games.

There was a definite difference between the two turfs regarding injuries that sidelined the athletes over one week, but not requiring surgery. The frequency of this type of injury was higher on artificial turf. Artificial turf related injuries occurred at a rate of .20 injuries per game while the rate on regular turf was .16 injuries per game. An injury occurred every 4.9 games on artificial turf while the rate on regular turf was slightly slower, that being one every 6.4 games.

Knee injuries that forced the player out of action from one day to a week were slightly higher on artificial than on regular turf. Injuries on artificial turf occurred at a rate of .25 per game while the rate on regular turf was a less frequent rate of .22 injuries every game.

It was also indicated in the review of data that injuries of this degree occurred at a rate of one every 4.6 games on regular turf while the rate on artificial turf was more frequent at one injury for every 4.0 games played.

The frequency of ankle injuries that occurred during game competition were again at a higher rate on artificial than that of regular turf. Ankle injuries happened at a rate of .63 injuries per game on artificial turf while on regular turf they occurred at a rate of .39 injuries per game. An ankle injury occurred every 1.6 games on artificial turf while on regular turf it was not as frequent, that rate was one injury every 2.6 games.

The number of ankle injuries that required surgery were by far the lowest of all reported injuries. Only five were reported on artificial and six on regular turf. There were .04 injuries per game on artificial turf while on regular turf it was at a rate of .02 injuries per game. The difference was much easier to observe in regard to injury occurrences per game. An ankle injury requiring surgery occurred at a rate of one every 22.6 games on artificial turf while on regular truf it was at a less frequent rate of one every 36.3 games.

The next question dealt with the number of players sidelined one week or more without surgery being required. Once again artificial turf had a higher rate of injuries occurring than that of regular turf. The number of injuries per game on artificial turf was .21 while on regular turf it was only .13 injuries per game. For every 4.8 games played on artificial turf an injury of this degree occurred while the frequency on regular turf was one injury every 7.5 games, the difference being 2.7 games.

The last question was concerned with the number of players that missed one practice, but no more than one week. Injuries on artificial turf once again had a higher degree of occurrence.

There were .37 injuries per game on artificial turf compared to a lower rate of .23 injuries per game on regular turf. For every 2.7 games played on artificial surfaces one injury occurred. Regular turf produced injuries at a less frequent rate of one every 4.4 games.

Out of the eight questions included in the questionnaire, only one indicated favorable results in regard to the use of artificial turf. That question dealt with the number of knee injuries requiring surgery. The data received from the remaining seven questions showed that regular turf produced fewer injruies during game competition. Even though some of the questions pertaining to the safety of artificial turf. One of the selling points used by artificial turf manufacturers is how their surface protects the participants. Facts have been compiled in this report that do not agree entirely with those of the turf producers. Even though this report dealt only with one season of football, it has produced information that disagrees with the popular opinion of many people who feel that artificial turf is an avenue leading to a more safe environment for the football player. Even with these results, it still does not prove that artificial turf is not as safe as regular turf. This can only be determined through a more extensive study dealing with a longer period of time and with more than the two types of injuries included in this report. It was mentioned by one responding athletic trainer that his observations had shown an increase in the number of head, shoulder, and elbow injuries besides the ones included in the questionnaire. It is hoped that the results of this report will motivate others to research this area so that a complete understanding may eventually be reached as to how safe artificial turf really is.

FOOTNOTE

[1]Monsanto Company, "Survey of 1967 Football Knee and Ankle Injuries." Unpublished study, April, 1968.

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Jensen, Timothy B. Product Research Supervisor, Minnesota Mining and Manufacturing Company, St. Louis, Missouri. Personal letter, March 5, 1970.

Monsanto Company. "Survey of 1967 Football Knee and Ankle Injuries." Unpublished study, St. Paul, Minnesota, April, 1968.

Warnalis, Larry. General Sales Manager, American Biltrite Company, Boston, Massachusetts. Personal letter, March 2, 1970.

A P P E N D I X

FORM LETTER MAILED TO ATHLETIC TRAINERS

Dear Sir:

I am in the process of obtaining information for my Master's Report. My topic is "A Comparison of Artificial and Regular Turfs in Regard to Ankle and Knee Injuries." I would greatly appreciate your help in this matter.

Enclosed is a brief questionnaire regarding the above mentioned injuries. Would you please complete it and return it at your earliest convenience. Please be sure to just list the injuries that occurred during game competition.

Thanking you in advance for your valuable time and cooperation in this matter.

Sincerely,

Gib Romaine

Enclosures

SURVEY OF 1969 FOOTBALL KNEE AND ANKLE INJURIES

Please record the number of knee injuries pertaining to each question. Be sure to place the number under the type of turf that it occurred on. Please list only game injuries.

	ARTIFICIAL	REGULAR
1. How many knee injuries occurred during game competition?	_____	_____
2. How many knee injuries required surgery?	_____	_____
3. How many injuries did not require surgery, but were sidelined more than one week?	_____	_____
4. How many missed one practice, but no more than one week?	_____	_____

Please follow the same procedure and answer the following questions pertaining to the ankle.

	ARTIFICIAL	REGULAR
5. How many ankle injuries occurred during game competition?	_____	_____
6. How many ankle injuries required surgery?	_____	_____
7. How many injuries did not require surgery, but were sidelined more than one week?	_____	_____
8. How many missed one practice, but no more than one week?	_____	_____

How many games did you play on Artificial Turf? _____

How many games did you play on Regular Turf? _____

Your Name _____

Name of University _____

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ABSTRACT

The purpose of this report was to determine whether there was any difference between artificial and regular turfs in regard to their effect upon knee and ankle injuries.

It was hoped that this report would provide valuable information to coaches and other interested people who are surveying the pros and cons of artificial turf, hoping to improve their existing program.

An investigation of related literature revealed very little pertinent information. Monsanto, producer of Astroturf, was the only manufacturer that had completed a study in this area. Minnesota Mining and Manufacturing Company, producer of Tartan Turf, and American Biltrite, producer of Polyturf, did not have information at this time, but are in the process of gathering data.

For this report a questionnaire was designed to collect material pertaining to football knee and ankle injuries in regard to the type of turf on which they occurred. The question dealt mainly with the number of injuries and their severity.

A list of the 21 universities that used artificial turf during the 1969 season was made available by the manufacturers of the turfs. An equal number of schools that played their home games on regular turf was chosen randomly from the National College Coaches Blue Book 1969-'70. A questionnaire with a self addressed, stamped envelope was mailed to the selected universities. There were 42 questionnaires mailed and 31 athletic trainers replied for a total of 74 percent answering.

This report included 113 games played on artificial turf and 218 games on regular turf.

Only one of the eight questions dealing with knee and ankle injuries produced favorable results in regard to the use of artificial turf. That question dealt with the number of knee injuries requiring surgery. The data received from the remaining seven questions showed that regular turf produced fewer injuries during game competition. Even though some of the questions showed only slight differences, this report tended to raise some doubts pertaining to the safety of artificial turf. One of the selling points used by artificial turf manufacturers is how their surfaces protect the participants. The results of this report did not entirely agree with those of the turf producers. Even with the results of this report turning out as they did, it still does not mean that artificial turf is not as safe as regular turf. This can only be determined through a more extensive study dealing with a longer period of time and possibly concerning more than those injuries discussed in this report. It was suggested that injuries to the head, shoulders, and elbows also be investigated. It is hoped that the results of this report will motivate others to research this area so that a complete understanding may eventually be reached as to which is more safe for the athlete, artificial or regular turf.