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Perceptions of rugby union headgear effectiveness in reducing concussions

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**PERCEPTION OF RUGBY UNION HEADGEAR EFFECTIVENESS IN REDUCING
CONCUSSIONS**

A Thesis

Presented to

The Faculty of the Department of Human Performance

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

By

Matthew J. Dusa

August, 2003

UMI Number: 1425500

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ABSTRACT

PERCEPTION OF RUGBY UNION HEADGEAR EFFECTIVENESS IN REDUCING CONCUSSIONS

by Matthew J. Dusa

Rugby Union is an international team sport that involves a high incidence of contact. Subsequently, the rate of injury, particularly head injuries, is also increased with competitive participation. Recently, the governing body of rugby union, the International Rugby Board (IRB), has addressed the head injury concern by allowing the use of protective headgear. The purpose of this study was to examine the effectiveness of IRB approved headgear in reducing concussive head injuries. One hundred and thirty one surveys were returned from collegiate men's rugby union teams. The use of headgear was widely variable among the rugby union participants; however, the general perception from the participants was rugby union headgear was somewhat effective in reducing concussions. Although head injuries were reported while wearing headgear, the severity of the symptoms and the duration of time the symptoms were experienced was decreased. Therefore benefit may exist for all rugby union athletes to wear headgear to reduce the incidence and severity of head injuries while participating in competitive rugby union.

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**PERCEPTION OF RUGBY UNION HEADGEAR EFFECTIVENESS IN REDUCING
CONCUSSIONS**

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Author's Last Name	conception & design	acquisition of data	analysis & interpretation of the data	drafting of the article	critical revision of the article for important intellectual content	final approval of the article	provision of study materials or patients	statistical expertise	obtaining of funding	administrative, technical, or logistic support	collection & assembly of data
Dusa	X	X	X	X	X	X	X			X	X
Kahanov	X				X	X				X	
Roberts					X	X				X	
Wilkinson					X	X				X	

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ABSTRACT

PERCEPTION OF RUGBY UNION HEADGEAR EFFECTIVENESS IN REDUCING CONCUSSIONS

Objective: The perceived effectiveness of rugby union headgear in reducing concussions in American male collegiate rugby union athletes was assessed.

Design and Setting: Data collection was conducted by survey method distributed using electronic mail.

Subjects: One hundred and thirty-one men's club rugby union participants from eight university teams in the United States were surveyed.

Measurements: Demographics, perception of headgear effectiveness, concussion history, symptoms experienced and protective equipment used were measured. Descriptive statistics were used to assess demographic data. A Chi-squared, assesses associations and differences in the frequencies of responses in each category set up by the Likert scale.

Results: One hundred and thirty one surveys were returned. Player position and years of experience played a role in the number of concussions and use of protective headgear. Seventy six different athletes reported a concussion while playing, with the majority of those not wearing headgear (9%). The perception of the athletes on the effectiveness was most reported as "often" and "sometimes."

Conclusions: The incidence of concussions and severity of concussions were less within the group wearing headgear. However the perception was variable and statistically non-significant between all responding groups. The general perception is positive of the effectiveness of rugby headgear in reducing head injury.

Key Words: Head injuries, Concussion, Protective equipment, Soft-shelled headgear

Rugby union is an international game played in most countries and both hemispheres around the world. In the United States, rugby union is played in the high school, collegiate and club levels, with a playing population estimated at 50, 000 participants. Like many contact or collision sports rugby union has an increased incidence of injury associated with competitive participation. Injuries to rugby athletes include all body areas; however, the majority (24.6%) of injuries are diagnosed as concussions.¹

Concussions have accounted for 300,000 sport related injuries per year in the United States, and likewise are of particular concern to the rugby community.² An early study on rugby union injuries reported that head and facial injuries account for between 14 to 27% of all injuries.³ Investigation into the indications and effectiveness of equipment in the reduction of injury incidence is lacking but necessary with such a high number of head and facial injuries, specifically concussions.

The use of protective equipment in rugby union has long been avoided as part of the sports culture. Until recently, the only head protection used by participants was mouthguards and tape for ear protection.³ In 1993, the International Rugby Board (IRB) decreed that a player may wear headgear as protection for the ears or against abrasions from the hard ground.⁴ Specifically, headgear, often referred to as a scrum cap, is soft shelled head protection made from leather or fabric containing thin padding (Figure 1). These laws were placed in effect after a review conducted by the National Health and Medical Research Council of Australia (NHMRC) stated that “helmets or headgear must be sport specific to be effective, and research must be conducted to determine the

demands of the various sports.”⁴ Based on the types of collisions and the style of tackles in rugby union the IRB determined soft-shelled headgear was most appropriate for the use in competition to reduce injuries and adhere to the spirit of the sport.

Head protection is used in many sports where participants are susceptible to concussive injury. To function effectively headgear must attenuate impact energy, thereby decreasing the magnitude of the impact force to the head.⁵ Hard-shelled headgear used in football, lacrosse, or bicycling helmets with an impact resistant lining are somewhat effective in reducing concussive impacts.⁵ Few studies exist which focus on headgear effectiveness in rugby union. Protective headgear is currently used in rugby union in an attempt to decrease head injuries, yet recent history of headgear use in rugby union has manifested minimal studies on effectiveness. The effectiveness of hard shelled style helmets in reducing multidirectional and rotational impacts has been argued in the research.^{5,6,8,9} However, soft-shelled headgear, such as rugby union headgear, needs further investigation to draw conclusions on effectiveness prior to blanket acceptance.^{1,3,5,7}

Currently, there is a lack of research on rugby union headgear effectiveness in the United States. The studies in the area of headgear effectiveness in rugby union are from Australia, New Zealand and Canada, where rugby union is a traditionally a more popular sport.^{3,5,7,9} The general position among empirical researchers on the topic of rugby union headgear effectiveness is inconclusive as to whether rugby union headgear should be mandated. Thus, further research in the United States is warranted on the topic of rugby union headgear effectiveness in reducing concussions. The purpose of this study was to

determine the relationship between rugby union soft-shelled headgear as a protective device as it relates to concussive head injuries.

METHODS

This descriptive study used a survey instrument to investigate rugby union player's recall of concussion and the use of soft-shelled headgear. Eight university men's rugby union clubs were randomly selected from the United States Rugby Football Union club contact list. Club representatives agreed to forward a copy of the study's cover letter and survey to members of their respective clubs.

The survey was an original design using closed ended questions and a Likert scale to evaluate the participant's perception of headgear effectiveness. The survey consisted of fourteen questions approved by the institutional review board on human subjects. In addition to assessing basic demographic data, the Likert scale assessed headgear effectiveness using a five point ranking scale: never, rarely, sometimes, often, and always. The survey also consisted of questions pertaining to individual's concussion history, including protective equipment used, symptoms incurred, and total days the symptoms were experienced.

The survey and cover letter were first distributed to an expert panel of three certified athletic trainers with 25 years of experience to determine validity. Based on the expert panel suggestions, the survey and cover letter were revised with minor editorial changes before e-mailing to participants. The survey was posted on a temporary website hosted by the researcher. In addition, a cover letter preceded the survey in the electronic mailing. The cover letter included details regarding the purpose and benefits of the study,

as well as assurance in the respondent's privacy and anonymity. The cover letter included a statement that return of the survey was consent to participate in the study.

Once the survey was completed by each participant, the data were electronically mailed back to the researcher's electronic mail inbox. The data were anonymously stored and printed for data analysis. The Statistical Package for Social Science (SPSS 11.0 Chicago, IL: SPSS Inc; 2001) was used to analyze the data.¹⁰ Descriptive statistics such as frequency tables, mean and cross tabulations were used to assess demographic data. A nonparametric test, chi-squared, assessed associations and differences in the frequencies and the number of responses in each category of the Likert scale.

RESULTS

Basic Characteristics and Incidence of Concussions

One hundred and thirty-one surveys (N= 131) were returned from the expected club representative response (65%) of 200. The majority of the respondents, 48.9%, were seniors, however, 26% reported less than one year of rugby union experience with 3-4 years of experience being the next highest rate (22.9%) of the total respondents. All the positions in rugby union were included with the majority of the responses from the forward positions, specifically 16.8 % from the lock position and 16% reporting as half backs (Table 1).

From the total response of 131 participants a total of 136 concussions were reported. Seventy-six (58%) participants reported one or more concussions with a limit of five. Symptoms related to concussions are present in table two. Forty-six seniors reported concussions accounting for 60.5% of the athletes sustaining head injuries. While

freshman (14.5%), sophomores (10.5%) and juniors (15%) were relatively similar in their distribution. From the total number of players reporting concussions (n=76) the players from the forward position reported the highest incidence with 47 (61%).

Players with 3-4 and more than six years of experience reported the most concussions, accounting for 36% of the total players reporting concussions. Forty-seven participants (36%) reported only experiencing one concussion, while fourteen players reported three or more concussions in their collegiate career. The most frequent symptom of athletes reporting only one concussion (50%) was a headache followed by dizziness (35%) (Table 2). The average amount of days that symptoms were experienced after the first concussion was 4.21 days.

Headgear Use and Perceived Effectiveness

From the total number of reported concussions (N=136) the number of concussions without the use of headgear (n=104) was higher than the number of athletes who sustained concussions while wearing protective headgear (n=32). Sixty-four (49%) of the participants responded to question three which was the Likert scale on perceived effectiveness of headgear in reducing concussions. Therefore, sixty-seven athletes reported not using headgear as a protective device and not sustaining a concussion while participating in collegiate rugby union. The perception of the athletes who chose to wear headgear was generally positive with the option “often” and “sometimes” chosen 40% (n=26) and 23% (n=15) respectively. The second highest group with years of experience, 3-4 years, reported headgear as effective in reducing concussions as “often” 26% of the time. The perception of the players in the forward position, representing 55.7% of the

participants, reported the effectiveness of headgear as “sometimes” (27.9%) and “often” (39.5%).

A chi squared was calculated to test the relationship between athletes who experienced a least one concussion while wearing headgear and their perception on the effectiveness of headgear in reducing concussions. Cross tabulation was evaluated with perception and concussion history. The values from the perception categories were collapsed from five to three categories including “always” and “often” into a positive attitude and “never” and “rarely” into a negative attitude with “sometimes” remaining in the middle. The $X^2 = 1.245$ with a $df = 2$, the $P = .543$ indicating no statistical significance of the chi square association. A Cramer’s V was tested for practical significance (.139) and a $P = .537$, again indicating no statistical significance.

DISCUSSION

The purpose of this study was to add to the relatively limited body of research on rugby union headgear’s perceived effectiveness as a protective device in reducing concussive head injuries. Results demonstrate a wide variation of responses based on years of rugby union experience and headgear use within university men’s club rugby union. However, with more experience in the game of rugby union the use of headgear also increased (Table 3). This is similar to Pettersen’s study which identified more international level players wearing headgear more than youth or club level players with less experience.⁷

The data also indicated an increase in the number of reported concussions with years of experience and years in school. The increased number of concussions associated

with an increase number of years of rugby union experience and years in school could be an indication of why athletes with more experience also report a higher headgear usage. The nature of the sport of rugby union and wide variability of roles in each position were represented. The data support that the use of headgear is dependent on the position played, with players in the forward position wearing headgear more often than players in the backs position. This data is consistent with regard to the role and responsibilities of the different positions. Typically, forwards are more frequently involved in contact and collision including scrummages, rucks, and mauling. These entail more opportunity for contact and therefore would lead people to believe that forwards necessitate more head protection.

The data of reported concussions and use of headgear supports that headgear use may decrease the incidence of concussions. A total of 136 concussions were reported with 104 being from athletes who chose not to wear headgear. However, an argument can be made that headgear does not reduce the incidence of concussion since athletes did sustain concussions while wearing headgear. In a 2000 study, the researchers indicated that “(rugby union) headgear is unlikely to reduce concussion or more severe head injury.”⁵ The data from the current study indicates that the symptoms experienced by athletes who do not wear headgear are, on average, experienced for less time, two days. On the other hand athletes who did not wear headgear experienced symptoms for 4.2 days. Concussions that result in symptoms lasting less than 24 hours are classified as mild head injuries while grade three concussions generally have post-traumatic symptoms, which last for greater than 24 hours.¹¹ The reduction of symptoms in terms of

amount of time missed in days by headgear wearers may be an indication that headgear is effective in reducing the time lost from concussion and potentially the severity of brain trauma.

The athlete's perception of headgear effectiveness is inconclusive. The data from the Likert scale on the perceived effectiveness of headgear in reducing the number of concussions was extremely variable and limited to 64 participants (49%) (Table 3). Why athletes are choosing or not choosing to wear headgear is unclear. Pettersen, (2000) reported that choosing headgear was due to the fact that it is "not mandatory" or "cost too much." ⁷ The data indicated that with more experience in the sport and an increase in head injuries that athletes are more frequently using the headgear as a protective device.⁷ Whether these athletes are more susceptible to head injury or does the headgear become less effective due to prior head injuries is questionable and is a point for future research.

The data indicates that 40% of the athletes who wear headgear felt that headgear "often" reduced the number of concussions while 23% felt headgear reduced the number "sometimes." These responses are more frequent than those respondents who felt that headgear "rarely" (8.4%) and "never" (4.6%) reduced the number of concussions which is indicative of athletes who are wearing headgear and sustaining concussions. Fewer athletes sustained concussions while wearing headgear indicating that some of the positive attitude of headgear effectiveness is also from athletes who have received a concussion without headgear use. The data indicates that regardless of the athlete's perception on headgear effectiveness or headgear use or nonuse, concussions are being

sustained by all rugby union participants. The frequency of head injuries while wearing headgear may be reduced, but not negated.

Two coaches responded with qualitative responses to the study. Both coaches indicated that the most effective use of headgear was that of “glancing blows” for protection of the ears and against lacerations. Headgear was described as offering players the “impression of being invulnerable to injury, which is not the case.” Both coaches agree that headgear should not be used if a concussion has been sustained to get the athlete back on the field with more protection; rather the athlete should “rest.” This could lead to circumstances such as secondary impact syndrome and cause further brain damage to the athlete. One coach with over 30 years experience playing and coaching agreed that headgear does “not help if you are slammed full speed... but he would prefer to wear the headgear” than not wear headgear. Finally, there was a suggestion to modify the headgear to protect the ears rather than give the false impression of head safety.

CONCLUSION

While adding to the limited body of research on this topic of rugby union headgear effectiveness there is always a need for further investigation on rugby union head injuries and devices or equipment that could protect the athlete. Like many surveys, this study was limited to the perception of collegiate men’s participants, a group which has relatively little experience, compared to senior division and international level athletes. Also, the number of questions and responses limited this study. In future studies the perception of headgear effectiveness should be asked of all participants regardless of their concussion history. However, headgear did demonstrate the

effectiveness of reducing the severity and frequency of concussive head injuries.

Therefore benefit may exist for all rugby union athletes to wear headgear to reduce the incidence and severity of head injuries while participating in competitive rugby union.

Figure 1. IRB Approved Soft-Shelled Headgear

Table 1. Number of Rugby Union Respondents by Position (N=131)

Position	Number	Percent (%)
Prop	14	10.7
Hooker	14	10.7
Lock	22	16.8
Flanker	20	15.3
Number 8	3	2.3
Half Back	21	16.0
Fly Half	4	3.1
Center	15	11.5
Wing	14	10.7
Full Back	4	3.1
Totals	131	100.0

Table 2. Total Number of Symptoms Experienced Per Concussion (N=131)

	Concussion One (n=76)	Concussion Two (n=29)	Concussion Three (n=14)	Concussion Four (n=5)	Concussion Five (n=3)
Symptoms					
Headache	65	25	11	3	2
Amnesia	9	5	1	0	0
Ringing ears	19	5	3	3	0
Disorientation	44	16	10	4	2
Dizziness	45	12	9	4	2
Fatigue	17	5	2	0	0
Nausea	24	9	5	2	1
Blurred Vision	21	6	2	2	0
Loss of Consciousness	15	4	3	0	0

Table 3. Perception of Headgear Effectiveness Based on Years of Experience (N=131)

Rugby Experience	Perception of Headgear Effectiveness					<u>Total</u> N= 64
	Never n=6	Rarely n=11	Sometimes n=15	Often n=26	Always n=6	
Less than 1	1	1	4	3	0	9
1-2	1	2	1	5	2	11
3-4	3	3	4	7	2	19
5-6	1	4	1	3	2	11
More than 6	0	1	5	8	0	14
Total	6	11	15	26	6	64

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EXTENDED SUPPORT MATERIAL

Chapter 1

INTRODUCTION

Rugby union is an international game played in most countries and in both hemispheres around the world (Finch, McIntosh, & McCrory, 2001). In the United States, rugby union is played on the high school, collegiate, and club levels, with a playing population estimated at 50,000 participants (Marshall & Spencer, 2001). In 1924, rugby union was a sanctioned sport in the Olympic Games, but has since been removed. Injuries to rugby union athletes include all body areas, however, a large majority (24.6%) of injuries are diagnosed as concussions (Marshall & Spencer). The prevalence of concussive head injuries in the sport of rugby union requires increased attention to develop safer laws and protective equipment (McIntosh, McCrory & Comerford, 2000). With the recent introduction of headgear used as a protective device and the high incidence of head injury associated with rugby union, further investigation is needed on protective equipment to develop the safest and most effective headgear that reduces the number of concussions. The purpose of this study was to determine the relationship between rugby union headgear as a protective device as it relates to the number of concussive head injuries during one season.

Like many contact or competitive sports, rugby union has an increased incidence of injury associated with competitive participation. Head injuries encompass 14-27% of all incurred sporting injuries (Finch, et al., 2001). Specifically, concussions account for 25% of the total head and face injuries in rugby union (Marshall & Spencer, 2001). Concussions have accounted for 300,000 sport related injuries per year in the United

States (Powell, 2001), and likewise is of particular concern to the rugby union community. Finch, McIntosh, and McCrory (2001) reported that head and facial injuries account for 14 to 27% of all rugby injuries. With such a high number of head and facial injuries, specifically concussions, it is necessary to investigate the indications and effectiveness of equipment to reduce the incidence of injury.

The use of protective equipment in rugby union has long been avoided as part of the sports culture (Wilson, 1998). Until recently the only head protection used by participants was a mouthguard. In 1993 the International Rugby Board (IRB) decreed that a player may wear headgear as protection for the ears or against abrasions from the hard ground. Specifically, headgear, often referred to as a scrum cap, is soft shelled head protection made from leather or fabric containing thin padding (Wilson). These 1993 IRB laws were placed in effect after a review was conducted by the National Health and Medical Research Council of Australia (NHMRC) that stated “helmets or headgear must be sport specific to be effective, and research must be conducted to determine the demands of the various sports” (IRB, 2000). Based on the types of collisions and style of tackles in rugby union, the IRB determined soft shelled headgear was most appropriate for the use in competition to reduce injuries and adhere to the spirit of the sport.

Head protection is used in many sports where participants are susceptible to head injury. McIntosh, et al (2000) reported that for headgear to function effectively, it must attenuate impact energy, thereby decreasing the magnitude of the impact force to the head. Mueller (2001) explained that hard shelled headgear, such as football, lacrosse, or bicycling helmets with an impact resistant lining are somewhat effective in reducing

concussive impacts. Few studies exist which focus on headgear effectiveness in rugby union. Protective headgear is used in rugby union in an attempt to decrease head injuries. Recent history of headgear use in rugby union has manifested little research on rugby union headgear effectiveness. Sources argue the effectiveness of hard shelled style helmets in reducing multidirectional and rotational impacts (Hobrick, 2001; McIntosh, et al., 2000; Wilson, 1998). However, most researchers argue that soft shelled headgear, such as rugby union headgear, is an area which needs further investigation prior to acceptance and use (Finch, et al., 2001, Hobrick, 2001; McIntosh, et al., 2000; Wilson, 1998).

The purpose for this study was to add to the body of knowledge in the field of headgear effectiveness against concussions for the sport of rugby union. Several studies conducted by McIntosh, et al (2000) were concluded by stating the need for further research in the area of headgear effectiveness. Wilson (1998) stated further research is required to determine the effectiveness of protective headgear in reducing the risk of concussions. Currently the only American study in regards to rugby union and concussions states soft-shell head protection is used, but the effectiveness regarding concussions is open to question (Marshall & Spencer, 2001). The current study may be the first of its kind in the United States to specifically use the survey method to address athlete's perception of effectiveness of rugby union headgear. Finally, this study will add to a growing body of knowledge concerning concussions in American sports. This project was written into a journal article for the *Journal of Athletic Training* according to the *Authors Notes* (see Appendix A).

Hypothesis

The role of protective headgear is to attenuate the forces of impact, to reduce the accelerations at the point of impact and to distribute the force over a larger area (Wilson, 1998). Therefore, the null hypothesis for a study on rugby union headgear effectiveness in reducing concussions is that rugby union headgear should not reduce concussion type head injuries.

Limitations

Limitations to the current study include:

- 1) The number of participants registered with the United States Rugby Football Union will limit the total amount of participants and limit the generalizability to worldwide rugby union.
- 2) The number of registered men's collegiate players in the western territorial union will limit the sample size.
- 3) The number of surveys sent to the selected participants will also limit the study. The participants will be limited to 200 male collegiate rugby union athletes, which is roughly 14% of the western territorial union men's collegiate rugby union population
- 4) The number of participants who choose to respond will be a limiting factor out of the researchers' control.
- 5) The number of participants who specifically use headgear or have experience with rugby union headgear will further limit the study. Associated with this limitation is the number of respondents which have sustained a concussion type head injury.

Delimitations

Over 50,000 rugby union players exist in the United States. The population sample for this study will be delimited to American men's collegiate club rugby union players that are registered in current standing with United States Rugby Football Union. Homogeneity will be increased by a standard age of (18-25) the participants. Collegiate rugby union club participants have a more uniform age bracket, and since a limited number of youth programs exist in the United States, collegiate participants will be studied. In addition, collegiate players also generally have the same previous experience and knowledge of the game. Therefore, a standard playing level and competition standard is continuous throughout the collegiate rugby union clubs, which is less than four years, based on limited exposure and opportunities for youth and high school rugby union players.

Assumptions

Assumptions that the United States Rugby Football Union database mailing list is up to date and correct will be made. Moreover, it will be assumed that the participants respond truthfully about the amount of time using the headgear. In addition, the assumption is being made that all respondents will fill out their own survey and answer the questions thoroughly and honestly, and will be able to recall head injury events.

Definition of Terms

Concussion- the impairment of neural function, loss of consciousness, disturbed vision and equilibrium including other brain stem involvement (Powell, 2001). This

study will not discriminate between the grades of concussion. Non-discrimination will increase the population response.

Headgear- A device worn on the head to protect the wearer from the likelihood of injury (Wilson, 1998). Only IRB regulated headgear will be discussed in the study. IRB approved headgear will not place any limitations on the study because only these headgear are allowed in competitive rugby union.

Head Injury- Any injury to the head which causes symptoms including but not limited to cognitive function deficit, loss of consciousness, amnesia, post-concussion syndrome, subdural hematomas, headaches and convulsions.

Rugby Union Headgear (Scrum Cap) - Soft shelled head protection made from leather or fabric containing thin inner padding (see Appendix B).

Rugby Union- A ball carrying sport which involves two 15 player teams in which full body contact is used to stop the forward progress of the ball (Finch, et al. 2001). This is the style of rugby played in the United States with greater popularity than other types of rugby. Therefore, rugby union will be the chosen sport focus.

Project Completion

Data from this study will be compiled into a journal article for *The Journal of Athletic Training* according to the *Authors Notes* (see Appendix A).

Chapter 2

REVIEW OF LITERATURE

The sport of rugby union has popularity increasing in western countries ever since it's inception in the 1800's. Today, rugby union has gained recognition internationally, including popularity on all competitive levels in the United States. Comparable to many contact sports, rugby union has a high incidence of injury, particularly head injuries. Recently, the International Rugby Board (IRB) has allowed the use of headgear to help prevent the severity and frequency of head injuries, including concussions. Due to the recent IRB Law 4 approval, the use of rugby union headgear is gaining popularity; however, the effectiveness of the rugby union headgear in reducing concussive forces is not fully understood. This review of literature explores concussions, the sport of rugby union and the limited research available on rugby union headgear and its' effectiveness.

Concussions

Today, competitive sports account for large numbers of athletes participating in youth, high school, collegiate, professional, and recreational sports. As programs and activities flourish, the program director's responsibility is to provide an environment that minimizes potential injury. However, inherent in sports participation is the risk of injury. Risk of injury is increased while participating in activities categorized as contact and collision type sports, which include ice hockey, football, soccer, martial arts, and rugby union (Matser, Kessels, Lezak, Troost, & Jordan, 2000). Head injuries encompass 14-27% of all incurred sporting injuries (Finch, et al., 2001). Specifically, concussions

account for 25% of the total head and face injuries in rugby union (Marshall & Spencer, 2001).

Defined by the Merck Manual (1992) a concussion is a head injury that is “transient posttraumatic loss of neurologic functions accompanied by structural lesions or edema” (p.1262). Kelly (2001) reports that concussions are also known as mild traumatic brain injury (MTBI), or as Matser (2000) describes, acute traumatic brain injury (ATBI). Regardless which definition is used, concussion, MTBI or ATBI, each encompasses a variation of the same signs and symptoms.

Definitions associated with concussions have been disputed (Giza & Hovda, 2001). The classic definition of concussion is a posttraumatic state that results in loss of consciousness (McCrea, 2001). Clinically, MTBI is referred to as physiologic, not anatomic disruption of the brain (Bailes & Hudson, 2001). However, there has been an increase in concussion awareness in the last ten years, thus, several standard definitions, including signs and symptoms, have been introduced as a result of the increased concussion awareness. The concussion definition generally accepted by medical professionals is characterized by impairment of neural function, loss of consciousness (LOC), disturbed vision and equilibrium and other brain stem involvement (Powell, 2001).

The Centers for Disease Control and Prevention report approximately 300,000 sport related concussions each year (Mueller, 2001). Similarly, concussions have been reported to occur 2.2 to 3.9 per 1000 player contact hours while participating in rugby union training (McIntosh, et al., 2000). Heightened awareness and education are

necessary due to the prevalence of concussion in sport participation. Specifically, education and adaptation of the laws that govern and protect athletes in a contact sport with a high prevalence of head injuries in such sports as rugby union are needed. This study will investigate the perceived effectiveness of protective headgear which has been chosen to reduce the number of concussions in rugby union.

Mechanism of Injury

Concussions occur as kinetic energy is applied to the head by acceleration, deceleration, and rotational forces. The amount of acceleration-deceleration or rotational force applied to the head may vary. Forces to the head usually result in a translational (linear) impact, which disrupts the cerebral anatomy and cytostructure (Bailes & Hudson, 2001). Rotational forces or angular movements have been shown to disrupt the secondary fixation of the brain to the cranium. However, Mueller (2001) states that the physiologic and anatomic injury caused by angular impact are not well known and require further study.

Figure 1. Human Brain Review

Note. From A.D.A.M. Medical Illustration Team Website. Review Date: 3/31/2001

In rugby union, contact resulting in concussions typically stems from head to head, head to ground, knee to head or shoulder/elbow to head contact. Generally, impacts to the head that cause concussions, as seen in Figure 1, occur in the temporo-parietal region of the cranium (Giza & Hovda, 2001; McIntosh, et al., 2000; McCrea, 2001). Impacts occur frequently in contact/collision sports, such as rugby union (Marshall & Spencer, 2001). In addition to the type of impact sustained, the speed at which an object strikes the head or the ground plays a role in the mechanism of injury. Video analysis studies by McIntosh, et al (2001) reported external objects striking the head causing a concussion had a mean speed of 5.5 m/s -1. A combination of speed, force and area struck on the head all play an important role in the severity and mechanism of concussions or MTBI.

Several pathophysiologic effects occur when an impact to the head is sustained. Due to the complexity and the obscure details regarding post-concussive physiologic symptoms, a basic overview will be presented. Giza and Hovda (2001) explain the most important components of posttraumatic cerebral concussion include but are not limited to, an abrupt release of neurotransmitters, and an unregulated ionic flux between neural synapses. In addition, when head impact occurs, a generation of lactic acid, a significant decrease in intracellular magnesium, free radical production and the beginning of the inflammatory response occur in the cranium. Previously discussed post-traumatic events that occur with head impact are the direct cause of symptoms associated with MTBI (Giza & Hovda). Bailes and Hudson (2001) explain that the significance of inflammation in the skull is the primary cause for athletes' symptoms to increase, which can result in subdural hematomas, intracranial hemorrhage or death. A subdural hematoma is defined by the Merck Manual (1992) as venous bleeding in the subdural space as a result of acceleration or deceleration forces to the head. Intracranial hemorrhage is explained in the Merck Manual (1992) as intracranial swelling or pressure within the cranium, which results in neural disruption (see Figure 2).

Figure 2. Intracranial Hemorrhage as seen through a Magnetic Resonance Image.

Note. From A.D.A.M. Medical Illustration Team Website. Review Date: 3/31/2001

Head and neck injuries with intracranial bleeding have the potential for fatal outcomes and account for over half the related deaths in high school football (Muellar, 2001). Severe head injuries that result in hematomas and increased intracranial pressure have a 50% mortality rate and can lead to fatal herniation of brain tissue through the base of the skull at the foramen magnum.

Signs and Symptoms

Collectively, the signs and symptoms associated with a concussion vary from each individual and the impact severity. Powell (2001) explains that a problem with identifying a concussion is the wide variety of signs and symptoms that may appear depending on the individual. Each sign and symptom will be categorized and assigned

grades based on severity. Categorizing signs and symptoms provides clinicians a more objective and standardized method of immediately assessing and injured athlete's mental status (McCrea, 2001). The grading system was created based on experiential theory, not scientifically based research (Bailes & Hudson, 2001). The lack of scientific research allows for many interpretations and variations to occur between grading systems.

Unfortunately, throughout history differences exist in the definition, nomenclature, and grades associated with MTBI. Regardless of the nomenclature used or scale employed, a standard is set for the definition, recognition and care of athletes with concussions.

In the United States, no governing body, including the American Medical Association or the National Athletic Trainers Association, has determined which scale to use when a concussion occurs (Powell, 2001). However, there are three accepted and universally used grading scales for concussions. Cantu (1986) developed a scale focusing on memory disturbances to classify the concussion. The memory disturbances include retrograde and anterograde amnesia. Retrograde amnesia is memory lost after an injury and anterograde amnesia is memory lost prior to injury. Recently, the Colorado Medical Society and the American Academy of Neurology have added levels of consciousness and other associated symptoms to the previous Cantu scale (Kelly, 2001). Some of these additions include tinnitus (ringing in the ears), nausea, nystagmus (involuntary movement of eye) and audio, visual and equilibrium changes.

All scales incorporate three grades associated with the documented symptoms. Grade one is a mild traumatic head injury and a grade three concussions is the most severe marked by prolonged absence of consciousness.

Table 1. Sports Concussion Grading Scales.

	Grade 1	Grade 2	Grade 3
Cantu (1986)	No loss of consciousness Post traumatic amnesia <30min	LOC <5min or posttraumatic amnesia 30min to 24hours	LOC > 5min or posttraumatic amnesia > 24hours
Colorado Medical Society (1991)	Confusion without amnesia, no LOC	Confusion with amnesia, no LOC	Loss of Consciousness
American Academy Of Neurology (1997)	Transient confusion, no LOC, concussion symptoms <15min	Transient confusion, no LOC, concussion symptoms >15min	Any loss of consciousness (brief or prolonged)

Once impact to the head occurs, depending on the severity of the damage, each individual will present different signs and symptoms and varying degrees of consciousness. One standard scale to determine MTBI severity has been developed to determine the level of coma or consciousness. The Glasgow coma scale was developed to measure the level of consciousness associated with moderate to severe head injuries (Bailes & Hudson, 2001). The Glasgow coma scale uses a point system to evaluate the LOC. The Glasgow coma scale is separated into three subdivisions, motor response, verbal response and eye opening.

Table 2: Glasgow Coma Scale

Best Motor Response	M	Best Verbal Response	V	Eye Opening	E
To Verbal Command:		oriented and converses	5	spontaneous	4
obeys	6	disoriented and converses	4	to speech	3
To Painful Stimulus:		inappropriate words	3	to pain	2
localizes pain	5	incomprehensible sounds	2	no response	1
flexion-withdrawal	4	no response	1		
flexion-abnormal	3				
extension	2				
no response	1				

The three subdivisions have several degrees of responsiveness which are accompanied by a numerical score. A lower total score on the Glasgow coma scale represents the lowest level of consciousness, a state of unconsciousness (coma). The highest point total on the comma scale indicates the least amount of damage, indicated by displaying alert and responsive answers to questions. However severe the injury, a standard assessment of concussion should be performed on all athletes with head injuries by trained health professionals. This grade, as well as clinical findings, will be the determining factor for management and return to play decisions.

Assessment and Management

Previously, inflammation and neuro-chemical changes were studied through autopsies performed on victims of fatal head injuries (Giza & Hovda, 2001). These authors also state that autopsies and diagnostic machines, such as CT scans, x-rays and MRI's are the only method of discovering the true pathomechanics of head injury. A thorough field and clinical assessment is essential when an athlete is presented to medical professionals, such as doctors, nurses, or certified athletic trainers. McCrea (2001) explains that concussions are difficult to identify because the post-concussive mental status is usually more subtle than obvious. Recently, efforts have been made in the medical community to develop a brief standardized method for assessing concussions on the field. McCrea has stated that a standardized concussion assessment method results in a more clear and accurate injury evaluation in contrast to a general clinical evaluation. Kelly (2001) states that the typical questions asked, such as "how many fingers am I holding or where are you" are of little diagnostic value. It is necessary for primary care

professionals to have a standard method to evaluate head injuries on the field. Marshall and Spencer (2001) argue that the best way to prevent concussions is to educate the people who will be responsible for caring for injured athletes.

The standardized assessment of concussion (SAC) was developed to provide clinicians with a more objective and standardized method of immediate assessment. McCrea (2001) explains that the SAC instrument is intended as a supplement to other methods of concussion evaluation (eg. postural stability testing, eye movement, and neuropsychological evaluation), but not meant to stand-alone as an assessment tool or for return to play criteria. The importance of properly assessing the concussion is to prevent further injury exacerbating the symptoms. The SAC involves questions regarding athlete orientation, immediate and delayed memory, exertion maneuvers, and concentration tests. The SAC orientation and memory tests indicate cognitive status of the athlete and give an indication of the severity. Either in a clinical or field setting, the same cognitive assessments is used to determine the severity of the injury. In addition to the use of cognitive assessments of concussions, diagnostic neuroimaging machines are used to supplement neurological evaluation. The machines used for additional assessment include, x-ray, CT scan, and MRI. The images produced indicate boney and soft tissue damage, including vasculature, meningeal tissue, as well as associated intracranial bleeding (Matser, et al., 2000). Finally, these diagnostic machines should be used when severe head injuries require more in-depth diagnosis and management, as well as for research purposes in the area of head injury.

The length of time an athlete should remain sidelined once a concussion is sustained is debated (Kelly, 2001). Return to play status is based on the severity of the symptoms and clinical findings. The argument of length of recovery is fueled by the condition known as secondary concussion syndrome or second impact syndrome. A secondary concussion is acceleration or deceleration forces to the head after the initial head injury occurs. A condition marked by a second impact following a concussion may or may not be to the head (Arnheim & Prentice, 2000). Second impact syndrome is a life threatening condition that demands immediate medical attention. Matser, et al (2000) reports sports-related second impact syndrome to have a mortality rate approaching 100%. Second impact syndrome is a condition that all health care providers should be aware of when clearing an athlete to return to play.

Return to play criteria are under constant scrutiny from athletes, coaches, and parents. The health care provider is responsible and should use extreme caution when allowing an athlete to return. Recovery time on one scale has been cited by the American Academy of Neurology as one week for mild concussions to one month for severe concussions. Kelly (2001) adds that concussions with LOC are commonly associated with longer recovery time. Several accepted scales exist that address the question of recovery time and return to play status, all of which are used as a guide and modified on an individual basis. Conservative management is the best course of action when making these decisions.

Once a head injury occurs, it is the responsibility of the medical care provider to be up to date on recognition and management of concussions. The process starts with

identifying the signs and symptoms, and properly grading the severity of the head injury. Appropriate management of the head injury is essential for a positive outcome. This may include referral for more sophisticated diagnostic evaluation. The last step is allowing an athlete to return to contact participation after proper healing time for the injury. These steps are important to this study because it sets a standard for the participants to follow when determining what type and how many concussions they have sustained, either with or without headgear use in rugby union participation.

Rugby Union

Rugby union is traditionally a European and southern hemisphere sport which lacks national exposure and intercollegiate status in the United States (Marshall & Spencer, 2001). Rugby union is continuously played and involves kicking and contesting the ball in lineouts, scrums, and rucks (Marshall & Spencer). Much like American style football, rugby union involves full body contact with the defensive goal of tackling the ball carrier to prevent scoring (IRB, 2001). Rugby union differs from American football in that 15 players participate simultaneously. Rugby union is a ball carrying sport, progressing by running with no forward passes or blocking. Tackling and contact are used to stop the opposition from scoring. Unlike American football, there are no downs or lines of scrimmage, and penalties incur when the ball is thrown forward, or blocking for the ball carrier occurs.

Headgear

The sport of rugby union is a collision sport, which involves tackling the opposition to prevent forward progress and scoring. When rugby union was invented in

1823, no protective gear was used by the players (IRB, 2001). Historically, players would protect their ears by taping them down to decrease abrasion injuries (Wilson, 1998). Other than ear tape, no other protection has been used or permitted as legal. However, recently in an age of increased competition, new training methods, and increases in speed, strength and player size, the demand for protective equipment has become a topic of great concern for the governing body in rugby union. The International Rugby Board (IRB, 2001), specifically expressed increased concern about protection against head and face injuries. Marshall and Spencer (2001) confirm the concern of head injuries by stating participants in rugby union are largely unshielded from collision forces to the head. Today, rugby union players are seeking increased amount of protective equipment, such as mouthguards, shoulder pads and headgear to protect against injury. (Hobrick, 2001)

The International Rugby Board (IRB) was formed in Dublin, Ireland in 1847 to function as the governing body for laws of the game. The IRB meets yearly to review rules, called laws in rugby union, of the game to create a fair, safe and competitive game. Specifically, player's uniforms, including protective wear is one law determined by the IRB. The IRB is aware of the need for increased head and face injury protection. Head and face injuries account for over 20% of injuries incurred in rugby union. (Finch, et al., 2001) In 1993, the IRB reviewed and included in law four the use of protective wear under the players uniform section. The IRB law 4, as it pertains to headgear, states "A player may wear headgear made of soft and thin materials provided that no part of the headgear is thicker than 1 cm when uncompressed, and no part of the headgear has a

density of more than 45 kilograms per cubic metre” (2001). In addition, only headgear approved by the IRB may be worn in official matches. Currently, only a few manufacturers and one main design of the headgear exist (see Appendix B1). Typically, headgear provides the thickest padding around the crown of the head (temporal and parietal region), with lesser strips of padding on the top of the head. In contrast, protective headgear used in other sports to prevent head injuries uses a hard outer shell and a shock absorbing liner (Wilson, 1998). Few studies have been published on the effectiveness of rugby union headgear in preventing concussions; however, the studies which focus on this topic all agree that more research is necessary (Finch, et al., 2001; Hobrick, 2001; Marshall & Spencer, 2001; McIntosh, et al., 2000; Wilson, 1998). This study investigated athlete’s perception of rugby union headgear effectiveness.

Headgear versus Helmets

Several studies state that in order for a helmet to be an effective agent against concussions, it must attenuate impact energy, thereby decreasing the impact force to the head (McIntosh, et al., 2000). McIntosh, et al., also report that the closing speed of an object striking the head, on average, will cause a concussion from 7 to 14 m/s. The introduction of headgear has raised argument about the intent of rugby union headgear. Limited information is available with regards to the effectiveness of soft headgear. Rugby union headgear has been described to protect the head and theoretically reduce the risk of brain injury (Hobrick, 2001; Marshall & Spencer, 2001; McIntosh, et al., 2000; Wilson, 1998). In contrast, some have reported the purpose of headgear is to only decrease abrasions and lacerations to the head and face (Finch, et al., 2001). This is very

different from the intended use of hard-shelled American style football, hockey or lacrosse helmets, which is to transfer and absorb to forces applied to the head by impact (Wilson, 1998). Therefore, the soft headgear in rugby union must be able to attenuate the force to prevent the concussion. Only one study tested the energy attenuation of rugby union headgear, and determined that the majority of headgear tested failed to meet the ability to diminish the force. McIntosh, et al (2000) report that most headgear tested in simulated drop tests provides insufficient protection for impacts. Therefore, further investigation is warranted in determining the effectiveness of headgear in reducing head impact.

Research indicates that the contact associated with rugby union participation has a high incidence of injury (Marshall & Spencer, 2001; McIntosh, et al., 2000; Pettersen, 2002). The elevated injury rate has spawned the development and legalization of soft headgear to decrease head injuries. Limited research reports the ineffectiveness of soft-shelled headgear to attenuate the forces that produce concussions. Clearly, research must continue to explore the effectiveness of rugby union headgear in reducing concussions. Thus, the purpose of this study was to add to the current research on the topic of rugby union headgear effectiveness.

Chapter 3

METHODS

This study used a common descriptive research method, the survey (Thomas & Nelson, 2001). The proposed research was built on a relatively few number of studies pertaining to the effectiveness of headgear in reducing concussions. Pettersen (2002) indicates that there is a need for further investigation of headgear effectiveness. Currently, there is a lack of research on rugby union headgear effectiveness in the United States. All the studies in the area of headgear effectiveness in rugby union are from Australia or Canada, where rugby union is traditionally a more popular sport. In addition, two studies using the survey method were reported in a professional journal, both of which questioned the effectiveness for the rugby union headgear. Thus, further research in the United States is warranted on the topic of rugby union headgear effectiveness in reducing concussions. This chapter will be presented in four sections: participants, apparatus and instrumentation, procedures, design and analysis of data and project completion.

Participants

Participants for this study were chosen from the current United States Rugby Football Union player enrollment list (52,185 players). This list is generated by the United States Rugby Football Union to track the number of players in the country as well as to collect dues to promote the sport in America. From this list, 200 men's collegiate participants (3% total participants) were chosen, at random, from all of the eight regions and three divisions using a random numbers list. A delimited random sample will

increase the generalizability of the results (Thomas & Nelson, 2001). By delimiting the participants to men's collegiate players, the participant demographics will also be more homogeneous.

Apparatus and Instrumentation

The purpose of this study was to determine the effectiveness of rugby union headgear in reducing concussions. The survey method was chosen to investigate the present problem in rugby union and asked to a specific population. A surveys' value is based on the premise that problems may be solved or practices improved (Thomas & Nelson, 2001).

The apparatus used in this study was the rugby union headgear, or "scrumcap." The perception of the headgear's effectiveness was the focus of the study. Rugby union headgear is a soft cap used to reduce injuries while participating. However, its effectiveness in reducing concussions is in question. Headgear is designed uniformly by manufactures to obey the guidelines set by the IRB. Rugby union headgear is made of fabric or leather and foam to form fit to the head (see Appendix B).

This survey used both open-ended and closed questions (see Appendix C). The majority of the questions were closed questions using a ranking system and a Likert scale. The scale was based on a previous study of Australian schoolboys' perception of headgear (Finch, et al., 2001). The Likert scale has five levels including always, often, sometimes, rarely, and never. Open-ended questions provided athletes the opportunity to expand or provide additional comments regarding topics (McIntosh, 2000).

Procedures

The survey was electronically mailed to participants and attempted to gain a perspective on how effective rugby union headgear is in preventing concussions. In addition, a cover letter preceded the survey in the electronic mailing (see Appendix D). The cover letter included details regarding the purpose and benefits of the study, as well as assurance in the respondent's privacy and anonymity. The cover letter also included a statement that return of the survey is consent to participate in the study. The survey and cover letter were first distributed to 10 peers and colleagues (ATC or M.D. with a minimum of 3 years experience) for critique (see Appendix F). Based on these suggestions, the survey and cover letter were revised before sending to the participants.

Random collegiate club contact information obtained from the United States Rugby Football Union membership list was used to contact club representatives via electronic mail (see Appendix E). The club contact was asked to participate in the study by forwarding the cover letter and survey link to their respective team's club electronic mailing list. The participants received the cover letter and a World Wide Web link to the survey. Once the survey was completed by each participant the data was electronically mailed to the researchers' electronic mail inbox. The data was anonymously printed and stored in a locked cabinet.

Design and Analysis of Data

The Statistical Package for Social Science (SPSS 11.0 Chicago, IL: SPSS Inc; 2001). Descriptive statistics such as mean and standard deviation was used to assess

demographic data. An analysis of data will use a nonparametric test, chi-squared to assess associations and differences in the frequencies or number of responses in each category set up by the Likert scale. The data was used to assess statistical significance of head injury occurrence between individuals who wear and don't wear headgear.

Project Completion

Data from this study will be compiled into a journal article for *The Journal of Athletic Training* according to the *Authors Notes* (see Appendix A).

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Appendix A

Authors Notes

Journal of Athletic Training

Official Publication of the National Athletic Trainers' Association

Authors' Guide

(Revised January 2002)

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discussed in the Case Report. Release forms can be obtained from the Editorial Office and from the *JAT* web page, or authors may use their own forms.

8. The *Journal of Athletic Training* uses a double-blind review process. Authors should not be identified in any way except on the title page.
9. Manuscripts are edited to improve the effectiveness of communication between author and readers and to aid the author in presenting a work that is compatible with the style policies found in the *AMA Manual of Style*, 9th ed. (Williams & Wilkins), 1998. Page proofs are sent to the author for proofreading when the article is typeset for publication. It is important that they be returned within 48 hours. Important changes are permitted, but authors will be charged for excessive alterations.
10. Published manuscripts and accompanying work cannot be returned. Unused manuscripts will be returned if submitted with a stamped, self-addressed envelope.

STYLE POLICIES

11. Each page must be printed on 1 side of 8½-by-11-inch paper, double spaced, with 1-inch margins in a font no smaller than 10 points. Each page should include line counts to facilitate the review process. Do not right justify pages.
12. Manuscripts should contain the following, organized in the order listed below, with each section beginning on a separate page:
 - a. Title page
 - b. Acknowledgments
 - c. Abstract and Key Words (first numbered page)
 - d. Text (body of manuscript)
 - e. References
 - f. Tables (each on a separate page)
 - g. Legends to figures
 - h. Figures
13. Begin numbering the pages of your manuscript with the abstract page as #1; then, consecutively number all successive pages.

14. Units of measurement shall be recorded as SI units, as specified in the *AMA Manual of Style*, except for angular displacement, which should be measured in degrees rather than radians. Examples include mass in kilograms (kg), height in centimeters (cm), velocity in meters per second ($\text{m} \cdot \text{s}^{-1}$ or m/s), angular velocity in degrees per second ($^{\circ} \cdot \text{s}^{-1}$), force in Newtons (N), and complex rates (mL/kg per minute).
15. Titles should be brief within descriptive limits (a 16-word maximum is recommended). If a disability is the relevant factor in an article, the name of the disability should be included in the title. If a technique is the principal reason for the report, it should be in the title. Often both should appear.
16. The title page should also include the name, title, and affiliation of each author, and the name, address, phone number, fax number, and e-mail address of the author to whom correspondence is to be directed. No more than 3 credentials should be listed for each author.
17. A structured abstract of no more than 250 words must accompany all manuscripts. Type the complete title (but not the authors' names) at the top, skip 2 lines, and begin the abstract. Items that are needed differ by type of article. **Literature Reviews:** Objective, Data Sources, Data Synthesis, Conclusions/Recommendations, and Key Words; **Original Research** articles: Objective, Design and Setting, Subjects, Measurements, Results, Conclusions, and Key Words; **Case Reports:** Objective, Background, Differential Diagnosis, Treatment, Uniqueness, Conclusions, and Key Words; **Clinical Techniques:** Objective, Background, Description, Clinical Advantages, and Key Words. For the Key Words entry, use 3 to 5 words that do not appear in the title.
18. Begin the text of the manuscript with an introductory paragraph or two in which the purpose or hypothesis of the article is clearly stated and developed. Tell why the study needed to be done or the article written and end with a statement of the problem (or controversy). Highlights of the most prominent works of others as related to your subject are often appropriate for the introduction, but a detailed review of the literature should be reserved for the discussion section. In a 1- to 2-paragraph review of the literature, identify and develop the magnitude and significance of the controversy, pointing out differences among others' results, conclusions, and/or opinions. The introduction is not the place for great detail; state the facts in *brief*, specific statements and reference them. The detail belongs in the discussion. Also, an overview of the manuscript is part of the abstract, not the introduction. Writing should be in the active voice (for example, instead of "Subjects were selected," use "We selected subjects") and in the first person (for example, instead of "The results of this study showed," use "Our results showed").
19. The body or main part of the manuscript varies according to the type of article (examples follow); however, the body should include a discussion section in which

the importance of the material presented is discussed and related to other pertinent literature. When appropriate, a discussion subheading on the clinical relevance of the findings is recommended. Liberal use of headings and subheadings, charts, graphs, and figures is recommended.

- a. The body of an **Original Research** article consists of a methods section, a presentation of the results, and a discussion of the results. The methods section should contain sufficient detail concerning the methods, procedures, and apparatus employed so that others can reproduce the results. The results should be summarized using descriptive and inferential statistics and a few well-planned and carefully constructed illustrations.
 - b. The body of a **Literature Review** article should be organized into subsections in which related thoughts of others are presented, summarized, and referenced. Each subsection should have a heading and brief summary, possibly one sentence. Sections must be arranged so that they progressively focus on the problem or question posed in the introduction.
 - c. The body of a **Case Report** should include the following components: personal data (age, sex, race, marital status, and occupation when relevant -- not name), chief complaint, history of present complaint (including symptoms), results of physical examination (example: "Physical findings relevant to the rehabilitation program were . . ."), medical history (surgery, laboratory results, examination, etc), diagnosis, treatment and clinical course (rehabilitation until and after return to competition), criteria for return to competition, and deviation from expectations (what makes this case unique).
 - d. The body of a **Clinical Techniques** article should include both the *how* and *why* of the technique: a step-by-step explanation of how to perform the technique, supplemented by photographs or illustrations, and an explanation of why the technique should be used. The discussion concerning the *why* of the technique should review similar techniques, point out how the new technique differs, and explain the advantages and disadvantages of the technique in comparison with other techniques.
20. Percentages should be accompanied by the numbers used to calculate them. When reporting nonsignificant results, a power analysis should be provided.
 21. **Communications** articles, including official Position Statements and Policy Statements from the NATA Pronouncements Committee; technical notes on such topics as research design and statistics; and articles on other professional issues of interest to the readership are solicited by the *Journal*. An author who has a suggestion for such a paper is advised to contact the Editorial Office for instructions.

22. The manuscript should not have a separate summary section -- the abstract serves as a summary. It is appropriate, however, to tie the article together with a summary paragraph or list of conclusions at the end of the discussion section.
23. References should be numbered consecutively, using superscripted arabic numerals, in the order in which they are cited in the text. References should be used liberally. It is unethical to present others' ideas as your own. Also, use references so that readers who desire further information on the topic can benefit from your scholarship.
24. References to articles or books, published or accepted for publication, or to papers presented at professional meetings are listed in numerical order at the end of the manuscript. Journal title abbreviations conform to *Index Medicus* style. Examples of references are illustrated below. See the *AMA Manual of Style* for other examples.

Journals:

1. van Dyke JR III, Von Trapp JT Jr, Smith BC Sr. Arthroscopic management of postoperative arthrofibrosis of the knee joint: indication, technique, and results. *J Bone Joint Surg Br*. 1995;19:517-525.
2. Council on Scientific Affairs. Scientific issues in drug testing. *JAMA*. 1987;257:3110-3114.

Book

1. Fischer DH, Jones RT. *Growing Old in America*. New York, NY: Oxford University Press Inc; 1977:210-216.
2. Spencer JT, Brown QC. Immunology of influenza. In: Kilbourne ED, Gray JB, eds. *The Influenza Viruses and Influenza*. 3rd ed. Orlando, FL: Academic Press Inc; 1975:373-393.

Presentations:

1. Stone JA. Swiss ball rehabilitation exercises. Presented at: 47th Annual Meeting and Clinical Symposia of the National Athletic Trainers' Association; June 12, 1996; Orlando, FL

Videos:

1. *Spine Injury Management* [videotape]. Champaign, IL: Human Kinetics; 2001.

Software:

1. *SPSS Base for Windows* [computer program]. Version 11.0. Chicago, IL: SPSS Inc; 2001.

Internet Sources:

1. Knight KL, Ingersoll CD. Structure of a scholarly manuscript: 66 tips for what goes where. Available at <http://www.journalofathletictraining.org/jat/66tips.html>. Accessed January 1, 1999.
2. National Athletic Trainers' Association. NATA blood borne pathogens guidelines for athletic trainers. Available at <http://www.journalofathletictraining.org>. Accessed January 1, 1999.
25. Table Style: 1) Title is bold; body and column headings are roman type; 2) units are set above rules in parentheses; 3) numbers are aligned in columns by decimal; 4) footnotes are indicated by symbols (order of symbols: *, †, ‡, §, ||, ¶); 5) capitalize the first letter of each major word in titles; for each column or row entry, capitalize the first word only. See a current issue of the *Journal* for examples.
26. All black-and-white line art should be submitted in camera-ready form. Line art should be of good quality; should be clearly presented on white paper with black ink, sans serif typeface, and no box; and should be printed on a laser printer -- no dot matrix. Figures that require reduction for publication must remain readable at their final size (either 1 column or 2 columns wide). Photographs should be glossy black and white prints. Do not use paper clips, write on photographs, or attach photographs to sheets of paper. On the reverse of each figure attach a write-on label with the figure number, name of the author, and an arrow indicating the top. (Note: Prepare the label before affixing it to the figure.) Authors should submit 1 original of each figure and 4 copies for review.
27. Authors must request color reproduction in a cover letter with the submitted manuscript. Authors will be notified of the additional cost of color reproduction and must confirm acceptance of the charges in writing.
28. Legends to figures are numbered with arabic numerals in order of appearance in the text. Legends should be printed on separate pages at the end of the manuscript.
29. The *Journal of Athletic Training* follows the redundant publication guidelines of the Council of Science Editors, Inc (*CBE Views*. 1996;19:76-77; also available on the *JAT* web site at <http://www.journalofathletictraining.org>). Authors found in violation of redundant publication will have sanctions invoked by the Journal Committee of the National Athletic Trainers' Association, Inc.

PUBLICATION POLICIES

30. Original Research manuscripts will be categorized under the following table of contents subheadings: clinical studies, basic science, educational studies, epidemiologic studies, and observational/informational studies.
31. Only Case Reports and Clinical Techniques that define and establish the optimal standard of care or the practice of athletic training will be considered for publication in *JAT*. All other Case Reports and Clinical Techniques will be considered for publication in the *NATA News*.
32. Media Reviews will appear in the *NATA News*.

Appendix B
Rugby Headgear

IRB Approved Soft-Shelled Headgear

Note. Retrieved from IRB website. Date. 3/31/2001

Appendix C

Survey

Effectiveness of Rugby Headgear in Reducing Concussions

I. Rugby History (select one)

Directions: *Please check the appropriate box that applies to you.*

A. Year in school? ☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior

B. Years Playing Rugby? ☐ 1-2 ☐ 3-4 ☐ 4-5 ☐ 5-6 ☐ 6+

(Select as many that apply)

C. Position? ☐ Prop ☐ Lock ☐ Flanker ☐ #8
 ☐ Half Back ☐ Wing ☐ Fullback
 ☐ Fly Half ☐ Center

II. Injury History while in College

Directions: *Please check the appropriate box that applies to you.*

A. In college have you had a head injury that led to a concussion? ☐ yes ☐ no

If **yes**, answer number III and go to next section.

If **No**, answer number III, thank you for your participation. Please put survey in return envelope and mail it back.

III. Headgear Effectiveness (Circle the appropriate number below)

Directions: *Please check one number.*

In your college experience how effective is headgear in reducing the number of Concussions?

-----1-----	-----2-----	-----3-----	-----4-----	-----5-----
Never	Rarely	Sometimes	Often	Always
☐	☐	☐	☐	☐

Directions: Please fill in appropriate box for each concussion (five max.) sustained in college rugby.

Concussion #	
<i>Which symptoms were felt?</i>	
<i>(Check all appropriate boxes)</i>	
☐ Headache	☐ Disorientation
☐ Nausea	☐ Amnesia
☐ Dizziness	☐ Blurred Vision
☐ Ringing Ears	☐ Fatigue
☐ Loss of Consciousness	
☐ Other	
Protective Equipment? ☐ yes ☐ no	
Mouthguard?	☐ yes ☐ no
Shoulder Pads?	☐ yes ☐ no
Headgear?	☐ yes ☐ no
Other	
Number of days felt symptoms:	

Concussion #	
<i>Which symptoms were felt?</i>	
<i>(Check all appropriate boxes)</i>	
☐ Headache	☐ Disorientation
☐ Nausea	☐ Amnesia
☐ Dizziness	☐ Blurred Vision
☐ Ringing Ears	☐ Fatigue
☐ Loss of Consciousness	
☐ Other	
Protective Equipment? ☐ yes ☐ no	
Mouthguard?	☐ yes ☐ no
Shoulder Pads?	☐ yes ☐ no
Headgear?	☐ yes ☐ no
Other	
Number of days felt symptoms:	

Concussion #	
<i>Which symptoms were felt?</i>	
<i>(Check all appropriate boxes)</i>	
☐ Headache	☐ Disorientation
☐ Nausea	☐ Amnesia
☐ Dizziness	☐ Blurred Vision
☐ Ringing Ears	☐ Fatigue
☐ Loss of Consciousness	
☐ Other	
Protective Equipment? ☐ yes ☐ no	
Mouthguard?	☐ yes ☐ no
Shoulder Pads?	☐ yes ☐ no
Headgear?	☐ yes ☐ no
Other	
Number of days felt symptoms:	

Concussion #	
<i>Which symptoms were felt?</i>	
<i>(Check all appropriate boxes)</i>	
☐ Headache	☐ Disorientation
☐ Nausea	☐ Amnesia
☐ Dizziness	☐ Blurred Vision
☐ Ringing Ears	☐ Fatigue
☐ Loss of Consciousness	
☐ Other	
Protective Equipment? ☐ yes ☐ no	
Mouthguard?	☐ yes ☐ no
Shoulder Pads?	☐ yes ☐ no
Headgear?	☐ yes ☐ no
Other	
Number of days felt symptoms:	

Concussion #*Which symptoms were felt?**(Check all appropriate boxes)*

☐ Headache	☐ Disorientation
☐ Nausea	☐ Amnesia
☐ Dizziness	☐ Blurred Vision
☐ Ringing Ears	☐ Fatigue
☐ Loss of Consciousness	
☐ Other	

Protective Equipment? ☐ yes ☐ noMouthguard? ☐ yes ☐ noShoulder Pads? ☐ yes ☐ noHeadgear? ☐ yes ☐ no

Other

Number of days felt symptoms:

Appendix D

Cover Letter

San José State
UNIVERSITY

**College of Applied
Sciences and Arts**
**Department of Human
Performance**

One Washington Square
San José, CA 95192-0054
Voice: 408-924-3010
Fax: 408-924-3053

December 1, 2002

Dear participant,

Your participation in a project regarding the effectiveness of rugby headgear in reducing concussions is needed. Specifically, a survey to ascertain the effectiveness of IRB approved headgear will add to a small body of research on protective equipment in rugby union.

Your role in this study would be to answer the survey questions as accurately and honestly as possible. The survey should take only 5 minutes. Please take time from what I realize is a demanding schedule to complete the enclosed survey packet.

In accordance with guidelines regarding research with human subjects (a) your participation is voluntary and no risks to you through participation are expected, (b) nothing adverse results from a decision not to participate, and (c) all responses will be recorded anonymously (return envelopes that included the surveys have been coded to facilitate a follow up mailing only). Additionally, your decision to complete and return the survey implies you have given informed consent for participation in this study.

Any questions or complaints regarding this project may be directed to Dr. Leamor Kahanov, Director, Graduate Athletic Training Program, at (408) 924-3040.

Your consent to participate in this study and response is much needed. The greater the number of responses the better our chances of conducting meaningful analyses in an area which is of great concern in the rugby community. Thankyou in advance for your assistance.

Sincerely,

Matthew J. Dusa, ATC

Appendix E

Peer Critique

Survey Critique

1. Is the survey clear and concise?
2. Does the survey include the appropriate pertinent detail?
3. Does the survey focus on the stated objective?
4. Other comments?