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The Effects of Two adhesive Ankle Taping Techniques Upon Selected Motor Abilities and Ankle Flexibility

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THE EFFECTS OF TWO ADHESIVE ANKLE TAPING TECHNIQUES UPON SELECTED MOTOR ABILITIES AND ANKLE FLEXIBILITY

BY

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THE EFFECTS OF TWO ADHESIVE ANKLE TAPING TECHNIQUES

UPON SELECTED MOTOR ABILITIES

AND ANKLE FLEXIBILITY

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Advisor — Date

Head, Health, Physical Education, and Recreation Department — Date

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CHAPTER I

INTRODUCTION

Significance of the Study

The ankle joint, because of the inadequate support supplied by muscles and ligaments, suffers frequent and often severe injury.[1] Many coaches and athletes believe that adhesive taping of the ankle will reduce the occurrence of ankle injuries. Garrick has shown in his study that adhesive taping does help prevent ankle injuries to some degree.[2] As a result, many athletes, professional and amateur, have their ankles taped routinely for protective purposes before practicing and playing in athletic contests.

The adhesive taping of the ankle joint helps prevent injury by reducing the maximal range of movement of the joint.[3] The athletic trainer, when applying nonelastic adhesive ankle taping, attempts to reduce the maximal range of movement without hindering an athlete's motor performance. Whether or not motor performance is restricted is not conclusive. It is of importance to the coach and athlete to know if ankle taping does significantly impair a participant's athletic performance.[4]

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[1]Carl E. Klafs and Daniel D. Amaheim, Modern Principles of Athletic Training (St. Louis, Mos.: The C. V. Mosby Company, 1969), p. 39.

[2]James G. Garrick and Ralph E. Requa, "The Roll of External Support in Prevention of Ankle Sprains," Medicine and Science in Sports, Vol. 5, No. 3., p. 202.

[3]J. L. Mayhew, "Effects of Ankle Taping on Motor Performance," Athletic Training, Vol. 7, No. 1, p. 10.

[4]Jerry R. Thomas and Doyce J. Cotton, "Does Ankle Taping Slow Down Athletes," Coach and Athlete, Vol. 24, No. 4, p. 20.

There are many techniques of taping ankles for the prevention of injuries, and Dolan states that there are 24 such methods.[5] The coach and/or trainer, depending on his background and experience, usually employs one of many methods of preventive taping of the ankle joint. Different taping techniques may vary in restricting the range of motion, thereby affecting motor performance in varying degrees.

The results of this study should be beneficial to trainers, coaches, and athletes in that it hopefully will establish a more rational approach to evaluating certain aspects of adhesive ankle taping.

Statement of the Problem

The purpose of this study was to determine the effects of two different techniques of adhesive ankle taping on the performance of selected motor skills of athletes and ankle flexibility.

Hypotheses

The following hypotheses were investigated:

There is no significant difference in the performance of selected motor skills of athletes whose ankles have been taped with the South Dakota State University Regular taping technique, the traditional closed Gibney Basketweave taping technique and no tape.

There is no significant difference in the ankle flexibility of athletes taped with the South Dakota State University Regular taping technique and the closed Gibney Basketweave taping technique.

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[5]Joseph P. Dolan and Lloyd J. Holladay, Treatment and Prevention of Athletic Injuries (Danville, Ill.: The Interstate Printers and Publishers, Inc., 1967), p. 102.

Limitations and Delimitations

1. The subjects were 29 students enrolled at South Dakota State University who have had athletic experience on the intercollegiate or the interscholastic level within the previous four years.

2. The subjects had not experienced any ankle injuries six months previous to this study.

3. The investigator had no way of evaluating the extent of motivation of each subject while performing the motor performance items.

4. The motor performance test items administered were the vertical jump, the 40 yard dash, and the Barrow zig zag run.

5. Johnson and Johnson Zonas zinc-oxide linen athletic tape was used for all the taping techniques.

6. The investigator taped all the subjects participating in this study.

Definition of Terms

Agility. Agility is the ability of an individual to move the body through total body movements in various directions.

Ankle flexibility. Ankle flexibility is the full range of motion in the ankle joint from maximum plantar flexion to maximal dorsal flexion measured in degrees of a circle.

Ankle joint. The ankle joint is the hinge joint formed by the articulation of the talus with the malleoli of the tibia and fibula.[6]

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[6]Katherine F. Wells, Kinesiology (Philadelphia, Pa.: W. B. Saunders Company, 1962), p. 250.

Goniometer. The goniometer is an instrument consisting of a protractor, a stationary arm, and a moveable arm designed to measure range of motion of joints in degrees of a circle.[7]

Neutral position. The neutral position is an angle of 90° measured at the ankle joint when the joint is in neither plantar or dorsal flexion.

Flexion. Flexion is dorsal flexion of the ankle joint measured in degrees from the neutral position.[8]

Extension. Extension is plantar flexion of the ankle joint measured in degrees from the neutral position.[9]

Straight ahead speed. Straight ahead speed is the time required to run a given distance in a straight line.

Motor performance. Motor performance is the ability of an athlete to perform fundamental motor skills in the most advantageous manner.

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[7]Harold M. Barrow and Rosemary McGee, A Practical Approach to Measurement in Physical Education (Philadelphia, Pa.: Lea and Febiger, 1971), p. 578.

[8]Ellen Neal Duvall, Kinesiology The Anatomy of Motion, (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1959), p. 34.

[9]Ibid.

CHAPTER II

REVIEW OF RELATED LITERATURE

Literature for the current study was reviewed in three areas which are: Taping and Injury Prevention, Taping and Motor Performance, and Taping and Flexibility.

Taping and Injury Prevention

Simon compared the Gibney Basketweave taping technique with the Louisiana heel lock cloth ankle wrapping for prevention of ankle injuries. He observed 75 football players treated with the two treatments and concluded there was no difference between the groups in injury prevention. No comparison was made to a nontaped group.[1]

Garrick and Requa studied 2,569 participants in a college intramural basketball program to see how the use of adhesive taping and the use of high and low topped shoes affected injury rates. The investigators observed that the use of high topped shoes and adhesive taping did appear to decrease the incidence of ankle sprains. Not enough ankle injuries were reported, however, to allow statistical analysis.

Wells surveyed athletes of 20 schools for the relationship between taping of the ankle joint and knee injuries. The investigator

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[1] James E. Simon, "Study of the Comparative Effectiveness of Ankle Taping and Ankle Wrapping on the Prevention of Ankle Injuries," Athletic Training, 4:6-7, 1969.

[2] James G. Garrick and Ralph K. Requa, "Role of External Support in Prevention of Ankle Sprains," Medicine and Science in Sports, 5:200-203, 1973.

concluded that there is no marked increase in knee injuries due to protective ankle taping.[3]

Taping and Motor Performance

It is of importance to know if adhesive taping of the ankle does significantly impair an athlete's performance. Motor performance depends on several factors and Clarke identifies these factors as muscular power, agility, muscular strength, muscular endurance, cardiovascular endurance, flexibility, and speed.[4]

Mayhew tested 66 male physical education majors in four motor performance tests with and without tape. The motor performance tests used were (1) the 50 yard dash, (2) vertical jump, (3) standing broad jump, and (4) Illinois Agility Run. The taping technique used was the standard closed Gibney Basketweave. The statistical analysis indicated that the taping did significantly impair the performances in the broad jump and vertical jump at the .05 level of confidence. The taped performance in the 50 yard dash showed a trend toward impaired performance; however, it was not significant. The Illinois Agility Run was unaffected by taping.[5]

Thomas and Cotton tested 14 athletes in the "right boomerang run" with two taping conditions and one untaped condition. The

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[3]John Wells, "The Incidence of Knee Injuries in Relation to Ankle Taping," Athletic Training, 4:4, 10-13, Winter, 1969.

[4]H. Harrison Clarke, Application of Measurement to Health, and Physical Education (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1967), p. 202.

[5]J. L. Mayhew, "Effects of Ankle Taping on Motor Performance," Athletic Training, 7:10-11, 1972.

athletes' ankles were taped using the closed basketweave procedure. In one condition only the right ankle was taped and in the other condition both ankles were taped. The taped performances were better than the untaped performances, but did not reach significance.[6]

Juvenal tested 30 male physical education majors in the running vertical jump. All subjects performed the running vertical jump under three conditions; the first being taped with linen tape, the second being taped with elastic tear tape, and the third being no tape. The taping procedures did significantly impair vertical jumping ability at the .05 level of confidence. It was further determined that the height jumped with elastic tape was significantly greater than the height jumped with linen tape.[7]

McCorkle tested 18 male subjects in three agility runs with three taping conditions and an untaped condition. The taping procedures used were the Johnson and Johnson Tape Cast, the Lonn-Mann Taping Technique, and the Springfield Modified Tape Technique. The agility runs used were the Modified Illinois Agility Run Number 1, the Modified Illinois Agility Run Number 2, and the Barrow zig zag run. Results indicated no statistical difference in the performance of the two modified Illinois Agility Runs. The Barrow zig zag run data was discarded because McCorkle felt that learning was still taking place.[8]

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[6]Jerry R. Thomas and Doyce J. Cotton, "Does Ankle Taping Slow Down Athletes?" Coach and Athlete, 24:4, 20-37, November, 1971.

[7]James Juvenal, "The Effects of Ankle Taping on Vertical Jumping Ability," Athletic Training, 7:146-149, 1972.

[8]Richard B. McCorkle, "A Study of the Effect of Adhesive Strapping Techniques on Ankle Action" (unpublished Master's thesis, Springfield College, Springfield, Mass.), 1963.

Hinshaw tested 27 male freshmen non-physical education majors in two motor performance tests with and without tape. The tests employed were the Wear Motor Ability test and the vertical jump. The group was tested three times without tape followed by three times with a basket-weave ankle taping. The average of the three trials was used for data purposes. Hinshaw found that there was a slight benefit attributed to the taping on motor performances.[9]

Taping and Flexibility

McCorkle tested five male subjects for range of maximum flexion-extension in untaped and taped ankle joints before and after physical activity using an ankle electrogoniometer. The taping procedures used were the Johnson and Johnson Tape Cast, the Lonn-Mann Taping technique, and the Springfield Modified Tape technique. It was found that taping did reduce the degree of maximum flexion-extension in the ankle joint. The Johnson and Johnson Tape Cast technique did reduce the maximum flexion-extension 16.5 degrees, the Lonn-Mann Taping technique did reduce the maximum flexion-extension 9.0 degrees, and the Springfield Modified Tape technique did reduce the maximum flexion-extension 18.1 degrees. The reduction in flexion-extension in the Lonn-Mann technique was significant at .05 level of confidence and the other two tapings were significant at the .01 level of confidence. One-leg squats and

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[9]Paul Hinshaw, "The Effect of Adhesive Ankle Strapping Upon the Motor Performance of Selected Male College Freshmen by Use of Selected Motor Ability Tests" (unpublished Master's thesis, Apalachian State University, Boone, N. C.), 1959.

an agility run were then performed and as a result the amplitude of ankle joint movement increased only slightly. The amplitude of the ankle joint increased under each taping condition as follows: The Johnson and Johnson Tape Cast 3.4 degrees, the Lonn-Mann Taping technique 2.7 degrees, and the Springfield Modified Tape technique 4.6 degrees. None of these increases were statistically significant.[10]

Bigley and Karst tested five subjects for the support given by four types of ankle taping techniques. The taping techniques utilized were the open basketweave, the open basketweave with stirrup, the open basketweave with heel lock, and the open basketweave with stirrup and heel lock. A cable tensiometer was employed to measure the resistance force the ankle exhibited as the ankle moved through its range of motion. All taping techniques provided support to begin with, but after a ten-minute exercise period, all lost a considerable amount of support. No statistical analysis was applied to the data; however, the investigators felt that the basketweave with stirrup and heel lock retained the most support.[11]

Libera tested 10 football players in order to determine the effects of a football practice session on the support and retention of support of tape and cloth wraps. Each subject experienced five

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[10]Richard B. McCorkle, "A Study of the Effect of Adhesive Strapping Techniques on Ankle Action" (unpublished Master's thesis, Springfield College, Springfield, Mass.), 1963.

[11]Gene Bigley and Ralph Karst, "The Measurable Support Given to the Ankle Joint by Conventional Methods of Taping" (unpublished Master's thesis, University of Wisconsin, Madison, Wisconsin), 1959.

treatments. The Louisiana ankle wrap, the Illinois ankle wrap, the modified basketweave taping technique, the modified basketweave and heel lock taping technique, the modified basketweave and heel lock taping technique, plus a control of no protection. The subjects participated in a spring football practice of 110 minutes consisting of the usual drills and scrimmage situations. A cable tensiometer was employed to measure the resistance force as the ankle moved through its range of motion. The basketweave and heel lock taping technique maintained 72.5% of initial support while the other methods were about 65% effective. The taping methods provided a significantly greater support (34%) than the ankle wraps in the pre- and post-measurements. Of the methods examined, the use of a heel lock in taping significantly provided higher levels of support and retention than taping without a heel lock or wrapping methods.[12]

Nelson tested male underclassmen for hip hyperextension, hip flexion, ankle extension, and ankle flexion. The subjects were equated into two groups using the 50 yard dash as the criteria. Group One was a control group while Group Two did exercises designed to increase flexibility. Seven weeks later the subjects were retested and no change in speed was found, although Group Two did have a non-significant increase in flexibility.[13]

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[12]Daniel Libera, "Ankle Taping, Wrapping, and Injury Prevention, Athletic Training, Vol. 7, No. 3, pp. 73-75.

[13]Robert Peter Nelson, "The Effect of Hip and Ankle Flexibility on Speed in Running" (unpublished Master's thesis, University of California, Los Angeles, California), 1960.

Reser tested the vertical jump of male students. The subjects' hip flexion and ankle extension were recorded and the students exercised to increase flexibility. Reser found upon retesting the individuals that there was some indication that only the degree of ankle extension has an effect on the vertical jump of individuals, but that it was not significant.[14]

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[14]James Marshall Reser, "The Effect of Increasing Range of Motion on Vertical Jump" (unpublished Master's thesis, University of California, Los Angeles, California), 1961.

CHAPTER III

METHODS AND PROCEDURES

Organization and Source of Data

The study was conducted during the months of April, May and June, 1974. Originally 31 students enrolled at South Dakota State University who had athletic experience on the intercollegiate or interscholastic level within the previous four years volunteered as subjects for this study. The subjects had not experienced any ankle injuries during the six months preceding the testing. All subjects took the motor performance tests under three treatments; ankles being taped using the South Dakota State Regular technique, ankles being taped using the traditional Gibney Basketweave technique, and the no-tape treatment. The motor performance tests administered were the 40 yard dash, the standing vertical jump and the Barrow zig zag run. Two subjects did not complete the treatments and tests due to injuries received in accidents unrelated to this study. The data on 29 subjects were included for analysis.

The second variable investigated was the testing for flexibility of the ankle joint during untaxed and taxed conditions. Employing a modified goniometer, the flexibility of the ankle joint was determined prior to adhesive taping, immediately upon completion of adhesive taping prior to the subjects' bearing weight on the ankle joint, and upon completion of the motor performance test battery. No flexibility was determined for the ankle joint during sessions where the subjects were administered the no-tape treatment.

A pilot study was conducted involving 11 volunteer subjects to perfect the taping techniques and to become acquainted with the testing procedures. The taping techniques were evaluated by the head athletic trainer at South Dakota State University and the testing procedures were checked by the investigator's advisor.

All subjects were taped by the investigator. A 1 1/2 inch zinc-oxide linen tape, brand name "Zonas", was used for all taping. The subjects were prepared for taping by first shaving the leg, drying with a towel, and applying a light coat of tape adherent. The tape was placed directly on the skin. The taping techniques outlined in this study were strictly adhered to. The taping was conducted under the supervision of James Booher, Registered Physical Therapist and certified athletic trainer, South Dakota State University. All taping procedures were applied to the subjects so that the subjects considered the tape comfortable.

Table I indicates the sequential order of treatments and also the sequential order of the motor performance test for the 31 subjects. To prevent learning, fatigue, and the effects of the loosening of the tape, the sequences of treatment and testing were rotated. All subjects were assigned a number and followed the assigned sequence orders. For example, Subject 1 was taped with the South Dakota State University regular technique at the first session and performed the motor tests in the following order: vertical jump, zig zag run and 40 yard dash. At session two, approximately one week later, Subject 1 was administered the no-tape treatment and performed the motor tests in the same sequence. During the third session, approximately another week later, Subject 1

TABLE I

SEQUENTIAL ORDER OF TAPING
AND TESTING SUBJECTS

Motor Performance Test Sequence / Taping Technique Sequence	Vertical Jump Zig Zag Run 40 Yard Dash	Zig Zag Run 40 Yard Dash Vertical Jump	40 Yard Dash Vertical Jump Zig Zag Run
SDSU Regular Technique No-Tape Gibney Technique	1, 19, 28	4. 13, 22	7, 16, 25
No-Tape Gibney Technique SDSU Regular Technique	2, 10, 11 20*, 29	5, 14, 23	8, 17, 21, 26
Gibney Technique SDSU Regular Technique No-Tape	3, 12, 30*	6, 15, 24	9, 18, 27, 31

*Subject 20 and Subject 30 did not complete the treatments or tests due to injuries received in accidents unrelated to this study.

was taped using the Gibney Basketweave technique and performed the motor tests in the same sequence. Subject 14 was tested for motor performance at all sessions in the following sequence: zig zag run, 40 yard dash, and vertical jump. At the first session Subject 14 was administered the no-tape treatment, at session two he was taped utilizing the Gibney Basketweave technique, and at session three he was taped utilizing the South Dakota State University Regular taping technique. All sessions met approximately at one week intervals.

Prior to being tested, the subjects jogged two laps around the gymnasium and were allowed to do as many stretching exercises as they desired.

Administration of the Treatment

The treatments selected for this study were (1) the South Dakota State University Regular taping technique, (2) the Gibney Basketweave technique, and (3) no tape.

The South Dakota State University Regular Taping Technique. The South Dakota State University Regular taping technique was selected because it is the taping technique primarily employed by the trainers at South Dakota State University for the prevention of ankle injuries. This technique was developed by James Booher, the head athletic trainer at South Dakota State University, during seven years experience in the athletic training field.

Figure 1 illustrates the "regular" taping technique and is described as follows.

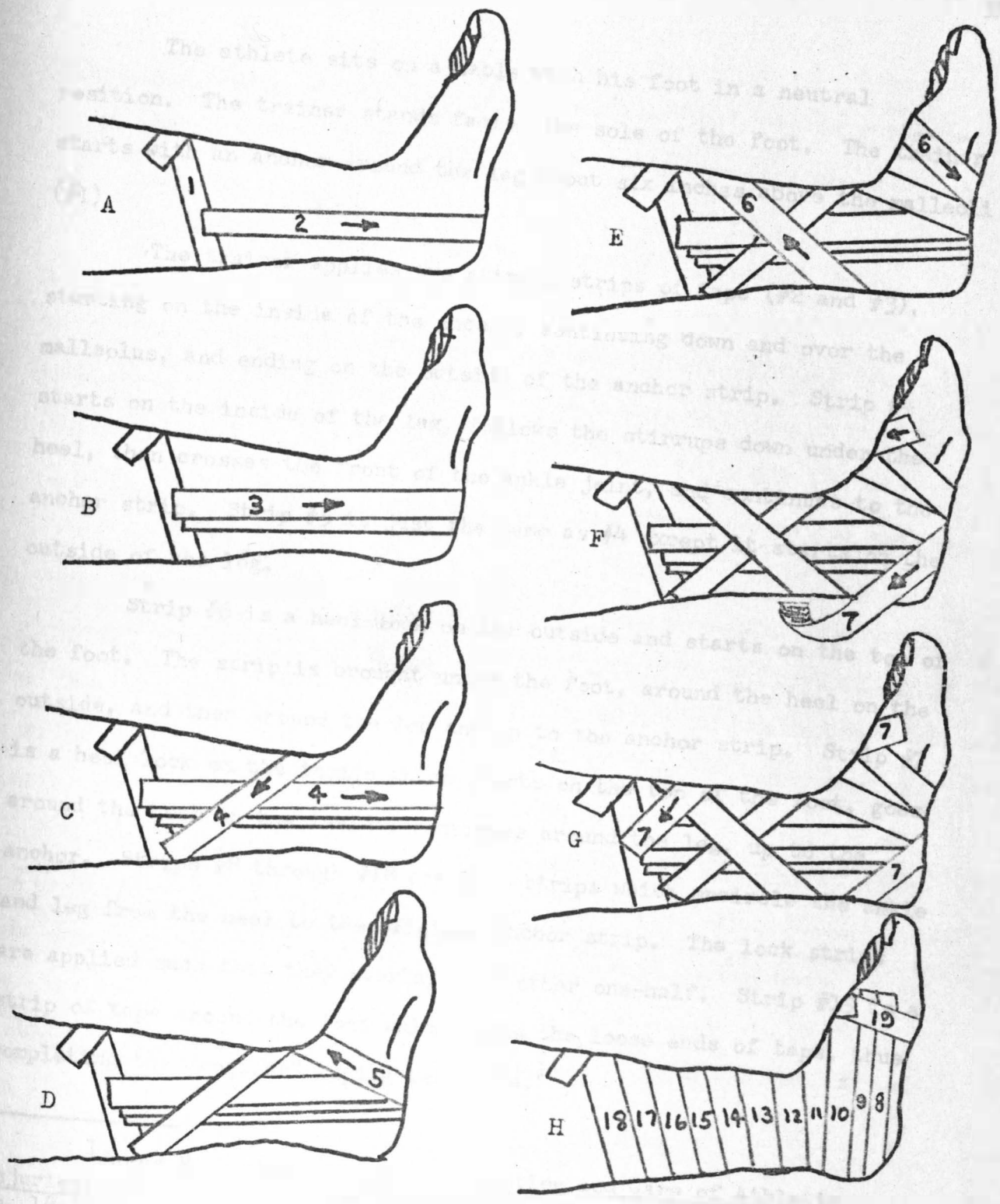

Figure 1

"Regular" Taping Technique

The athlete sits on a table with his foot in a neutral position. The trainer stands facing the sole of the foot. The trainer starts with an anchor around the leg about six inches above the malleoli (#1).

The trainer applies two stirrup strips of tape (#2 and #3), starting on the inside of the anchor, continuing down and over the malleolus, and ending on the outside of the anchor strip. Strip #4 starts on the inside of the leg, follows the stirrups down under the heel, then crosses the front of the ankle joint, and continues to the anchor strip. Strip #5 is just the same as #4 except it starts on the outside of the leg.

Strip #6 is a heel lock on the outside and starts on the top of the foot. The strip is brought under the foot, around the heel on the outside, and then around the leg and up to the anchor strip. Strip #7 is a heel lock on the inside which starts on the top of the foot, goes around the heel on the inside, continues around the leg, up to the anchor. Strips #8 through #18 are lock strips which encircle the ankle and leg from the heel to the original anchor strip. The lock strips are applied such that they overlap each other one-half. Strip #19 is a strip of tape around the foot which locks the loose ends of tape, thus completing the "regular" taping technique.[1]

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[1]James M. Booher, Manual: Prevention and Care of Athletic Injuries, South Dakota State University, Brookings, South Dakota, 1970, pp. 18-21.

The Closed Gibney Basketweave Taping Technique. The Gibney Basketweave technique was selected because Klafs and Arnheim state that it is traditionally the most widely used taping technique employed for the prevention of ankle injuries.[2]

Figure 2 illustrates the Closed Gibney Basketweave taping technique and is described as follows.

The athlete sits on a table with his leg extended and his foot in a neutral position. The trainer stands facing the sole of the athlete's foot. One anchor is placed around the leg about 5 inches above the malleoli (#1), and second anchor is placed around the arch and instep (#2). The trainer applies the first stirrup strip of tape (#3), starting on the anchor on the inside of the leg, continuing down the leg posterior to the malleolus, under the heel, and up to the opposite side of the ankle posterior to the malleolus, and ending on the anchor strip. The first Gibney (#4) is started on the inside, runs under the malleolus, and is attached to the foot anchor.

In an alternating series, 3 stirrups (#3, #5, #7) and 3 Gibneys (#4, #6, #8) are placed on the ankle, with each strip of tape overlapping at least one-half of the preceding strip. After the basketweave series has been applied, the Gibneys are continued on up the ankle (#9-#14), thus giving circular support. Three circular strips (#15, #16, #17) are applied to the arch of the foot.

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[2]Carl E. Klafs and Daniel D. Arnheim, Modern Principles of Athletic Training (St. Louis, Mo.: The C. V. Mosby Company, 1969), p. 248.

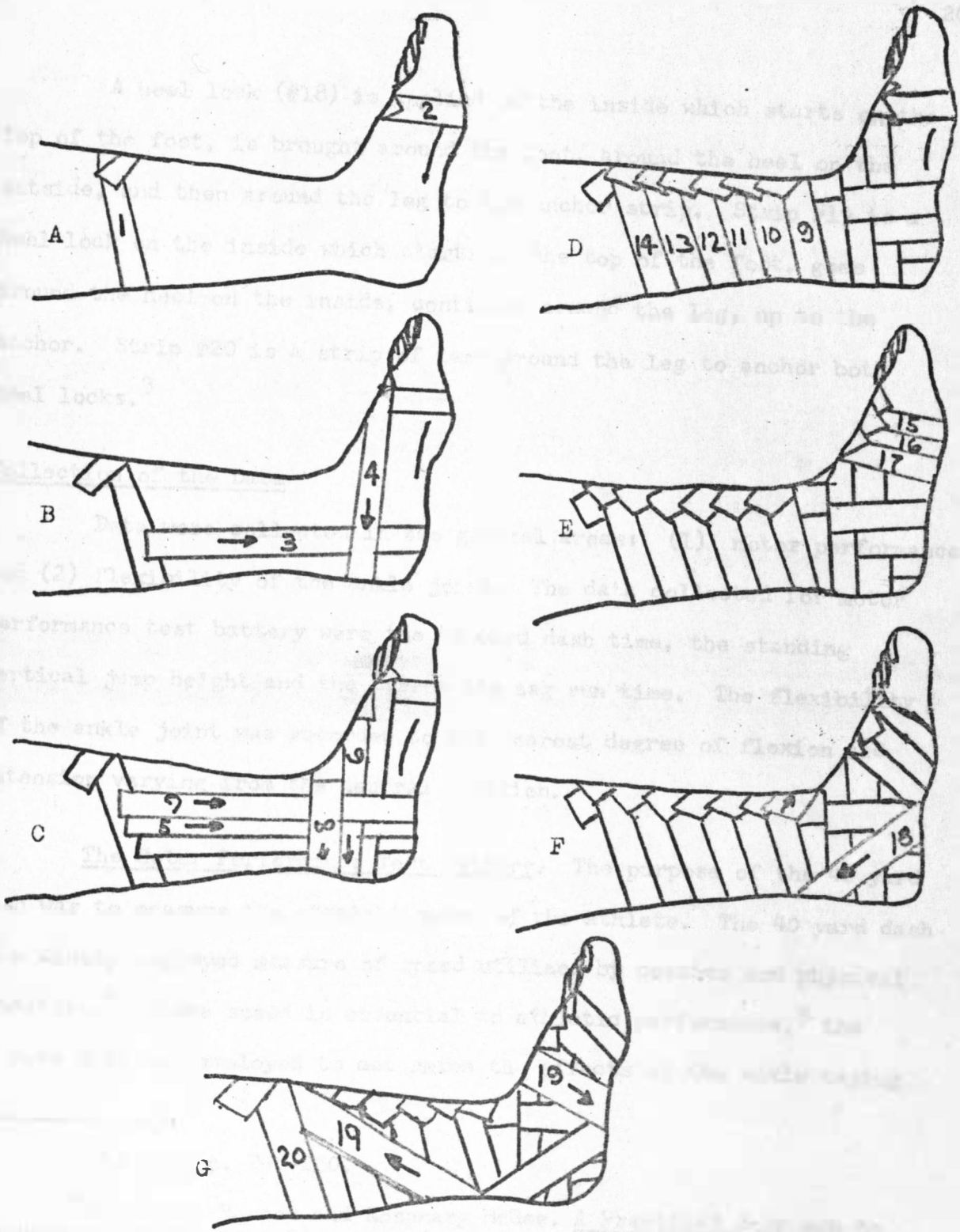

Figure 2

Basketweave Taping Technique

A heel lock (#18) is applied on the inside which starts on the top of the foot, is brought around the foot, around the heel on the outside, and then around the leg to the anchor strip. Strip #19 is a heel lock on the inside which starts on the top of the foot, goes around the heel on the inside, continues around the leg, up to the anchor. Strip #20 is a strip of tape around the leg to anchor both heel locks.[3]

Collection of the Data

Data were collected in two general areas: (1) motor performance and (2) flexibility of the ankle joint. The data collected for motor performance test battery were the 40 yard dash time, the standing vertical jump height and the Barrow zig zag run time. The flexibility of the ankle joint was recorded to the nearest degree of flexion and extension varying from the neutral position.

The Motor Performance Test Battery. The purpose of the 40 yard dash was to measure the straight speed of the athlete. The 40 yard dash is a widely employed measure of speed utilized by coaches and physical educators.[4] Since speed is essential to athletic performance,[5] the 40 yard dash was employed to determine the effects of the ankle taping

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[3]Klafs, pp. 248-250.

[4]Harold M. Barrow and Rosemary McGee, A Practical Approach to Measurement in Physical Education (Philadelphia, Pa.: Lea and Febiger, 1971), p. 121.

[5]H. Harrison Clarke, Application of Measurement to Health and Physical Education (Englewood Cliffs, N. J.: Prentice Hall, 1967), p. 202.

techniques upon speed. The 40 yard dash was administered indoors on a wooden gymnasium floor. A standing start was employed by the subjects. The timer was stationed at the finish line and started the stop watch on the first movement of the subject's feet. The timer stopped the watch as the runner crossed the finish line. Only one trial was permitted unless unforeseen circumstances arose. The time to the nearest tenth of a second was recorded on a score sheet.[6]

The standing vertical jump was administered to measure the jumping height of the athlete. The standing vertical jump is an often used test to measure leg power.[7] Since muscular power is considered essential to motor performance,[8] the standing vertical jump was utilized to determine the effects of the ankle taping techniques upon leg power. The test was administered utilizing chalk powder and a smooth wall surface. The subject stood facing the wall, feet flat on the floor and marked the wall at the point of highest reach. The subject next turned sideways to the wall, crouched, and jumped vertically as high as possible. At the height of his jump, the subject touched the wall and made a second powder mark. The difference between the two chalk marks was his vertical jump. Three trials were permitted and the best jump was recorded. The jump was measured to the nearest 1/2 inch employing a yard stick.[9]

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[6]Barrow, p. 236-237.

[7]Barrow, p. 122.

[8]Clarke, p. 202.

[9]Barrow, p. 164.

The Barrow zig zag run (Figure 3) was administered to measure the agility of athletes. The Barrow zig zag run is a test developed by Harold M. Barrow to measure agility.[10] Since agility is considered essential to motor performance,[11] the Barrow zig zag run was employed to determine the effects of the ankle taping techniques upon agility. The Barrow zig zag run was administered on a wooden gymnasium floor utilizing volleyball standards as obstacles. The athlete began at the start line and followed the prescribed course for three complete laps and finished at the finish line. Only one trial was permitted, unless unforeseen circumstances arose. The time required to run the prescribed course was recorded to the nearest tenth of a second.[12]

The raw data for the motor performance test battery appear in Appendix A.

The test for ankle flexibility. The purpose of the ankle flexibility test was to measure maximum flexion and extension of the ankle joint from the neutral position. Flexibility was tested because the flexibility of a joint effects the forces a muscle can exert and consequently effects the motor performance of that individual.[13] The goniometer is an often used instrument to measure flexibility of joints.[14]

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[10]Ibid., p. 123.

[11]Clarke, p. 202.

[12]Barrow, pp. 158-160

[13]John W. Northrip, Gene A. Logan, and Wayne C. McKinney, Introduction to Biomechanic Analysis of Sport (Dubuque, Iowa: Wm. C. Brown Company Publishers, 1974), p. 76.

[14]Barrow, p. 578.

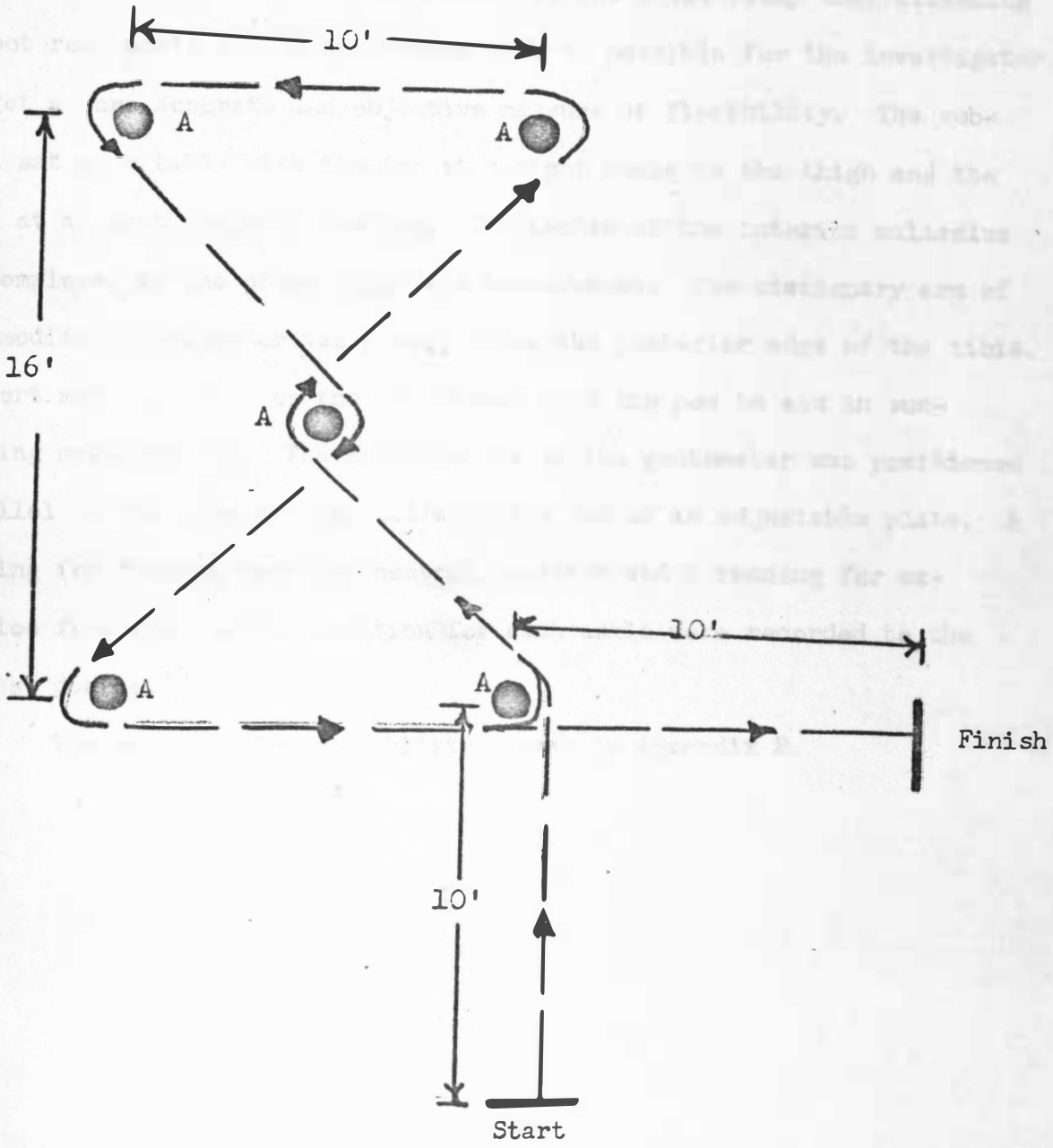

Figure 3

The Zig Zag Run Course

(A) Volleyball standards. The course is run three times before crossing the finish line.

A modified goniometer, as developed by the investigator, was employed in this test (Figure 4). It was found in the pilot study that attaching a foot rest plate to the goniometer made it possible for the investigator to get a more accurate and objective measure of flexibility. The subject sat on a table with the leg at a right angle to the thigh and the foot at a right angle to the leg. The center of the interior malleolus was employed as the pivot point for measurement. The stationary arm of the modified goniometer was placed along the posterior edge of the tibia. A short mark was made on the leg with a felt tip pen to aid in succeeding measurements. The moveable arm of the goniometer was positioned parallel to the sole of the foot with the aid of an adjustable plate. A reading for flexion from the neutral position and a reading for extension from the neutral position for each ankle were recorded to the nearest degree.[15]

The raw data for flexibility appear in Appendix B.

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[15]American Academy of Orthopedic Surgeons, Joint Motion: Method of Measuring and Recording, 1963, pp. 72-73.

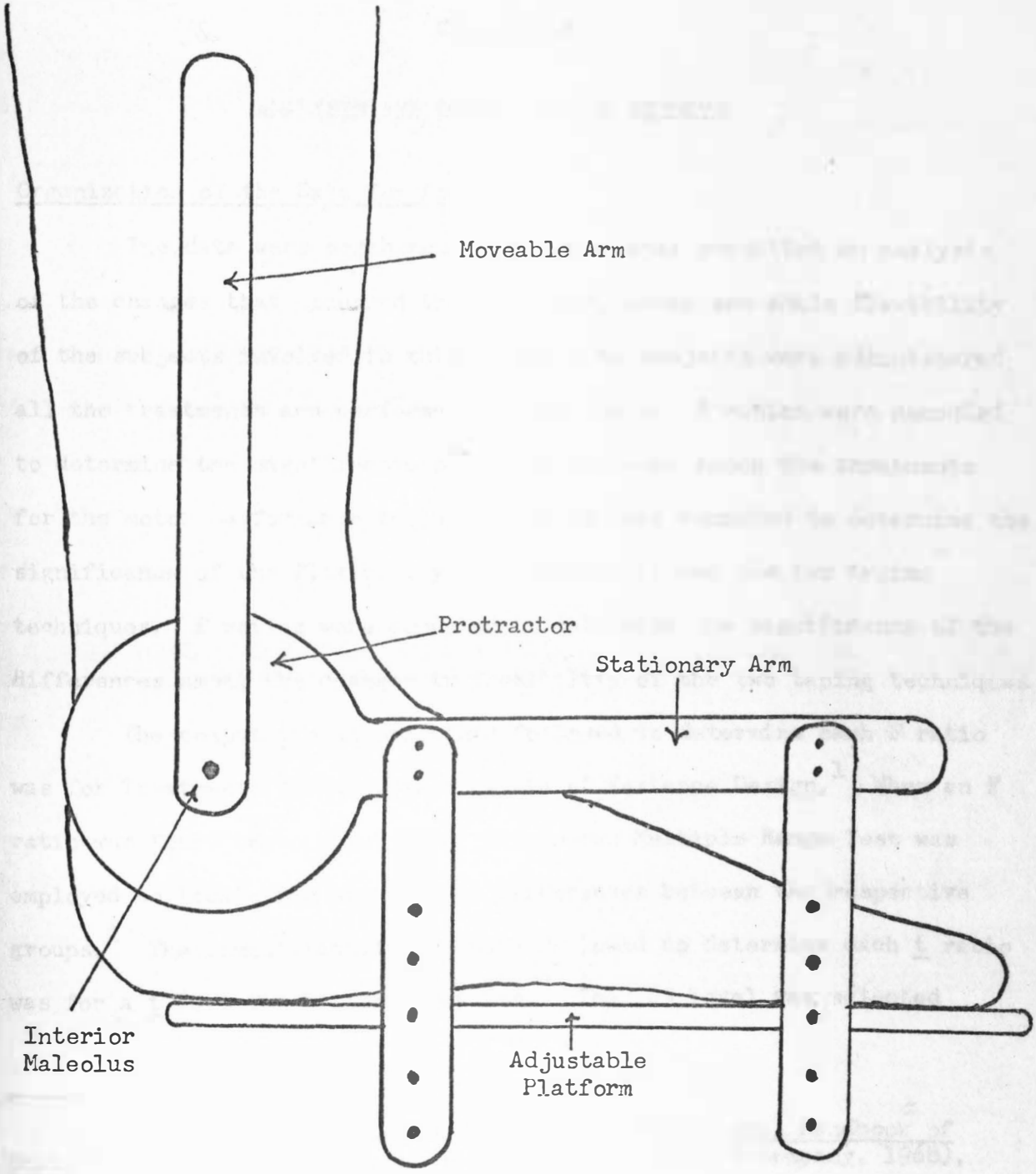

Figure 4

The Modified Goniometer

CHAPTER IV

ANALYSIS AND DISCUSSION OF RESULTS

Organization of the Data for Analysis

The data were organized in a manner that permitted an analysis of the changes that occurred in motor performance and ankle flexibility of the subjects involved in this study. The subjects were administered all the treatments and performed all the tests. F ratios were computed to determine the significance of the differences among the treatments for the motor performance tests. *t* ratios were computed to determine the significance of the flexibility differences between the two taping techniques. F ratios were computed to determine the significance of the differences among the changes in flexibility of the two taping techniques.

The computational procedure followed to determine each F ratio was for Treatments by Subjects Analysis of Variance Design.[1] When an F ratio was found to be significant the Duncan Multiple Range Test was employed to locate the significant differences between the respective groups.[2] The computational procedure followed to determine each *t* ratio was for a *t* Test for Related Measures.[3] The .05 level was selected

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[1]James L. Bruning and B. L. Kintz, Computational Handbook of Statistics, (Glenview, Illinois: Scott, Foresman and Company, 1968), pp. 43-47.

[2]Ibid., pp. 115-117.

[3]Ibid., pp. 12-15.

as the minimum level of confidence for the acceptance of significant differences. Raw scores for the statistical analysis are found in Appendices A and B.

Analysis of the Data for Motor Performance

The subjects scores in each of the motor performance tests were employed to compute the means for the respective test scores. Analyses of variance were computed using change between each treatments means as the criterion for the analysis. The means and standard deviations of the motor performance test scores are shown in Table II.

TABLE II

MEANS AND STANDARD DEVIATIONS OF THE MOTOR PERFORMANCE TESTS FOR THE DIFFERENT TREATMENTS

Treatment	40 Yd. Dash		Vertical Jump		Barrow Zig zag Run	
	Mean	S. D.	Mean	S. D.	Mean	S. D.
No tape	5.36	0.33	21.51	3.28	27.48	1.76
SDSU Regular Taping Technique	5.49	0.33	20.90	2.98	27.84	1.78
Gibney Basket-weave Taping Technique	5.45	0.35	20.53	3.19	27.67	1.81

Analysis of the data for the 40 Yard Dash. The results of the analysis of variance for the changes among treatments obtained from the 40 yard dash test are found in Table III. The F ratio of 5.43 indicated a significant difference beyond the .01 level of confidence.

TABLE III

ANALYSIS OF VARIANCE OF THE CHANGE IN 40 YARD DASH TIME MEANS AMONG TREATMENTS

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	F*
Total	9.89	86		
Subjects	8.37	28		
Treatments	0.25	2	0.125	5.43
Error	1.27	56	0.023	

*$F_{.01}$ (2/56) = 4.98

$F_{.05}$ (2/56) = 3.15

The results of the Duncan Multiple Range Test analyzing the performance time means among treatments are shown in Table IV.

TABLE IV

RESULTS OF THE DUNCAN MULTIPLE RANGE TEST COMPARING THE 40 YARD DASH TIME MEANS BETWEEN TREATMENTS

Treatment		No tape	Gibney Basketweave	SDSU Regular
	Mean	5.36	5.45	5.49
No tape	5.36		.09	.13*
Gibney Basketweave	5.45			.04
SDSU Regular	5.49			

*Indicates significance beyond the .01 level of confidence

R_2: .01 = .11

R_3: .01 = .11

R_2: .05 = .08

R_3: .05 = .09

The mean time of 5.36 seconds shown by the No-tape treatment was significantly better than the mean times of 5.45 seconds shown by the Gibney Basketweave treatment and 5.49 seconds shown by the South Dakota State University Regular treatment. No significant difference was found between the mean times of the Gibney Basketweave treatment and of the South Dakota State University Regular treatment.

Analysis of the data for the Standing Vertical Jump. The results of the analysis of variance for the changes among treatments obtained from the standing vertical jump are found in Table V. The F ratio of 5.94 indicated a significant difference among treatments beyond the .01 level of confidence.

TABLE V

ANALYSIS OF VARIANCE OF THE CHANGE IN VERTICAL JUMP HEIGHT MEANS AMONG TREATMENTS

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	F*
Total	851.59	86		
Subjects	766.09	28		
Treatments	14.97	2	7.49	5.49
Error	70.53	56	1.26	

*$F_{.01}$ (2/56) = 4.98
$F_{.05}$ (2/56) = 3.15

The results of the Duncan Multiple Range Test analyzing the performance time means among treatments are shown in Table IV.

TABLE VI

RESULTS OF THE DUNCAN MULTIPLE RANGE TEST COMPARING THE VERTICAL JUMP HEIGHT MEANS BETWEEN TREATMENTS

Treatment		Gibney Basketweave	SDSU Regular	No Tape
	Mean	20.53	20.90	21.51
Gibney Basketweave	20.53		.37	.98*
SDSU Regular	20.90			.61
No tape	21.51			

*Indicates significance beyond the .01 level of confidence

R_2: .01 = .82
R_3: .01 = .85
R_2: .05 = .60
R_3: .05 = .64

The mean height of 21.51 inches shown by the no-tape treatment was significantly better than the mean heights of 20.90 inches shown by the South Dakota State University Regular treatment and of 20.53 inches shown by the Gibney Basketweave treatment. No significant difference was found between the mean heights of the South Dakota State Regular treatment and of the Gibney Basketweave treatment.

Analysis of the data for the Barrow Zig Zag Run. The results of the analysis of variance for the changes among treatments obtained from the Barrow zig zag run are found in Table VII. The F ratio of 0.99 indicated there was no significant difference among treatments at the .05 level of confidence.

TABLE VII

ANALYSIS OF VARIANCE OF THE CHANGE IN PERFORMANCE MEANS AMONG TREATMENTS

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	F*
Total	268.60	86		
Subjects	211.85	28		
Treatments	1.94	2	0.97	0.99
Error	54.81	56	0.98	

*$F_{.01}$ (2/56) = 4.98
$F_{.05}$ (2/56) = 3.15

Analysis of the Data for Ankle Flexibility

The subjects scores recorded in degrees in each of the ankle flexibility tests were employed to compute the means for the respective tests. t ratios were computed using the change between the two taped treatments means as the criterion for analysis. Analysis of variance were computed using the changes among the two taped treatments as the criterion for analysis. The means and standard deviations of the flexibility tests are shown in Table VIII.

Analysis of the Data for the Comparison for Flexibility Between the Two Taped Treatments. The subjects scores in each of the flexibility tests were employed to compute the mean differences for the respective tests. The mean differences and the standard deviations of the mean differences are shown in Table IX.

TABLE VIII

MEANS AND STANDARD DEVIATIONS OF THE FLEXIBILITY TESTS FOR THE DIFFERENT TREATMENTS

Treatment	SDSU Regular Mean	SDSU Regular S. D.	Gibney Basketweave Mean	Gibney Basketweave S. D.
Flexion				
Before taping	16.57	5.32	16.71	5.63
Taped	10.60	6.15	12.00	5.45
Test Completed	14.03	4.88	14.17	5.54
Extension				
Before taping	50.74	7.79	52.02	6.75
Taped	43.71	7.87	41.55	7.57
Test Completed	45.26	7.89	44.76	6.03

TABLE IX

MEANS AND STANDARD DEVIATIONS OF THE DIFFERENCES BETWEEN MEANS FOR THE FLEXIBILITY TESTS FOR THE TAPED TREATMENTS

Difference	SDSU Regular Mean	SDSU Regular S. D.	Gibney Basketweave Mean	Gibney Basketweave S. D.
Flexion				
Before taping minus taped	5.84	4.60	4.71	5.18
Before taping minus test completed	2.53	4.22	2.53	4.77
Extension				
Before taping minus taped	7.03	6.55	10.47	6.65
Before taping minus test completed	5.48	6.90	7.26	5.04

The results of the t ratios for the comparison between taped treatments are found in Table X. The t ratios of -72, 77, and -178 indicate a significance beyond the .01 level of confidence.

TABLE X

t RATIOS OF THE COMPARISON OF MEAN DIFFERENCES BETWEEN TAPED TREATMENTS

Difference	t Ratio Flexion	t Ratio Extension
Before taping minus taped	77*	-178*
Before taping minus test completed	0	- 72*

* Indicates significance beyond the .01 level of confidence

$t_{.01}\ (57) = .68$

$t_{.05}\ (57) = 2.00$

The mean difference of 5.84 degrees for ankle flexion shown by the South Dakota State University Regular treatment was significantly greater than the mean difference of 4.71 degrees for flexion shown by the Gibney Basketweave treatment. The mean differences of 10.47 degrees and 7.26 degrees for ankle extension shown by the Gibney Basketweave treatment were significantly greater than the mean differences of 7.03 degrees and 5.48 degrees for ankle extension shown by the South Dakota State University Regular treatment.

Analysis of the data for the Retention of Stability. The results of the analysis of variance for the flexion changes within the South Dakota State University Regular treatment are found in Table XI. The F ratio of 24.53 indicated a significant difference among flexion measurements beyond the .01 level of confidence.

TABLE XI

ANALYSIS OF VARIANCE OF THE CHANGE IN FLEXION WITHIN THE SOUTH DAKOTA STATE UNIVERSITY REGULAR TREATMENT

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	F*
Total	7124	173		
Subjects	3811	57		
Treatments	997	2	498.5	24.53
Error	2316	114	20.32	

*$F_{.01(2/114)} = 4.79$
$F_{.05(2/114)} = 3.07$

The results of the Duncan Multiple Range Test analyzing the flexion results are shown in Table XII.

TABLE XII

RESULTS OF THE DUNCAN MULTIPLE RANGE TEST COMPARING THE FLEXION MEANS WITHIN THE SOUTH DAKOTA STATE UNIVERSITY REGULAR TREATMENT

		Taped	Test Completed	Before Taping
	Mean	10.60	14.03	16.57
Taped	10.60		3.43	.97*
Test Completed	14.03			2.54*
Before Taping	16.57			

*Indicates significance beyond the .01 level of confidence

R_2: .01 = 2.29
R_3: .01 = 2.39
R_2: .05 = 1.67
R_3: .05 = 1.76

The mean flexion of 16.57 degrees shown before taping was significantly greater than the flexion mean of 14.03 degrees shown upon completion of the tests and the flexion mean of 10.60 degrees shown taped. The mean flexion of 14.03 degrees shown taped was significantly greater than the mean flexion of 10.60 degrees shown before taping.

The results of the analysis of variance for the flexion changes within the Gibney Basketweave treatment are found in Table XIII. The F ratio of 26.83 indicated a significant difference among flexion measurements beyond the .01 level of confidence.

TABLE XIII

ANALYSIS OF VARIANCE OF THE CHANGE IN FLEXION WITHIN THE GIBNEY BASKETWEAVE TREATMENT

Source Variance	Sum of Squares	Degrees of Freedom	Mean Squares	F*
Total	5892	173		
Subjects	3880	57		
Treatments	644	2	322	26.83
Error	1368	114	12	

$F_{.05}$ (2/144) = 4.79

$F_{.05}$ (2/114) = 3.07

The results of the Duncan Multiple Range Test analyzing the flexion results are shown in Table XIV.

TABLE XIV

RESULTS OF THE DUNCAN MULTIPLE RANGE TEST COMPARING THE FLEXION MEANS WITHIN THE GIBNEY BASKETWEAVE TREATMENT

		Taped	Test Completed	Before Taping
	Mean	12.00	14.17	16.71
Taped	12.00		2.17*	4.71*
Test Completed	14.17			2.54*
Before Taping	16.71			

*Indicates significance beyond the .01 level of confidence

R_2: .01 = 1.75
R_3: .01 = 1.83
R_2: .05 = 1.27
R_3: .05 = 1.34

The mean flexion of 16.71 degrees shown before taping was significantly greater than the mean flexion of 14.17 degrees shown upon completion of the tests and the mean flexion of 12.00 degrees shown taped. The mean flexion of 14.17 degrees shown upon completion of the tests was significantly greater than the mean flexion of 12.00 degrees shown taped.

The results of the analysis of variance for extension changes within the South Dakota State University Regular treatment are found in Table XV. The F ratio of 46.73 indicated a significant difference among extension measurements beyond the .01 level of confidence.

TABLE XV

ANALYSIS OF VARIANCE OF THE CHANGE IN EXTENSION WITHIN THE SOUTH DAKOTA STATE UNIVERSITY REGULAR TREATMENT

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	F*
Total	12121	173		
Subjects	8603	57		
Treatments	1585	2	7925	46.73
Error	1933	114	16.96	

*F .01 (2/114) = 4.73

F .05 (2/114) = 3.07

The results of the Duncan Multiple Range Test analyzing the extension results are shown in Table XVI.

TABLE XVI

RESULTS OF THE DUNCAN MULTIPLE RANGE TEST COMPARING THE EXTENSION MEANS WITHIN THE SOUTH DAKOTA STATE UNIVERSITY TREATMENT

		Taped	Test Completed	Before Taping
	Mean	43.71	45.26	50.74
Taped	43.71		1.55	7.07*
Test Completed	45.26			5.48*
Before Taping	50.74			

*Indicates significance beyond the .01 level of confidence

R_2: .01 = 2.10
R_3: .01 = 2.19
R_2: .05 = 1.53
R_3: .05 = 1.61

The mean extension of 50.74 degrees shown before taping was significantly greater than the mean extension of 45.26 degrees shown upon completion of the tests and the mean extension of 43.71 degrees shown when taped. The mean extension of 45.26 degrees shown upon completion of the tests was significantly greater than the mean extension of 43.71 degrees shown when taped.

The results of the analysis of variance for extension changes within the Gibney Basketweave treatment are found in Table XVII. The F ratio of 95.78 indicated a significant difference among extension measurements beyond the .05 level of confidence.

TABLE XVII

ANALYSIS OF VARIANCE OF THE CHANGE IN EXTENSION WITHIN THE GIBNEY BASKETWEAVE TREATMENT

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	F*
Total	11265	173		
Subjects	5945	57		
Treatments	3335	2	1667.50	95.78
Error	1985	114	17.41	

*$F_{.01}$ (2/114) = 4.79

$F_{.05}$ (2/114) = 3.07

The results of the Duncan Multiple Range Test analyzing the extension results are shown in Table XVIII.

TABLE XVIII

RESULTS OF THE DUNCAN MULTIPLE RANGE TEST COMPARING THE EXTENSION MEANS WITHIN THE GIBNEY BASKETWEAVE TREATMENT

		Taped	Test Completed	Before Taping
	Mean	41.55	44.76	52.02
Taped	41.55		3.21*	10.47*
Test Completed	44.76			7.26*
Before Taping	52.02			

*Indicates significance beyond the .01 level of confidence

R_2: .01 = 2.14
R_3: .01 = 2.23
R_2: .05 = 1.56
R_3: .05 = 1.61

The mean extension of 52.02 degrees shown before taping was significantly greater than the mean extension of 44.76 degrees shown upon completion of the tests and the mean extension of 41.55 degrees shown upon completion of the tests was significantly greater than the mean extension of 41.55 degrees shown when taped.

Summary and Discussion of Results

The F ratio of 5.43 obtained from the analysis of the 40 yard dash time means indicated a significant difference between at least two groups had occurred. Results of the Duncan Multiple Range Test signified that the mean times of the athletes when taped with the South Dakota State University Regular taping technique and when taped with the Gibney Basketweave taping technique were significantly greater than the mean time of the no-tape treatment. The results imply that when the athletes' ankles are taped with either the South Dakota State University Regular technique or the Gibney Basketweave technique, he will run the 40 yard dash significantly slower than when the athletes experienced the no-tape treatment. Although Mayhew[4] did not find a significant difference in the performance times of the 50 yard dash, he stated that ankle taping does tend toward impairing performance.

The F ratio of 5.49 obtained from the analysis of the vertical jump height means indicated a significant difference between at least two groups had occurred. The Duncan Multiple Range Test signified that the mean heights of athletes when taped the South Dakota State University

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[4]J. L. Mayhew, "Effects of Ankle Taping on Motor Performance," Athletic Training, 7:10-11, 1972.

Regular treatment and when taped with the Gibney Basketweave treatment treatment were significantly less than the mean height of athletes experiencing the no-tape treatment. This implies that taping ankles with either the South Dakota State University Regular technique or with the Gibney Basketweave technique significantly hinders an athlete's vertical jumping ability. The above results agree with the results found by Mayhew[5] and Juvenal[6] in that ankle taping does significantly impair vertical jumping ability.

The lack of significant change among treatments for the Barrow zig zag run, indicated by an F ratio of .99, implies that the two ankle taping techniques employed in this study do not significantly affect performance related to agility. Mayhew[7] and, Thomas and Cotton[8] agree that ankle taping does not significantly affect agility. Hinshaw[9], however, found that agility improved slightly, although not significantly when the subjects ankles were taped.

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[5]Ibid.

[6]James Juvenal, "The Effects of Ankle Taping on Vertical Jumping Ability," Athletic Training, 7:146-149, 1972.

[7]Mayhew, loc. cit.

[8]Jerry R. Thomas and Doyce J. Cotton, "Does Ankle Taping Slow Down Athletes?" Coach and Athlete, 24:4, pp.20-37, November, 1971.

[9]Paul Hinshaw,"The Effect of Adhesive Ankle Strapping Upon Motor Performance of Selected Male College Freshmen by Use of Selected Motor Ability Tests" (unpublished Master's thesis, Appalachian State University, Boone, N. C.), 1959.

The t ratios computed for the comparison of flexion between the South Dakota State University Regular treatment and the Gibney Basketweave treatment indicated that the mean change of 5.84 degrees of flexion shown by the South Dakota State University Regular treatment when compared to the mean change of 4.71 degrees of flexion shown by the Gibney Basketweave treatment was significantly greater beyond the .05 level of confidence. The t-ratios computed for the comparison of extension between the South Dakota State University Regular treatment and the Gibney Basketweave treatment indicated that the mean changes of 10.47 and 7.26 degrees of extension shown by the Gibney Basketweave treatment when respectively compared to the mean changes of 7.03 and 5.48 degrees of extension shown by the South Dakota State University Regular treatment were significantly greater beyond the .05 level of confidence.

The F ratios of 24.53 obtained from the analysis of flexion and 26.83 obtained from the analysis of extension for the South Dakota State University Regular treatment indicated a significant difference between at least two groups had occurred. The results of the Duncan Multiple Range test signified that the mean flexions and mean extensions were significantly less when taped than upon completion of the motor performance tests.

The F ratios of 46.73 obtained from the analysis of flexion and 95.78 from the analysis of extension for the Gibney Basketweave treatment indicated a significant difference between at least two groups had occurred. Results of the Duncan Multiple Range test signified that the mean flexions and extensions were significantly less when taped than

when not taped. Also the mean flexions and extensions were significantly less upon completion of the motor performance test as compared to the no-tape treatment. In addition the data indicated that the ankle flexion and extension when taped was significantly less when compared to the ankle flexion and extension upon completion of the test. The above results are similar to the findings of McCorkle[10] as he found that ankle taping did significantly reduce maximum flexion-extension of the ankle joint. He additionally found that exercise did increase maximum flexion-extension, but that this increase was not significant.

The results of the analysis of variance of performance means obtained from the motor performance tests indicated there was a significant difference among the performance means beyond the .05 level of confidence; therefore, the null hypothesis pertaining to motor performance was rejected. The results of the analysis of the data for the changes of flexibility indicated significant differences in flexibility beyond the .05 level of confidence; therefore, the null hypothesis pertaining to flexibility was rejected.

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[10]Richard B. McCorkle, "A Study of the Effect of Adhesive Ankle Strapping Techniques on Ankle Action" (unpublished Master's thesis, Springfield, Mass.), 1963.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary and Implications of the Study

The purpose of this study was to determine the effect two types of adhesive ankle taping have upon selected motor performance tests and ankle flexibility.

Subjects incorporated in this study were 29 volunteers who were full-time students at South Dakota State University. All subjects had participated in athletics on the interscholastic or intercollegiate level during the previous four years. The subjects were administered all the treatments and performed all the tests.

Through reading, association, and experience with men of the athletic training profession, the investigator selected the two taping techniques to be tested, the motor performance tests to be administered, and the flexibility testing procedure. The subjects were administered the three treatments in one of three sequential orders during three sessions. Each session met approximately one week apart and the subject performed one of three sequential orders of motor performance tests. The motor performance sequences remained constant at each session. The treatments selected for study were the South Dakota State University Regular ankle taping technique, the Gibney Basketweave ankle taping technique, and a no-tape control treatment. The motor performance test items employed were the 40 yard dash, the standard vertical jump, and the Barrow zig zag run. In addition to the motor performance testing, the subjects were tested for ankle flexibility during the sessions they were

administered a taping treatment. Flexibility was tested three times: once prior to taping, once immediately after the taping prior to any weight bearing on the taped ankle, and once upon completion of the motor performance tests. A pilot study was conducted to perfect the taping techniques and evaluate the testing procedures.

The statistical techniques employed to analyze the data were analysis of variance and t-ratios. If the analysis of variance proved significant at the .05 level of confidence, the Duncan Multiple Range test was employed to locate the differences. Analysis of variances were computed for the motor performance tests to determine the differences among the mean changes for each motor performance test under each treatment. The F ratios for the 40 yard dash and the standing vertical jump were found to be significant beyond the .05 level of confidence. In both tests, the two taping procedures significantly hindered performance. The F ratio for the Barrow zig zag run indicated no significant difference among the three treatments.

t-ratios were employed to compare the South Dakota State University Regular taping technique to the Gibney Basketweave taping technique. The South Dakota State Regular treatment significantly reduced flexion more when compared to the Gibney Basketweave treatment. The Gibney Basketweave treatment significantly reduced extension more when compared to the South Dakota State University Regular treatment. Additionally, the Gibney Basketweave treatment significantly retained more stability when compared to the South Dakota State University Regular treatment. The F ratios computed for the changes in flexibility within each taping technique indicated that both taping techniques

significantly reduced flexibility upon taping, that both taping techniques retained a significant reduction of flexibility, but that both taping techniques did also regain a significant amount of flexibility upon completing the motor performance test.

Conclusions

Within the limitations described in this study, the following conclusions appear warranted.

1. Speed and vertical jumping ability were significantly impaired at the .05 level of confidence by both ankle taping techniques.

2. Agility was not significantly affected at the .05 level of confidence by either ankle taping technique.

3. Ankle flexibility was significantly reduced at the .05 level of confidence by both taping techniques.

4. The South Dakota State University Regular taping technique reduced ankle flexion more than the Gibney Basketweave taping technique and was significant beyond the .05 level of confidence.

5. The Gibney Basketweave taping technique reduced ankle extension more than the South Dakota State University Regular taping technique and was significant beyond the .05 level of confidence.

6. Both ankle taping techniques retained a significant reduction of ankle flexibility beyond the .05 level of confidence.

Recommendations for Further Study

Based on the findings of this study, the investigator proposes the following recommendations for further study:

1. That studies be conducted to measure the effect of other techniques of adhesive ankle taping upon motor performance.

2. That studies be conducted to measure the effect of other techniques of ankle taping upon ankle flexibility.

3. That a similar study be conducted using female subjects.

4. That a similar study be conducted utilizing different motor performance tests.

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APPENDICES

APPENDIX A

TABLE XIX

RECORDINGS OF PERFORMANCE* OF THE 40 YARD DASH

Subject \ Treatment	SDSU Regular	No-Tape	Gibney Basketweave
1	5.1	4.9	5.0
2	5.5	5.3	5.3
3	5.0	4.9	5.0
4	5.2	5.1	5.2
5	5.6	5.5	5.8
6	5.3	5.2	5.3
7	5.3	5.0	5.0
8	5.1	5.0	5.3
9	5.0	4.8	4.9
10	5.1	5.2	5.3
11	5.6	5.5	5.7
12	5.5	5.5	5.6
13	6.0	5.5	5.6
14	5.6	5.4	5.4
15	5.5	5.4	5.3
16	5.2	5.5	5.3
17	5.5	6.4	6.0
18	5.6	5.4	5.5
19	5.9	5.7	5.9
21	5.5	5.4	5.3
22	5.8	5.6	5.7
23	6.2	5.6	5.8
24	5.2	5.1	5.3
25	5.5	5.5	5.4
26	6.5	5.9	6.2
27	5.7	5.7	6.0
28	5.5	5.1	5.4
29	5.4	5.3	5.3
31	5.2	5.2	5.2
Mean	5.49	5.36	5.45
S. D.	.33	.33	.35

*All times recorded to the nearest .1 of a second

APPENDIX A

TABLE XX

RECORDINGS OF PERFORMANCE* OF
THE STANDING VERTICAL JUMP

Subject \ Treatment	SDSU Regular	No-Tape	Gibney Basketweave
1	23.5	24.0	23.5
2	22.5	23.0	23.0
3	23.5	24.0	23.5
4	26.0	27.0	26.0
5	19.0	18.0	17.0
6	22.5	24.0	23.5
7	23.0	26.5	27.0
8	23.5	23.5	22.5
9	24.5	25.5	24.0
10	21.0	21.0	19.5
11	21.0	22.0	21.0
12	19.5	18.0	16.5
13	17.5	18.0	16.5
14	21.0	20.5	18.0
15	19.0	21.0	20.0
16	19.5	20.5	20.0
17	20.5	20.5	19.0
18	19.5	21.5	19.5
19	15.5	14.5	14.0
21	22.0	23.5	21.0
22	18.0	21.0	19.5
23	14.0	14.5	13.0
24	24.5	25.5	22.0
25	25.5	20.5	20.0
26	17.5	17.0	17.5
27	18.0	18.5	19.0
28	18.5	23.0	22.0
29	23.5	25.0	21.5
31	22.5	23.0	23.0
Mean	20.90	21.5	20.53
S. D.	2.98	3.28	3.19

*All heights recorded to the nearest 1/2 inch

APPENDIX A

TABLE XXI

RECORDINGS OF PERFORMANCE* OF THE BARROW ZIG ZAG RUN

Subject \ Treatment	SDSU Regular	No-Tape	Gibney Basketweave
1	26.5	25.6	25.9
2	27.0	26.9	26.6
3	26.3	26.0	27.5
4	25.5	24.9	25.2
5	30.5	28.8	31.0
6	27.4	25.3	26.4
7	30.2	28.3	27.3
8	24.0	26.4	24.6
9	26.2	25.2	26.5
10	27.0	25.6	26.1
11	30.9	29.1	30.1
12	27.2	28.0	28.5
13	27.9	26.9	28.2
14	30.6	26.9	28.2
15	27.3	27.8	28.5
16	29.0	28.6	26.2
17	28.4	33.1	30.5
18	27.2	26.7	27.6
19	28.5	27.2	28.9
21	28.6	28.6	28.5
22	28.5	27.2	27.5
23	27.6	26.9	29.0
24	25.3	27.7	25.5
25	28.4	29.0	27.9
26	32.0	30.5	32.2
27	27.8	28.4	28.2
28	27.0	27.8	26.9
29	26.8	25.3	25.0
31	27.9	28.2	27.9
Mean	27.84	27.48	27.67
S. D.	1.78	1.76	1.81

*All times recorded to the .01 of a second

APPENDIX B

TABLE XXII

RECORDINGS OF THE MEASUREMENT* FOR FLEXION OF THE LEFT ANKLE

Subject	SDSU Regular			Gibney Basketweave		
	Before Taping	Taped	Test Completed	Before Taping	Taped	Test Completed
1	23	11	19	23	18	16
2	32	23	24	24	20	19
3	22	17	20	20	23	22
4	13	2	8	12	16	10
5	9	12	14	4	5	10
6	19	17	20	27	21	22
7	16	9	18	21	6	16
8	15	11	16	13	11	14
9	11	3	3	10	4	5
10	13	11	7	7	12	9
11	16	16	15	16	7	15
12	8	3	10	17	9	15
13	13	9	14	17	12	6
14	19	13	17	17	13	10
15	8	3	8	17	18	16
16	16	6	11	14	12	18
17	18	14	19	12	11	4
18	18	16	25	25	20	24
19	14	3	12	14	10	9
21	19	11	14	18	12	14
22	25	12	16	27	16	21
23	18	14	12	17	16	18
24	18	9	12	19	6	12
25	14	10	14	21	11	13
26	14	9	15	12	10	11
27	16	12	18	14	6	15
28	27	25	22	23	19	20
29	17	12	11	20	15	15
31	13	10	2	13	5	12
Mean	16.69	11.4	14.34	17.03	12.55	14.17
S. D.	5.43	5.57	5.63	5.65	5.40	5.16

*All measurements recorded to the nearest degree

APPENDIX B

TABLE XXIII

RECORDINGS OF THE MEASUREMENT* FOR FLEXION OF THE RIGHT ANKLE

Subject	SDSU Regular			Gibney Basketweave		
	Before Taping	Taped	Test Completed	Before Taping	Taped	Test Completed
1	20	10	20	15	14	18
2	26	28	21	23	25	32
3	25	22	22	27	25	21
4	16	2	7	13	7	12
5	10	10	7	6	9	16
6	17	11	11	24	9	9
7	19	1	11	16	12	13
8	14	10	12	10	12	12
9	9	-6	8	10	3	4
10	16	6	10	11	10	7
11	15	16	17	15	7	12
12	7	2	7	24	9	23
13	14	0	16	18	3	6
14	19	13	16	15	12	10
15	16	8	13	13	13	15
16	22	13	16	18	13	13
17	16	5	14	5	6	8
18	8	8	13	15	14	19
19	10	3	10	10	11	7
212	21	10	12	19	12	13
22	23	13	15	28	19	19
23	12	13	13	15	15	15
24	17	12	15	20	6	16
25	13	15	16	18	7	20
26	14	11	15	13	10	12
27	16	8	19	19	10	19
28	28	14	18	19	20	12
29	20	18	12	21	14	19
31	14	11	12	15	5	9
Mean	16.45	10.31	13.72	16.38	11.45	14.17
S. D.	5.31	6.20	4.09	5.68	5.55	5.98

*All measurements recorded to the nearest degree

APPENDIX B

TABLE XXIV

RECORDINGS OF THE MEASUREMENT* FOR EXTENSION OF THE LEFT ANKLE

	SDSU Regular			Gibney Basketweave		
Subject	Before Taping	Taped	Test Completed	Before Taping	Taped	Test Completed
1	54	48	49	58	47	50
2	51	48	46	57	40	49
3	48	40	43	50	39	44
4	59	43	50	56	50	53
5	55	44	40	52	44	50
6	52	43	45	49	51	44
7	60	33	33	51	35	39
8	44	43	48	46	43	47
9	49	39	41	46	35	39
10	48	36	43	51	39	44
11	64	45	53	64	49	53
12	47	39	45	54	40	41
13	49	31	39	52	26	42
14	61	51	51	62	53	50
15	50	39	41	52	37	42
16	52	40	46	44	42	44
17	44	44	45	54	45	45
18	64	62	63	61	46	51
19	44	40	43	55	39	42
21	45	43	45	51	43	35
22	57	44	47	60	41	39
23	49	47	40	52	40	39
24	44	42	42	42	32	34
25	54	50	52	60	35	47
26	71	65	68	69	55	58
27	42	45	50	56	43	42
28	38	34	42	42	25	37
29	43	36	34	50	40	50
31	59	54	60	57	55	54
Mean	51.62	43.72	46.34	53.55	41.69	44.97
S. D.	7.79	7.65	7.72	6.45	7.48	6.04

*All measurements recorded to the nearest degree

APPENDIX B

TABLE XXV

RECORDINGS OF THE MEASUREMENTS* FOR EXTENSION OF THE RIGHT ANKLE

	SDSU Regular			Gibney Basketweave		
Subject	Before Taping	Taped	Test Completed	Before Taping	Taped	Test Completed
1	55	51	51	52	48	50
2	50	48	43	52	38	49
3	46	36	37	44	32	37
4	48	42	48	48	40	45
5	11	37	30	43	42	50
6	53	50	52	51	48	48
7	54	32	34	50	44	45
8	46	43	46	44	43	47
9	41	39	43	43	36	40
10	51	38	39	46	42	36
11	59	50	52	59	51	51
12	42	41	41	49	39	39
13	51	37	40	51	40	34
14	52	50	51	61	52	49
15	42	34	37	50	30	42
16	52	37	35	47	31	40
17	31	42	40	37	39	41
18	63	58	58	56	58	53
19	42	40	47	51	38	45
21	48	48	49	52	42	38
22	55	48	47	60	31	45
23	53	49	45	55	37	40
24	42	34	36	41	34	41
25	53	44	48	53	48	45
26	68	66	62	69	54	56
27	48	34	35	48	35	42
28	40	43	43	44	31	36
29	44	38	34	50	43	51
31	59	58	58	58	55	57
Mean	49.86	43.69	44.17	50.48	41.41	44.55
S. D.	7.83	8.22	8.04	6.80	7.78	6.12

*All measurements recorded to the nearest degree