A STUDY OF ISOTONIC AND ISOMETRIC EXERCISES PERTAINING TO GOLF PERFORMANCE

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Edward A. Kriwiel

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E. Dean McCullough

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To Dr. E. Don McCullough for his untiring guidance and many hours spent as committee chairman for this research report is extended my deepest appreciation. Also, my thanks to the Wichita High School West golf team who participated in the experimental research; and to my wife, Mary, for her understanding and encouragement.

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

In the past decade, isotonic and isometric exercises have become an integral part of most conditioning programs that are conducted for competitive sports. Although most golf coaches agree that competitive golfers must have strength and coordination, there is some disagreement as to how this strength should be acquired. Coaches agree that isotonic and isometric exercises increase power, but many coaches contend that the increase will be accompanied by shortened muscles and restricted joint action. Despite rumors that were prevalent at one time, there has been no evidence that participating in weight training causes muscle-boundness (lack of flexibility and loss of coordination and timing).[1]

Even if one were to judge golf solely on the basis of its most obvious values, such as its current popularity, its carry-over advantages, and the student demand for instruction in its techniques, there should be little doubt for the use of training exercises to improve golf performance. Since isotonic and isometric exercises help

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[1]Donald R. Casady, Donald F. Mapes, and Louis E. Alley, Handbook of Physical Fitness Activities (New York: The Macmillan Company, 1965), p. 52.

athletes to develop in other sports, it is logical to assume that they might hold some importance for competitive golfers.[2]

I. THE PROBLEM

Statement of the problem. It was the purpose of this study (1) to compare the effect of certain isotonic and isometric exercises on golf performance at the high school level, (2) to determine if a combination of isotonic and isometric exercises would increase the efficiency of golf performance, and (3) to provide a supplementary exercise program for high school golf coaches which might be helpful in the improvement of competitive golf.

Importance of the study. This study was designed to investigate a way of improving the golfer's strength, flexibility, and endurance. The improvement of these qualities would result in longer, truer drives and iron shots with accurate chip shots and putts to assure him of a better score. Coaches and athletes know that a skilled man with strength usually has an advantage over a man who depends on skill alone. It is easier for a strong man to develop endurance and to learn to move his body effectively because his muscles have the ability to carry him through

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[2] Ibid., p. 51.

the necessary movements.[3] This is understood today, and technique and strength building are happily joined together. Recognition of the real value of strength in active sport naturally focuses attention on the means for its cultivation.[4]

Competitive golf on the high school level requires more than the usual repetitious practice of hitting certain shots. Golf should be given the same consideration as any other sport. There are no minor sports, insofar as benefit to participants is concerned; the distinction is made on a basis of spectator interest in the United States.

Hypothesis. The major hypothesis was that the combination program of both isotonic and isometric exercises would significantly increase the efficiency of golf performance.

II. DEFINITION OF TERMS

Isotonic exercise. If the weight being lifted by the person is light enough for him to move and the inertia of the barbell is overcome, the muscle shortens and movement

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[3]James A. Murray and Peter Karpovich, Weight Training in Athletes (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1956), p. 5.

[4]G. F. D. Pearson, Athletics (Edinburgh: Thomas Nelson and Sons, Ltd., 1963), p. 371.

is now involved. This type of contraction is called isotonic or dynamic.

Isometric exercise. "Iso" means equal, and an isometric contraction is one in which the muscle remains at the same (equal) length, because it is opposed by a resistance which it cannot overcome; this is a static contraction.

Golf performance. Golf performance was interpreted as meaning playing eighteen holes of golf. The distance the ball traveled while using a driver and five iron was also interpreted as golf performance.

Supplement. For the purpose of this investigation, the term "supplement" was interpreted as meaning adding to the regular golf program isotonic and isometric exercises for the improvement of golf performance.

Combination of isotonic and isometric exercises. In this report "combination" was interpreted as meaning the use of isotonic exercises on certain days during the week and on alternate days the use of isometric exercises.

III. METHOD OF PROCEDURE

Participants. The participants in this study were twenty-four members of the Wichita High School West varsity golf team.

Each member was required to play seventy-two holes of golf for the purpose of dividing them into three study groups and one control group according to their mean score. Also, a record was established on the average distance of their driver and five iron by requiring each member to hit twenty-five balls.

Exercise programs for the three study groups were administered at 7:45 a.m., five days a week for a period of eight weeks. This time was chosen so that all the members would participate in their normal practice after school.

Study Group I. This group used a combination of isotonic and isometric exercises on alternate days. On Monday, Wednesday, and Friday the members participated in isotonic exercises and on Tuesday and Thursday they participated in isometric exercises.

Study Group II. This group used only the isotonic exercises on Monday, Tuesday, Wednesday, Thursday, and Friday.

Study Group III. This group used only the isometric exercises on Monday, Tuesday, Wednesday, Thursday, and Friday.

Control Group. This group did not participate in any form of isotonic or isometric exercises.

Isotonic exercises. Isotonic exercises selected for this report were taken from Gary Player's Improvement Program which is designed to strengthen and tone up all of the muscles used in a normal golf swing.[5] Eight repetitions were used on each exercise for the first week. Two more repetitions for each exercise were added each week for the remainder of the study. There were twelve isotonic exercises used in this study with the recommended time to complete the daily training program limited to approximately twenty minutes.

Equipment used for the isotonic exercises were two barbells, seven pounds each. One five-pound weight attached to a four-foot rope on a one-inch cylinder was used for the wrist roll.

Isometric exercises. Isometric exercises selected for this report were taken from various studies, like those of isotonic exercises designed to strengthen and tone up all of the muscles used in a normal golf swing. There were two contraction bouts for each muscle exercise. The group began with an eight-second contraction the first week and increased it by two seconds each week until the recommended fifteen-second contraction bouts were reached for the remainder of

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[5]Gary Player, Gary Player's Golf Improvement Program (Alabama: Diversified Products Corporation, 1964), p. 1

the study. There were twelve isometric exercises used in this study, and the recommended time to complete the daily training program was approximately twenty minutes.

Equipment used for isometric exercises was one golf club shaft and a regular isometric set of bars of standard size.

Testing procedure. A test of each study group was given every two weeks on five phases of golf performance: (1) distance with the number one wood, or driver; (2) distance with the number five iron; (3) accuracy of a fifty-foot chip into a three-foot radius around the hole which was recorded on the basis of whether or not it was successful; (4) accuracy of a three-foot putt recorded on the basis of whether or not it was successful; and (5) accuracy of a ten-foot putt, also recorded on the basis of whether or not it was successful. Every participant in each of the five groups used six balls to complete the above skills. Only in the case of the driver and five iron was he allowed to repeat a shot. A target was set up which was to simulate a fairway for these two skills as the participants were required to hit a reasonably straight ball. If a ball were hit outside the fifty-yard area limit, the student was allowed to repeat until he had six balls in approximately the same direction. In this manner, there was a reasonable

certainty in recording the golfer's ability for distance which was of prime importance for this particular skill.

Also recorded were the results of eighteen holes of golf which each group was required to play on Saturday. Since every member participated on the same day for the same number of holes, it gave an indication of what progress was being made of their golf performance.

IV. LIMITATIONS OF THE STUDY

The limitations of this study should be considered in relation to the results obtained from the data. These limitations include the number of participants, the fact that all the participants were from the same school, the exercises used, and the length of time covered by the study.

The limitations of the study were as follows: The participants were twenty-four members of the Wichita High School West interscholastic golf team. All the participants were male. Isotonic exercises used in the study were the side lateral raise, front deltoid raise, curl, tricep kick-back, rear deltoid, golfer's twist, standing press, upright rowing, body twist, flying motion, stiff leg dead lift, and wrist roll. Isometric exercises used in the study were the back swing, downswing top, downswing middle, downswing bottom, hip pivot, left side pull, press lockout, pull, curl, backward arm raiser, frog kick, and toe rise. Exercise

programs were conducted every day except Saturday and Sunday. Exercises that were given each morning took place before school and were conducted in twenty minutes. Length of the study was eight weeks.

Very little research in isotonic and isometric exercises and their effect on golf performance can be found. Therefore it was hoped that results of this study and future studies in this area might be helpful in planning efficient and effective high school golf programs.

V. OVERVIEW

Chapter I outlines the scope of the study which has been undertaken with the purpose of acquainting the reader with the nature of the problem. Terms which could have received various interpretations have been defined for the clarification of their use in this paper. Chapter II presents the opinions of experts in the field of golf on isotonic and isometric exercises as they are related to golf performance. Chapter III describes and evaluates the techniques used in the testing procedure. Chapter IV contains the summary, conclusions, and recommendations of the evidence obtained in this paper.

CHAPTER II

REVIEW OF RELATED LITERATURE

Very little evidence regarding the effect of isotonic and isometric exercises upon golf is available. Most reports in the area related to this study have dealt with the effect of isotonic and isometric exercises on strength gains.

I. LITERATURE ON ISOTONIC EXERCISE

Since the time of the ancient Greeks, man is known to have lifted weights as a sport or for exercise. In the United States, the use of weight-training equipment to develop the strength and size of the muscles has greatly increased during the past two decades. The two main factors responsible for this increase have been the use of progressive resistance exercises in rehabilitation centers during and after World War II, and the favorable reports from research studies, completed in the 1940's and 1950's, that weight training is an efficient method of training athletes for increased performance.[1]

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[1]Donald R. Casady, Donald F. Mapes, and Louis E. Alley, Handbook of Physical Fitness Activities (New York: The Macmillan Company, 1965), p. 52.

Weight training is concerned with the development of increased physical capacity, which includes greater muscle endurance, greater strength, increased speed of movement, and greater power.[2]

Pearson says that strength, speed, stamina, and skill or technique are, with suppleness, the fundamental physical qualities upon which an athlete depends:

> Strength if it is to be maintained for a sufficiently long period for its accumulation to amount to something considerable, then the tasks set must become steadily harder.
>
> Of speed this may be said: athletic events consist of the propulsion through the air either of the athlete's own body-weight or of a missile which he releases; in either case very vigorous bodily effort is demanded and this requires strength of muscle. Improved contractile power of the muscles enables the "resistance" of the body-weight or the inertia of the missile to be "overcome" more easily and therefore more rapidly, and so movement is accelerated.
>
> Stamina is needed in some measure in all events. By dint of weight training with light weights and many repetitions, muscular endurance can certainly be increased. However, it is suggested that all types of athletes may best use weight-resistance mainly to improve strength, and the cultivation of stamina be conducted chiefly on track, road or open country. Let us express the reason this way: if two otherwise equal athletes run neck and neck in the closing stages of a race, it is the stronger man who will win.
>
> Without good technique no athlete can achieve his potential. Without it the runner fails fully to translate his energy into speed, and he tires before

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[2] Ibid., p. 51.

> he should, through uneconomical movement. It will be necessary to practice the event sufficiently often enough to maintain the correct speed pattern of movement for competition conditions.[3]

Some strength may be developed in a muscle through a great many methods. It has been proven that both isotonic and dynamic contractions are acceptable methods of gaining strength.[4]

Before discussing the better methods, O'Connor says a few variables should be pointed out to the coach.

> One rather obvious variable is the fact that every boy has a different number of fibers in a given muscle. The boy with more muscle fibers has greater potential of strength.
>
> Another variable is the efficiency of the lever action. The shorter (mesomorphic) boy has an advantage over the tall (ectomorphic) boy. The mesomorphic boy generally has the advantages of both more muscle fibers and more efficient levers. The ectomorphic boy usually has the disadvantages of both fewer muscles and less efficient lever action.
>
> Another variable in strength development is the desire of the boy to work hard and faithfully at the prescribed exercises.
>
> A fourth variable in strength development is the method utilized in the development of strength.[5]

A study by Berger has compared an isometric trained group and an isotonic trained group. Both groups were

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[3]G. F. D. Pearson, Athletics (Edinburgh: Thomas Nelson and Sons, Ltd., 1963), p. 373.

[4]Bob O'Connor, "Scientific Weight Training," Scholastic Coach, 34:54, September, 1964.

[5]Ibid., p. 55.

pretested with a static strength test (a back-leg dynamometer) and a dynamic strength test (a one-repetition maximum lift in the back arch). At the conclusion of a twelve-week training period both groups were retested with the same test. The results showed that while both groups gained strength, the group which exercised with the dynamic exercise improved more than the group in the strength test. The group which worked out with the isometric exercise showed a greater increase in static strength.[6]

Another study was conducted by Berger to determine the optimum number of repetitions needed to increase strength. The study covered a twelve-week period. Each of six groups trained with different number of repetitions. Two, four, six, eight, ten, and twelve repetitions were used for one set three days each week. The main gains in strength using two, ten, and twelve repetitions were smaller than the gains in strength using four, six, and eight repetitions. He concluded that the optimum number of repetitions for maximum strength gains was between three and nine.[7]

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[6]Richard A. Berger, "Comparison of Static and Dynamic Strength Increases," The Research Quarterly, 33:329, October, 1962.

[7]Richard A. Berger, "Optimum Repetitions for the Development of Strength," The Research Quarterly, 33:334, October, 1962.

Berger stated that it is just as effective to use three sets of six repetitions for gaining strength as it is to use an increased number of sets and repetitions. He used nine programs having combinations of one, two, and three sets with two, six, and ten repetitions per set. There were about twenty subjects in each group, and the study covered a twelve-week period. All of the programs were of the maximum resistance type. He found that three sets increased strength significantly more than one or two sets. Six repetitions were significantly superior to two, but not significantly superior to ten. Therefore, he concluded that three sets and six repetitions were best for increasing strength.[8]

The success of golfer Frank Stranahan in the middle 1950's indicates that his success on the golf course could be combined with medal-winning weight lifting. Stranahan believed the lifting helped his golf, but said if he had to give up one sport or the other, he would give up golf.[9]

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[8]Richard A. Berger, "Effect of Varied Weight Training Programs on Strength," The Research Quarterly, 33:168, May. 1962.

[9]James A. Murray and Peter Karpovich, Weight Training in Athletes (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1956), p. 147.

II. LITERATURE ON ISOMETRIC EXERCISE

Isometric contraction can develop strength faster than any other form of exercise, then maintain it with relatively simple and short workouts that will not leave the athlete unduly fatigued.[10]

The scientific verification of the value of isometric exercises was the result of studies performed by two German physiologists, Dr. Hettinger and Dr. Muller. The findings of their initial investigation, which was conducted in the early 1950's, have forced a revision of some of the prevalent concepts of the development of strength.[11]

Movement is not involved in any of the exercises, despite the fact that the muscle contraction should always be quite vigorous. The exerciser should always attempt to make a maximum contraction each time that he performs an isometric exercise. When two or more sets of isometric exercises are performed, greater strength gains have been recorded than when only one set of each exercise is performed.[12]

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[10]Bruce J. Pickford, "Isometric Contraction Program for Football," Scholastic Coach, 33:36, November, 1963.

[11]Casady, op. cit., p. 67.

[12]Ibid., pp. 68-69.

Research by Morgan shows that muscular strength can be improved by training statically, provided muscular contraction is at least two-thirds of maximum effort.[13] The recommended procedure for doing a set of isometrics is to hold the contraction for six seconds with one to three sets for each exercise with at least 75 per cent maximum effort.[14] According to Casady ten to twelve seconds is the time period most frequently recommended.[15]

Various tests and experiments have been carried out in relationship to the amount of time contraction should be maintained. Some individuals feel that three seconds is sufficient if the contraction is complete while others feel that a fifteen-second contraction is needed for maximum benefits. Experiments seem to indicate that longer contractions, if a contraction can be held, derive greater benefits. The fifteen-second contraction period would only be reached by athletes concerned with a maximum development

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[13]Bill Morgan, "Static Exercises," Scholastic Coach, 32:24, February, 1963.

[14]Phillip J. Rasch and Laurence E. Morehouse, "Effect of Static and Dynamic Exercises on Muscular Strength and Hypertrophy," Journal of Applied Physiology, 2:29, July-November, 1957.

[15]Casady, op. cit., p. 68.

of the muscle in relationship to an athletic activity or skill.[16]

A study by Thompson reveals that a coach can expect a five per cent increase in strength for a few weeks after the isometric program has begun.[17]

Hoffman states:

> An average person can make a gain of 5% a week in strength, and in a twenty-week period will double in strength. People already highly developed cannot double their strength in twenty weeks, but any man can make good gains in a few weeks with the Functional Isometric Contraction System if he trains with regularity and according to directions.[18]

Isometrics can develop muscular strength at any point of stimulation throughout a range of motion. This is particularly good for joints in which one muscle group starts the movement and another group finishes the action.[19]

Gardner states that isometric exercises strengthen only that part of the range of motion at which the exercise

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[16]Don W. Mullison, Isometric Rope Exercise Manual (Fort Collins: Copyright, Don W. Mullison, Colorado State University, 1962), p. 7.

[17]Hugh Thompson, "Values of Isometric Training," Scholastic Coach, 32:40, September, 1962.

[18]Bob Hoffman, Exercise Without Movement (York, Pa.: The Bob Hoffman Foundation, 1962), p. 47.

[19]Jay A. Bender, Harold M. Kaplan, and Alex J. Johnson, "Isometrics: A Critique of Faddism Versus Facts," Journal of Health, Physical Education, and Recreation, 34:22, May, 1963.

is done. Therefore, if a wide range of motion is required to do a movement, the subject must either strengthen the muscle at several points in the movement or rely upon the isotonic method of weight training.[20]

Hoffman states:

> More strength will improve control, coordination, judgment of space and distance. All skills which are required to be a better golfer. You must have strong nerves and strong muscles to control the various strokes.
>
> So the most important means to improve is to build all around bodily strength. Strength will give you more endurance. It is a well known fact that tired players lose control and accuracy in any sport. If you are playing in a tournament you need strength enough to keep from getting tired. More strength will help and the best way to build more strength is with strength building exercises. The most important of these is winding of a weight to strengthen hands, wrists, and forearms.
>
> You must, of course, develop a smooth accurate swing, but you must have power too. Take one of your clubs, build Functional Isometric Contraction power by applying it in three functional positions, in the same positions as your golf swing. With these strength building movements and regular practice you should greatly improve your score.[21]

These articles revealed that research had been done mostly at the university level. The length of the programs and the types of exercise varied greatly. But despite these variations, the results in each case showed a gain in

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[20]Edward K. Capen, "The Effect of Systematic Weight Training on Power, Strength, and Endurance," The Research Quarterly, 21:84, May, 1950.

[21]Hoffman, op. cit., pp. 214-15.

strength. Since these articles, however, dealt with strength in varying degrees for the improvement of performance, they offered little evidence on which to judge the merits of isotonic and isometric exercises as they might affect golf performance: and it should be restated that this literature was not found to contain reports dealing with this specific relationship.

CHAPTER III

METHOD AND TESTING PROCEDURE

The data in this study were collected from results of a series of applied programs and tests given to twenty-four senior high school boys at Wichita High School West, Wichita, Kansas. The background of the participants, the exercises given, and the testing procedures are necessary in understanding the data.

I. METHOD OF PROCEDURE

Participants. The participants in this study were twenty-four members of the Wichita High School West varsity golf team. Wichita High School West was twelve years old at the time of the study. The total enrollment of this coeducational school was 1,914 students. Located in the southwest part of the city, the school drew its enrollment from families which ranged from middle to lower socio-economic groups, with a majority from the middle group.[1]

At Wichita High School West both college preparatory and prevocational programs were offered, indicating a wide range of mental ability and interest. The students were

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[1]Donald O. Cowgill, A Pictorial Analysis of Wichita (Wichita: Community Planning Council and University of Wichita, 1964), pp. 87-90.

quick to respond and cooperated fully in helping to complete this study.

Exercise programs and the length of the study. Exercise programs for the three study groups were administered at 7:45 a.m. five days a week for a period of eight weeks. This time was chosen so that all the members would participate in their normal practice after school.

Equating. For the purpose of testing the effect of the physical exercises, it was necessary to establish three experimental groups and one control group. The groups were equated on the basis of mean scores derived from playing seventy-two holes of golf. According to data reported in Table I (page 33), it was appropriate to assign the twenty-four subjects to four comparable groups. No significant differences were observable in the means or standard deviations of the four groups. On the basis of these data, the control and experimental groups satisfied the assumptions necessary to a further analysis of the data. Subsequent results of tests employing the driver and the five iron confirmed the comparability of the four groups at the beginning of the study. The groups and the exercises used during the study are described below. In the tabular presentations, the four groups were designated: Combination Group I,

Isotonic Group II, Isometric Group III, and Control Group IV.

Combination group. This group used a combination of isotonic and isometric exercises on alternate days. On Monday, Wednesday, and Friday the members participated in isotonic exercises and on Tuesday and Thursday they participated in isometric exercises.

Isotonic group. This group used only the isotonic exercises on Monday, Tuesday, Wednesday, Thursday, and Friday.

Isometric group. This group used only the isometric exercises on Monday, Tuesday, Wednesday, Thursday, and Friday.

Control group. This group did not participate in any form of isotonic or isometric exercises.

II. ISOTONIC EXERCISES

Isotonic exercises selected for this report were taken from Gary Player's improvement program and were those designed to strengthen and tone up all the muscles used in a normal golf swing.[2] Eight repetitions were used on each

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[2]Gary Player, Gary Player's Golf Improvement Program (Alabama: Diversified Products Corporation, 1964), p. 1.

exercise for the first week. Two more repetitions for each exercise were added each week for the remainder of the study. There were twelve isotonic exercises used in this study with the recommended time to complete the daily training program as approximately twenty minutes.

Equipment used for the isotonic exercises were two barbells, seven pounds each. One five-pound weight attached to a four-foot rope on a one-inch cylinder was used for the wrist roll.

Side lateral raise.[3] Participant starts from a standing position with feet together and hands down with palms facing in. First movement is to extend the arms sideward to a position above the head, touching wrists with palms facing out. Second movement is to lower arms to the original position.[4]

Front deltoid raise. Participant starts from a standing position with feet together and hands down with the weight in front of the legs. First movement is to extend the arms forward to a position above the head. Second movement is to lower arms to the original position.[5]

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[3] See Appendix A for illustrations of this and other isotonic exercise items.

[4] Player, op. cit., p. 3. [5] Ibid., p. 4.

Curl. Participant starts from a standing position with feet together and hands down with palms facing in. First movement is to bend the arms upward with palms in until weight touches the shoulder. Second movement is to lower arms to the original position.[6]

Tricep kick-back. Participant starts from a semi-squat position with feet together and one arm straight in front of the knee and the other arm bent with the weight beside the leg. First movement is to keep the straight arm in position and extend the other arm into a backward raise position. Second movement is to lower the extended arm to the original position. This exercise should be repeated with both arms.[7]

Rear deltoid. Participant starts from a full-squat position with feet together and both arms straight at the sides. First movement is to rise to a semi-squat position and at the same time extend both arms into a backward raise position. Second movement is to return to the original position.[8]

Golfers twist. Participant starts from a bent-over position with feet spread and the left hand on the hip and

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[6] Ibid. [7] Ibid., p. 5. [8] Ibid.

the right hand touching the left toe. First movement is to twist to the right extending right hand as far as one can without losing balance. Second movement is to return to the original position.[9]

Standing press. Participant starts from a standing position with feet together and arms bent forward into curl position. First movement is to extend both arms upward to a position above the head. Second movement is to return to the original position.[10]

Upright rowing. Participant starts from a standing position with feet spread shoulder-width and hands down with the weight in front of the legs. First movement is to raise the hands to a position just under the chin. Second movement is to return to the original position.[11]

Body twist. Participant starts from a bent-over position with feet spread shoulder-width and the left hand touching the right toe and the right hand extended upward and backward. First movement is to reverse the procedure by touching your left toe with your right hand and extending your left hand upward and backward. Second movement is to return to the original position.[12]

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[9] Ibid., p. 6.

[10] Ibid.

[11] Ibid., p. 7.

[12] Ibid., p. 8.

Flying motion. Participant starts from a bent-over position with feet spread shoulder-width and both hands facing in just inside the knees. First movement is to raise both hands sideward to shoulder level. Second movement is to return to the original position.[13]

Stiff leg dead lift. Participant starts from a standing position with feet spread shoulder-width and hands down in front of the legs. First movement is to bend forward and touch the ground with the weight. Second movement is to return to the original position.[14]

Wrist roll. Participant holds the cylinder in front and away from the body. First movement is to roll the weight up to the cylinder. Second movement is to unroll the weight back to the original position.[15]

III. ISOMETRIC EXERCISES

Isometric exercises selected for this report, taken from various studies, are designed to strengthen and tone up all the muscles used in a normal golf swing. There were two contraction bouts for each isometric exercise. The group using this exercise began with an eight-second contraction the first week and increased it by two seconds each week

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[13]Ibid., p. 7. [14]Ibid., p. 8. [15]Ibid., p. 11.

until the recommended fifteen second contraction bouts were reached for the remainder of the study. There were twelve isometric exercises used in this study and the recommended time to complete the daily training program was approximately twenty minutes.

Equipment used for isometric exercises was one golf club shaft and a regular isometric set of bars of standard size.

Back swing.[16] Participant starts from normal golf stance fixing the shaft of the club on the isometric bar two feet from the ground. Force should be exerted in the same manner as one would for the normal backswing.[17]

Downswing top. Participant starts from a normal golf stance fixing the shaft of the club on the isometric bar at the top of the downswing. Emphasis should be stressed on beginning the downswing with the hips exerting the force in like manner.[18]

Downswing middle. Participant starts from a normal golf stance fixing the shaft of the club on the isometric

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[16]See Appendix B for illustrations of this and other isometric exercise items.

[17]Ben Hogan, Isometric Exercise Program for Golfers (Fort Worth: Ben Hogan Sales Company, 1964), p. 5.

[18]Ibid., p. 9.

bar at the middle of the downswing exerting the force through the hips.[19]

Downswing bottom. Participant starts from a normal golf stance fixing the shaft of the club on the isometric bar at the bottom of the downswing. Emphasis should be stressed on exerting the force through the hitting area with the wrists.[20]

Hip pivot. Participant starts from a normal golf stance fixing the shaft of the club on the isometric bar with both hands. Force is exerted to turn hips as they would be turned in the downswing.[21]

Left side pull. Participant starts with a normal golf stance holding the vertical section of the isometric bar with the left hand keeping the elbow straight. Force is exerted to turn as one would turn in the downswing.[22]

Press lockout. Set the bar at a height about three inches below the lockout position. Participant's arms are fully extended overhead. Grasping the bar with hands at shoulder-width apart, look straight ahead, tighten leg,

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[19] Ibid.

[20] Ibid., p. 6.

[21] Ibid., p. 8.

[22] Ibid., p. 10.

hip, and back muscles, and push on bar exerting the force upward.[23]

Pull. Set the bar at a height where it will be six or seven inches below the waist. Grasping the bar with hands at shoulder-width apart, rise on toes slightly, look up slightly, bend the arms, and pull exerting force upward.[24]

Curl. Set the bar at a height where it will be just above the waist. Grasp the bar with hands at shoulder-width apart and keep elbows to the side of the body. With the arms bent at a ninety-degree angle, exert the force upward.[25]

Backward arm raiser. Set the bar at a height where it will be just below the waist. Stand in front grasping the bar with hands at shoulder-width apart, keeping the arms straight exert the force backward and up.[26]

Frog kick. Set the bar at a height where it will be overhead just out of reach. Leap up and grasp the bar with an overhand grip. Hang with arms fully extended, pull knees

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[23]Bob Hoffman, Exercise Without Movement (York, Pa.: The Bob Hoffman Foundation, 1962), p. 68.

[24]Ibid.

[25]Don W. Mullison, Isometric Rope Exercise Manual (Fort Collins: Colorado State University, Copyright, Don W. Mullison, 1962), p. 18.

[26]Ibid., p. 15.

up to chest, bending at hips and knees only.[27]

Rise on toes. Set the bar at a height where it will rest just touching the shoulders. Keep the knees and hips locked tight holding the bar with the hands at a comfortable position. Rise on the toes and push on the bar exerting the force upward.[28]

IV. TESTING PROCEDURE

A test of each study group and of the control group was given every two weeks on five phases of golf performances: (1) distance with the number one wood, or driver; (2) distance with the number five iron; (3) accuracy of fifty foot chip into a three foot radius around the hole which was recorded on the basis of whether or not it was successful; (4) accuracy of a three foot putt recorded on the basis of whether or not it was successful; and (5) accuracy of a ten foot putt, also recorded on the basis of whether or not it was successful. Every participant in each of the five tests used six balls to complete the above skills. Only in the case of the driver and five iron was he allowed to repeat a shot. A target was set up which was to simulate a fairway for these two skills as the participants were required to hit a reasonably straight ball. If

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[27]Hoffman, op. cit., p. 40. [28]Ibid., p. 68.

a ball were hit outside the fifty yard limit, the participant was allowed to repeat until he had six balls in approximately the same direction. In this manner, there was a reasonable certainty in recording the golfer's ability for distance, which was of prime importance for this particular skill.

Also recorded were the results of eighteen holes of golf which each group was required to play on Saturday. Since every member participated on the same day for the same number of holes, it gave an indication about what progress was being made of their golf performance.

V. ANALYSIS OF THE DATA

The data for this study were organized into tabular form for analysis. Mean scores for each group and standard deviations were computed. The Fisher test applied to the driver test indicated that the groups were too small to analyze with a typical statistical test of significance. Although there were observable differences in performance between groups, the degrees of freedom were too few to allow reference to an appropriate table.

Since it is impractical to involve a large enough number of students in such a study to employ a sophisticated test of significance to the data, it is necessary to use caution in the analysis of data in tabular form. The investigator does not naively assume that differences between

groups are statistically significant, but uses his best judgment to infer the advantages of one program over another. This treatment is further justified by the fact that it is anticipated that the results will be used primarily by golf coaches and such treatment should facilitate their interpretation and understanding.

The golf score. The results of pre-test and post-test scores for eighteen holes of golf are summarized in Table I. Although there are no observable differences between the mean scores for each group on the pre-test, the mean scores on the post-test show significant gain as evidenced by decreased scores. It should be noted that the variance or standard deviation on the pre-test rounds were essentially the same for all three experimental groups. The standard deviation for the control group, while somewhat less, is not significant. It is apparent from Table I that all four groups made improvement in golf scores, but Experimental Group I, Experimental Group II, and Experimental Group III made greater gains than the Control Group. It is also apparent that the standard deviations were lowered for all four groups. The smaller within-group variances indicate that each group scored more consistently on eighteen holes of golf.

TABLE I

SUMMARY OF THE RESULTS OF THE PRE-TEST AND POST-TEST ROUNDS OF EIGHTEEN HOLES OF GOLF

	GROUP I			GROUP II			GROUP III			GROUP IV		
Subject	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1	81.7	82.0	.3	80.2	71.0	-9.2	83.0	74.0	-9.0	83.8	81.0	-2.8
2	84.7	78.0	-6.7	82.7	80.0	-2.7	77.7	83.0	5.3	98.3	89.0	-9.3
3	85.0	84.0	-1.0	89.0	83.0	-6.8	84.8	82.0	-2.8	84.3	83.0	-1.3
4	92.0	97.0	5.0	90.3	85.0	-5.3	104.2	88.0	-16.2	87.0	83.0	-4.0
5	87.8	82.0	-5.8	112.8	87.0	-25.8	108.5	92.0	-16.5	94.9	93.0	-1.9
6	115.5	89.0	-26.5	97.5	92.0	-5.5	88.7	88.0	-.7	99.2	91.0	-8.2
Average	91.1	85.3	-5.8	92.2	83.0	-9.2	91.2	84.5	-6.7	91.3	86.7	-4.6
S.D.	11.3	6.2		10.7	6.5		11.3	5.8		6.4	4.5	

The driver. Data summarized in Table II are the results of tests conducted to determine efficiency with the driver. The results are expressed in total yards carried from the tee. This measurement was used to minimize the effect of roll which would be influenced by hard ground, wind, or other factors. It is apparent from the mean scores on the pre-test that there is no significant difference among the four groups in driving yardage. However, post-test mean scores indicate significant gains for Experimental Group I, Experimental Group II, and Experimental Group III, as compared to the Control Group. No valid inferences may be drawn from the standard deviation data.

The five iron. The mean score differences on the pre-test satisfied the assumption that all four groups were essentially alike at the beginning of the study. The mean score differences between groups on the post-test were not significant. However, it is apparent that all groups made gains. According to Table III, Experimental Group I and Experimental Group II showed the most improvement as expressed in mean score gain, and Experimental Group I showed the most consistency as expressed in the standard deviation.

TABLE II

SUMMARY, BY YARDAGE, OF THE RESULTS OF THE PRE-TEST AND POST-TEST, USING THE DRIVER

	GROUP I			GROUP II			GROUP III			GROUP IV		
Subject	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1	181.1	185.2	4.1	188.4	191.9	3.5	182.5	195.5	13.0	186.7	185.6	-1.1
2	156.4	179.2	22.8	170.9	178.7	7.8	178.3	195.4	17.1	169.2	172.8	3.5
3	176.5	179.0	2.5	167.4	175.5	8.1	172.6	173.5	.9	174.4	174.3	-.1
4	170.9	178.3	7.4	173.8	172.9	-.9	169.2	171.9	2.7	162.8	165.4	2.6
5	178.2	184.6	6.4	181.9	187.4	5.5	175.5	177.4	1.9	169.2	169.5	.3
6	186.6	184.7	-1.9	179.2	185.6	6.4	178.3	185.4	7.1	179.3	181.8	2.4
Average	175.0	181.8	6.8	176.9	182.0	5.1	176.0	183.2	7.2	173.6	174.9	1.3
S.D.	9.6	3.4		7.2	7.0		4.6	9.7		7.9	6.9	

TABLE III

SUMMARY, BY YARDAGE, OF THE RESULTS OF THE PRE-TEST AND POST-TEST, USING THE FIVE IRON

	GROUP I			GROUP II			GROUP III			GROUP IV		
Subject	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1	153.7	155.4	1.7	151.6	154.6	3.0	155.4	156.4	1.0	152.7	154.6	1.9
2	146.4	148.2	1.8	150.9	153.7	2.8	157.2	158.6	1.4	149.2	150.7	1.5
3	149.2	151.9	2.7	155.4	158.3	2.9	151.7	153.2	1.5	148.2	148.3	.1
4	145.6	151.8	6.2	149.2	153.8	4.6	151.9	151.7	-.2	150.9	150.9	.0
5	148.3	151.8	3.5	143.7	150.9	7.2	142.9	144.4	1.5	145.5	149.3	3.8
6	147.4	151.9	4.5	142.8	145.7	2.9	143.8	148.7	4.9	151.9	152.7	.8
Average	148.4	151.9	3.5	149.6	152.5	2.9	150.5	152.2	1.7	149.7	151.1	1.4
S.D.	4.1	2.1		4.4	4.7		4.9	3.5		3.9	2.2	

The fifty foot chip shot. The results of the pre-test of accuracy in the fifty foot chip shot, expressed in percentage of successful chip shots into a three foot radius, are summarized in Table IV. At the beginning of the study period, all four groups were essentially comparable in accuracy on this test. All three experimental groups showed considerable improvement in accuracy. A comparison of pre-test and post-test scores for the Control Group indicates little gain in accuracy on the fifty foot chip shot. No variances or standard deviations were computed for these tests because of the non-geometric nature of percentage points. However, it is evident that a wide range of improvement was made within each group ranging from a minus eleven per cent improvement to a plus thirty-four per cent improvement within Experimental Group I. If a test of analysis of variance could be employed with these data, it is reasonable to expect that the results would support the hypothesis that the groups were more variable at the end of the study period than at the beginning.

The three foot putt. The results of the three foot putt are expressed in Table V in percentage of accuracy. Although the experimental groups appear to be slightly better putters at the beginning of the study, all groups showed improvement in accuracy during the study period.

TABLE IV

SUMMARY, BY PERCENTAGE SUCCESSFUL, OF THE RESULTS OF THE PRE-TEST AND POST-TEST OF FIFTY FOOT CHIP INTO A THREE FOOT RADIUS

	GROUP I			GROUP II			GROUP III			GROUP IV		
Subject	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1	.160	.333	.173	.240	.333	.093	.200	.500	.300	.160	.166	.006
2	.240	.333	.093	.120	.500	.380	.240	.333	.093	.200	.333	.133
3	.160	.500	.340	.240	.333	.093	.200	.166	-.034	.320	.333	.013
4	.280	.166	-.114	.240	.333	.093	.240	.333	.093	.280	.166	-.114
5	.120	.333	.213	.200	.166	-.034	.200	.500	.300	.160	.166	.006
6	.200	.500	.300	.160	.500	.340	.280	.166	-.114	.120	.166	.046
Average	.193	.361	.168	.200	.361	.161	.221	.333	.112	.206	.222	.016

TABLE V

SUMMARY, BY PERCENTAGE SUCCESSFUL, OF THE RESULTS OF THE PRE-TEST AND POST-TEST OF THREE FOOT PUTT

	GROUP I			GROUP II			GROUP III			GROUP IV		
Subject	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1	.600	1.000	.400	.760	.833	.073	.800	1.000	.200	.680	.666	-.014
2	.640	1.000	.360	.520	1.000	.480	.600	.666	.066	.800	.666	-.134
3	.760	.666	-.094	.560	1.000	.440	.760	1.000	.240	.480	.833	.353
4	.720	.833	.113	.680	.833	.153	.680	.666	-.014	.640	.666	.026
5	.760	.833	.073	.760	.833	.073	.720	.833	.113	.600	.833	.233
6	.680	.666	-.014	.760	.833	.073	.760	.833	.073	.760	.666	-.094
Average	.693	.833	.140	.673	.888	.215	.713	.833	.120	.606	.722	.116

Experimental Group II appears to have made greater gain than the other groups, with no participant scoring below eighty-three per cent accuracy on the post-test. It is doubtful that any of these gains can be attributed to an exercise routine. However, the significant differences between the percentage of accuracy for Experimental Group II and the Control Group would merit further study to determine the influence of isotonic exercises upon putting.

The ten foot putt. A comparison of the mean scores in Table VI indicates no significant difference at the beginning of the study for the three experimental groups on the ten foot putt. The Control Group scored somewhat below the level of the experimental groups on the pre-test. At the end of the study period there were no significant differences in the mean scores for each of the four groups. However, the gain for the Control Group was somewhat higher than the gains of the three experimental groups. Again, it is doubtful that these gains can be attributed to an exercise routine. Further study with larger groups over a longer period of time may indicate some influence of exercises upon putting, but no inferences can be drawn from the data available.

TABLE VI

SUMMARY, BY PERCENTAGE SUCCESSFUL, OF THE RESULTS OF THE PRE-TEST AND POST-TEST OF TEN FOOT PUTT

	GROUP I			GROUP II			GROUP III			GROUP IV		
Subject	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
1	.360	.833	.473	.400	.666	.266	.440	.666	.226	.360	.666	.306
2	.200	.333	.133	.280	.333	.053	.360	.500	.140	.200	.500	.300
3	.280	.500	.220	.240	.166	-.074	.200	.333	.133	.240	.333	.093
4	.240	.333	.093	.320	.500	.180	.280	.500	.220	.280	.666	.386
5	.400	.333	-.067	.160	.500	.340	.240	.166	-.074	.160	.333	.173
6	.160	.333	.173	.200	.333	.133	.120	.333	.213	.080	.000	-.080
Average	.273	.444	.171	.260	.416	.156	.273	.416	.143	.220	.416	.196

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY

The purpose of this study was to determine the effect that isotonic and isometric exercises have on golf performance at the high school level. In recent years it has been the custom to use isotonic and isometric exercises partly to improve skill techniques and partly to develop strength and endurance. This study dealt specifically with the effect that isotonic and isometric exercises have on golf performance.

A review of background literature revealed that very little research in the field of isotonic and isometric exercises and their effect upon golf performance had been done. Related studies dealt mostly with the effect of isotonic and isometric exercises on strength gains. Most of the research was done at the university level. The studies offered no evidence on which the merits of isotonic and isometric exercises, in relation to golf performance, could be judged.

This study was designed to cover eight weeks. Twenty-four high school boys from the varsity golf team at Wichita High School West were divided into four equivalent groups; one group used a combination of isotonic and isometric

exercises on alternate days, one group used only the isotonic exercises, one group used only the isometric exercises, and the fourth group did not use exercises at any time during the study. These different treatments, assigned to the groups, were applied to determine the effects of the isotonic and isometric exercises over variable time spans, and to determine what, if any, effect resulted in golf performance. The items included in the isotonic exercises were the side lateral raise, front deltoid raise, curl, tricep kick-back, rear deltoid, golfers twist, standing press, upright rowing, body twist, flying motion, stiff leg dead lift, and wrist roll. The items included in the isometric exercises were the back swing, downswing top, downswing middle, downswing bottom, hip pivot, left side pull, press lockout, pull, curl, backward arm raiser, frog kick, and toe rise. All four groups followed the same general routine in practice. They were tested at the beginning of the study, and every two weeks on five phases of golf performance: (1) distance with the number one wood; (2) distance with the number five iron; (3) accuracy of a fifty foot chip into a three foot radius around the hole, which was recorded on the basis of whether or not it was successful; (4) accuracy of a three foot putt recorded on the basis of whether or not it was successful; and (5) accuracy of a ten foot putt, also recorded on the basis of whether or not it was successful. Every participant

in each of the five tests used six balls to complete the above skills. Also recorded were the results of eighteen holes of golf which each group was required to play each week. The data collected were treated by comparing mean scores of the different groups and applying the standard deviation.

At the end of the eight-week period in the test using the driver there were significant differences between Experimental Group I and the Control Group, and between Experimental Group II and the Control Group, and between Experimental Group III and the Control Group. All three experimental groups showed an improvement. Eighty-three per cent of all the participants showed improvement. However, those participating with the control group showed no significant improvement. Although Experimental Group III showed the most improvement, no significant difference was observed between Experimental Group I, Experimental Group II, and Experimental Group III.

In the test using the five iron there were no significant differences between any of the groups. Ninety-five per cent of the participants showed improvement; however, even though Experimental Group I showed the most improvement, the Control Group improved enough that there were no significant differences.

For the fifty foot chip test there were significant differences between Experimental Group I and the Control Group, and between Experimental Group II and the Control Group, and between Experimental Group III and the Control Group. All three experimental groups showed an improvement. Seventy-five per cent of all the participants showed improvement. However, those participating with the Control Group showed no significant improvement. Although Experimental Group I showed the most improvement, no significant difference was observed between Experimental Group I, Experimental Group II, and Experimental Group III.

In the test for the three foot putt there were significant differences between Experimental Group II and the Control Group. Experimental Group II showed the most improvement; however, no significant difference was observed between Experimental Group I, Experimental Group III, and the Control Group. Seventy-nine per cent of all the participants showed improvement.

At the end of the eight-week period in the test for the ten foot putt there were no significant differences between any of the groups. Eighty-three per cent of all the participants showed improvement. The Control Group showed more improvement than any of the experimental groups.

In the test based on the results of eighteen holes of golf there were significant differences between

Experimental Group I and the Control Group, and Experimental Group II and the Control Group, and Experimental Group III and the Control Group. Although Experimental Group II showed the most improvement, no significant difference was observed between Experimental Group I, Experimental Group II, and Experimental Group III.

II. CONCLUSIONS

The following conclusions are based upon the evidence obtained in this study.

It was apparent at the end of the eight-week period that any advantage to the use of isotonic and isometric exercises in relation to golf performance could clearly be determined. It is concluded that within the limitations of this study the combination method was not superior to either the isotonic or isometric method used separately. However, an improvement was observed between the Experimental Groups and the Control Group on all the tests. There was a significant improvement on only the test using the driver, on the fifty foot chip test, and the three foot putt test. Also, an improvement was observed based on the results of eighteen holes of golf played each week. Since the groups were alike to begin with, differences observed clearly imply that an advantage could be determined. It may therefore be

concluded that there is an advantage in the use of isotonic and isometric exercises in relation to golf performance.

III. RECOMMENDATIONS

The coach, when planning a golf program, should plan on the use of isotonic and isometric exercises as a means of developing skill among his players. This recommendation is made, of course, within the limitations of this study and is not considered to be universally applicable. It should also be noted that the value of the combination method should not be discredited on the basis of the findings of this study. It was superior in two tests and therefore warrants further investigation.

More research is needed before any definite conclusions can be drawn concerning the various types of isotonic and isometric exercises to be used. Similar studies should be conducted using longer periods of time than eight weeks. Similar studies should be conducted using different age groups and other methods of testing golf performance.

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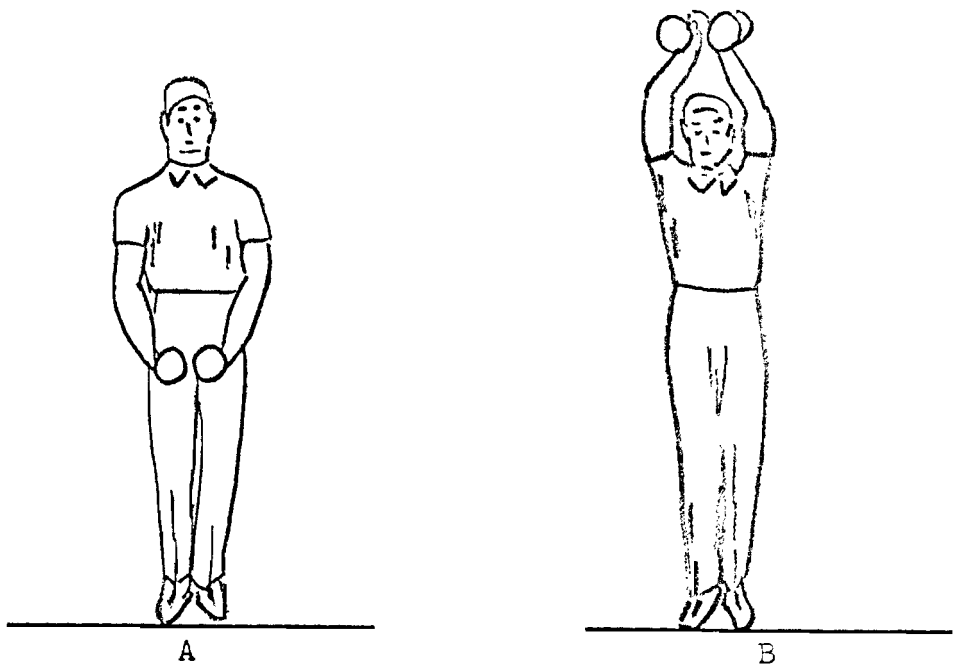
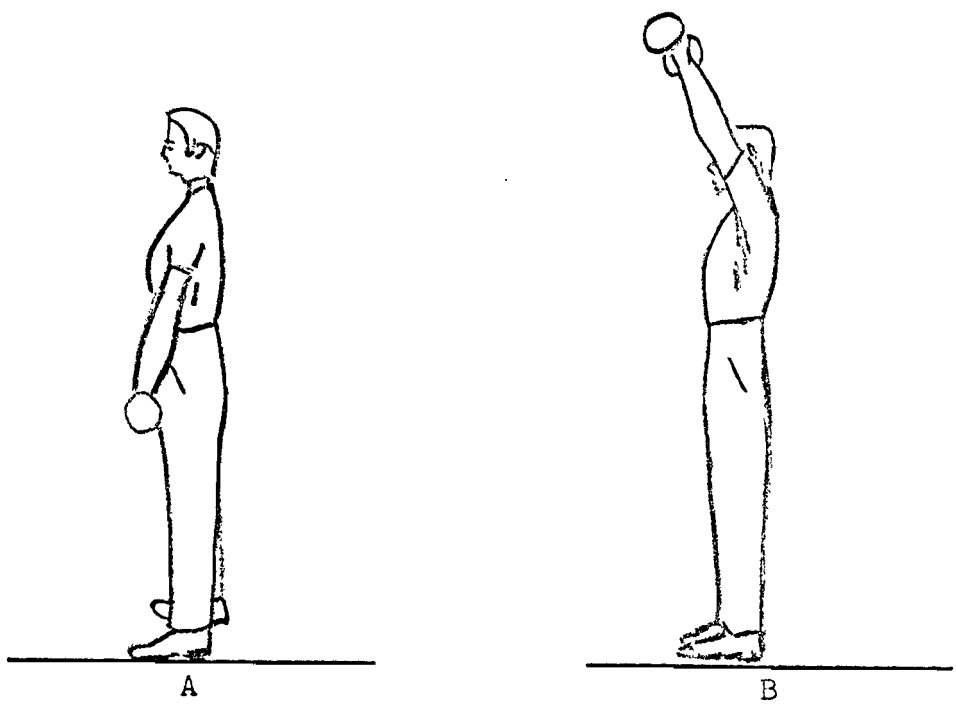
APPENDIX A

ILLUSTRATIONS OF ISOTONIC EXERCISES

ISOTONIC EXERCISES

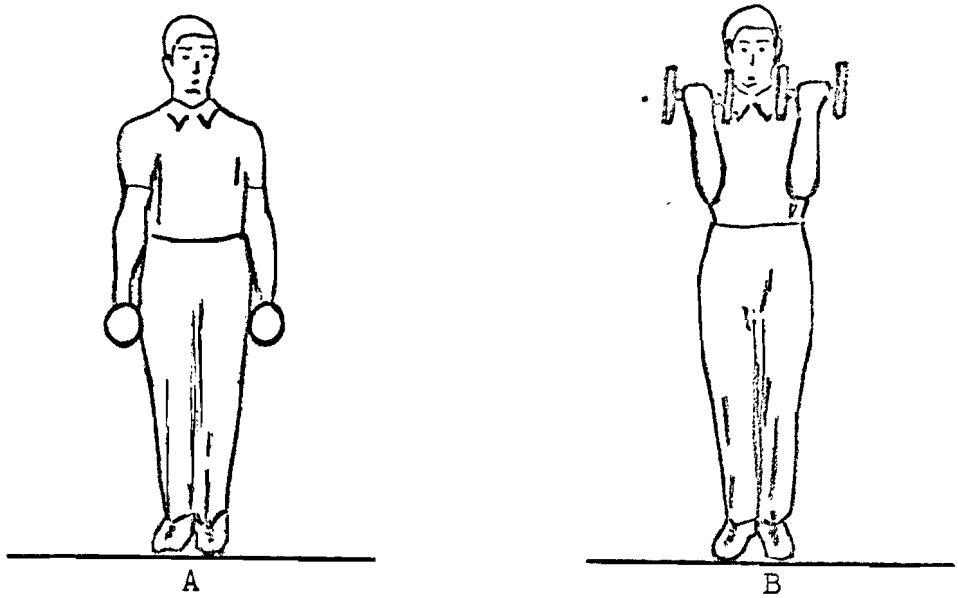


1. Side lateral raise



2. Front deltoid raise

ISOTONIC EXERCISES (continued)



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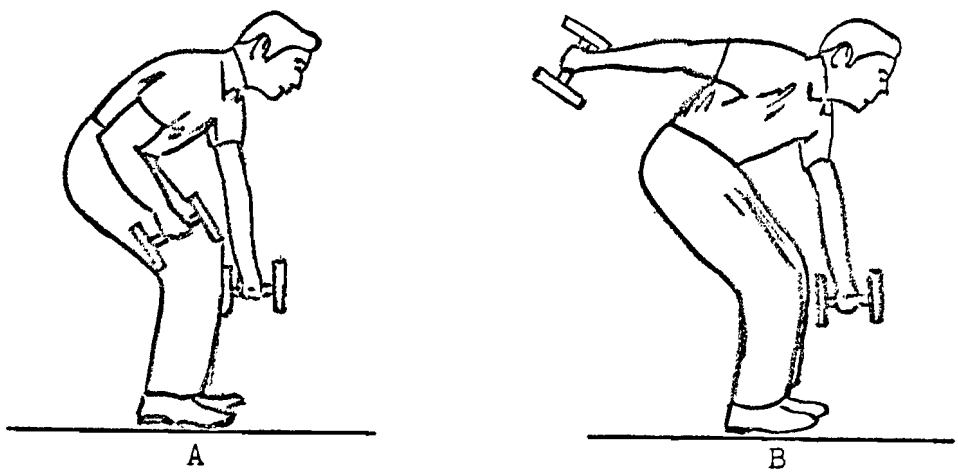
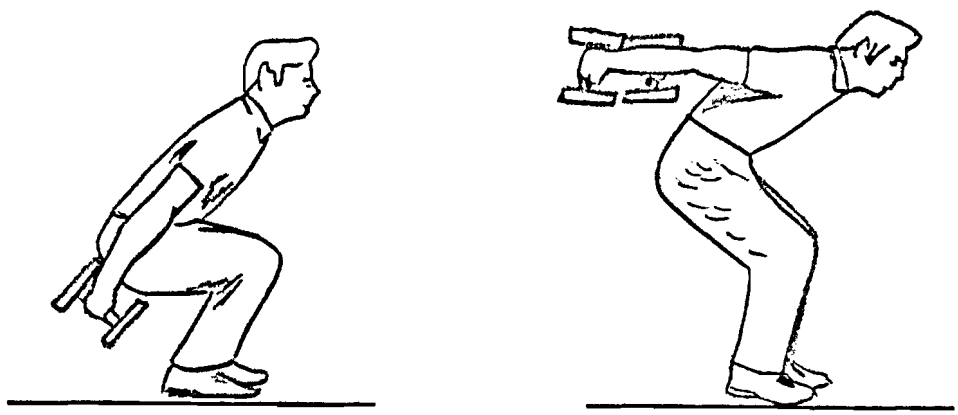


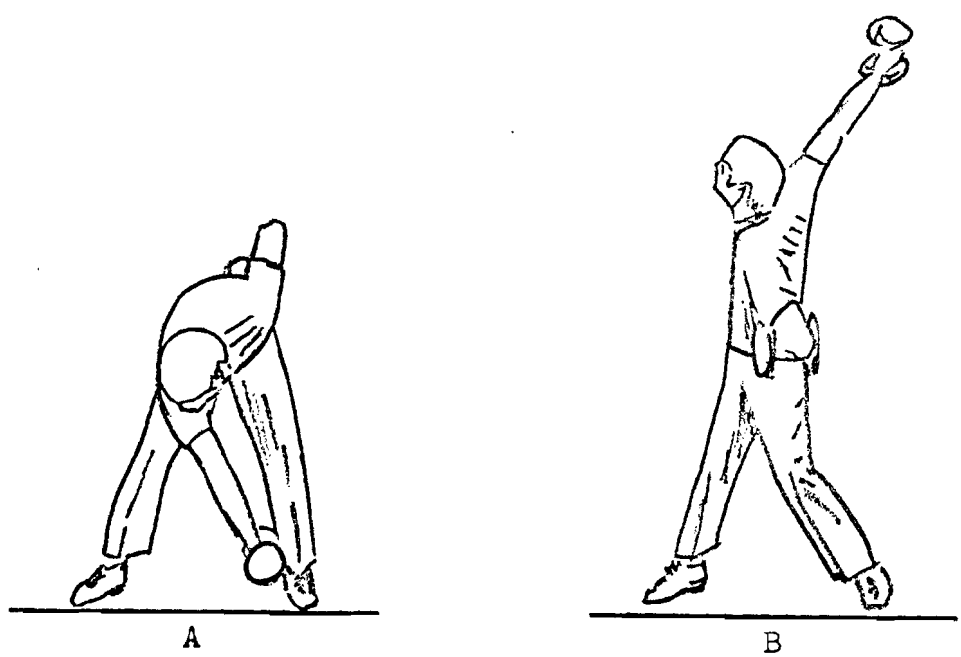
4. Tricep kick-back

ISOTONIC EXERCISES (continued)



A B

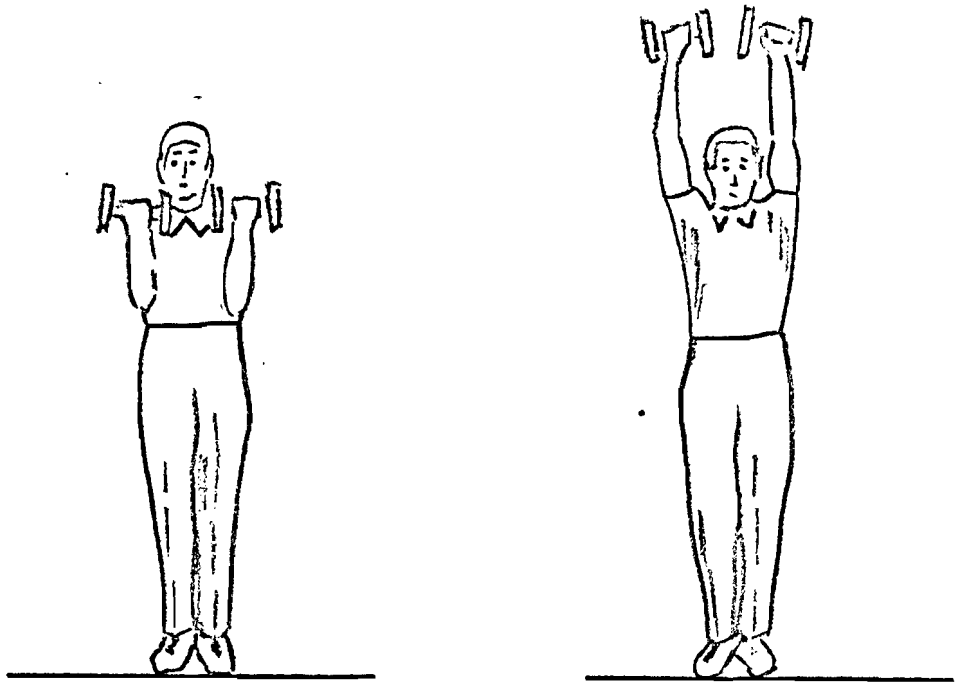
5. Rear deltoid



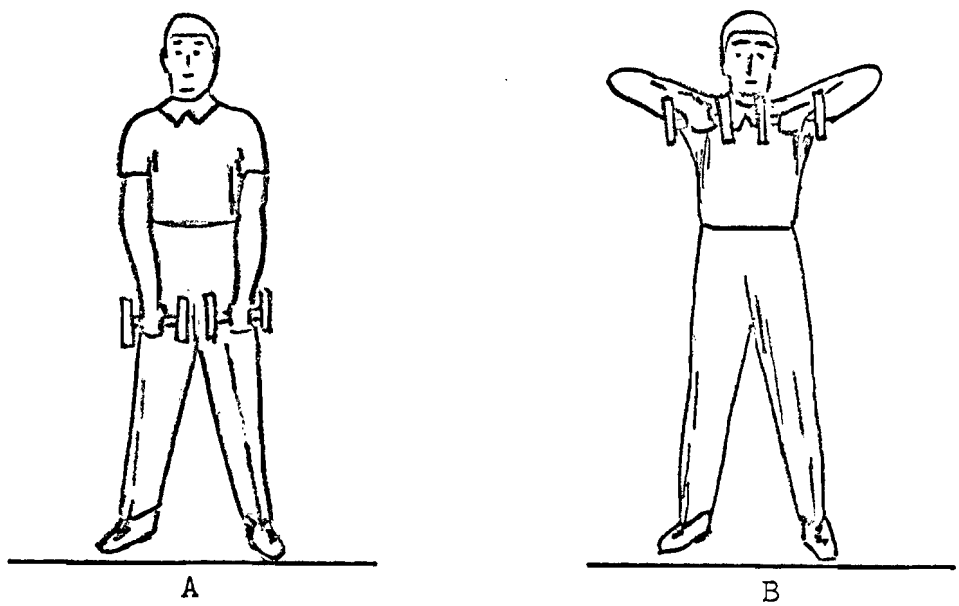
A B

6. Golfers twist

ISOTONIC EXERCISES (continued)

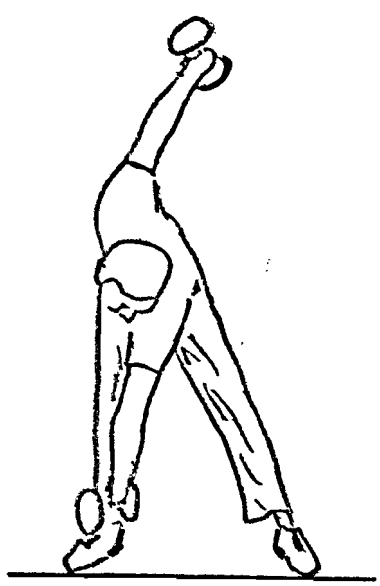


7. Standing press

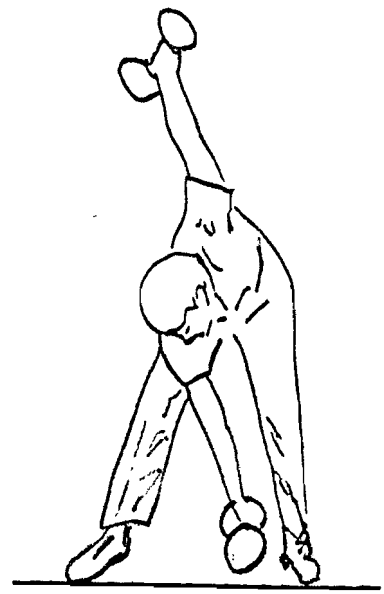


8. Upright rowing

ISOTONIC EXERCISES (continued)

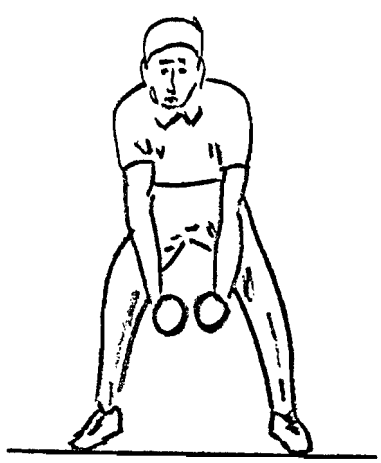


A



A

9. Body twist



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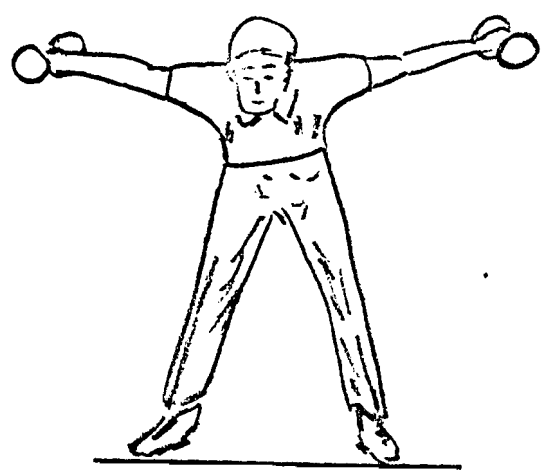
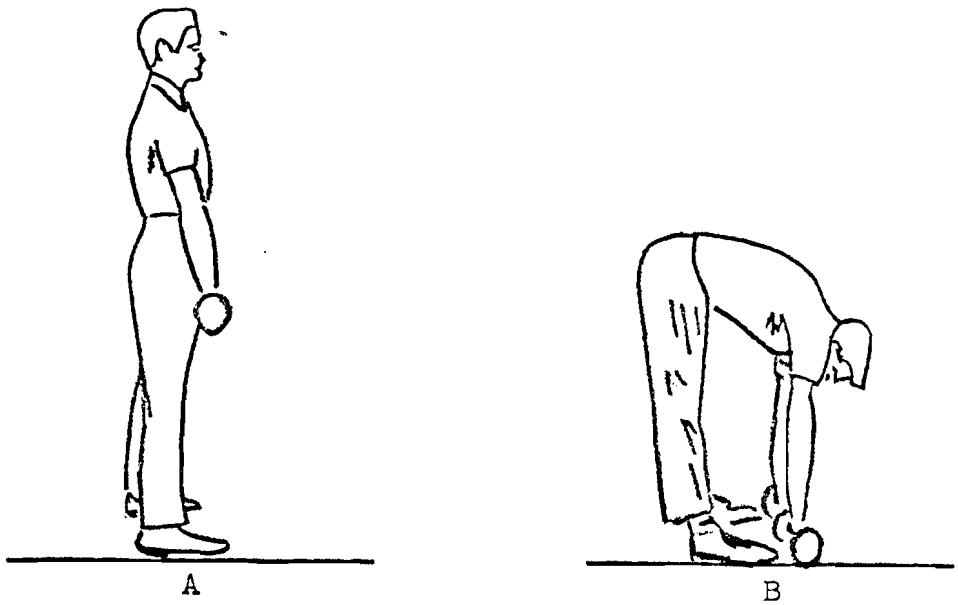


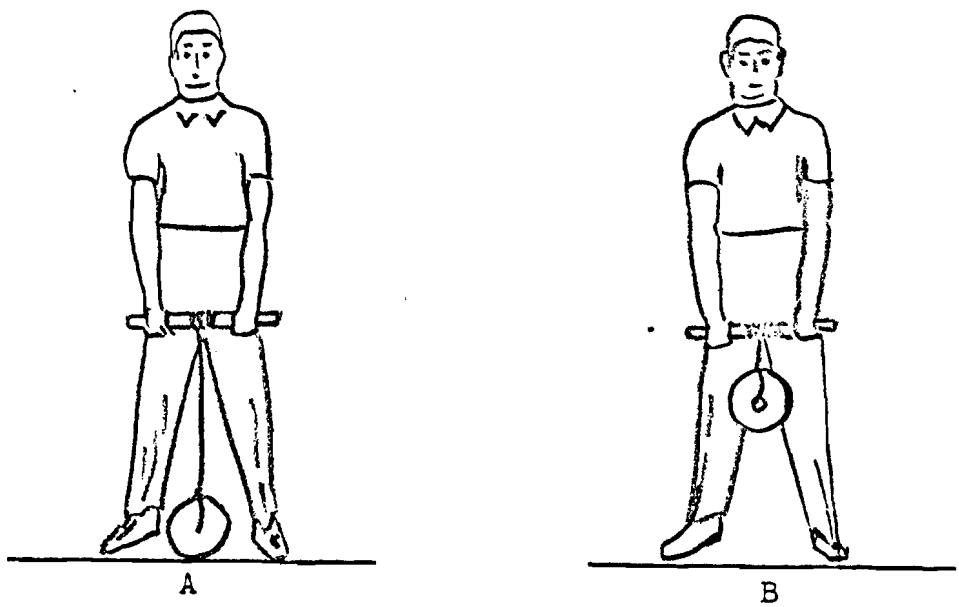
B

10. Flying motion

ISOTONIC EXERCISES (continued)



11. Stiff leg dead lift

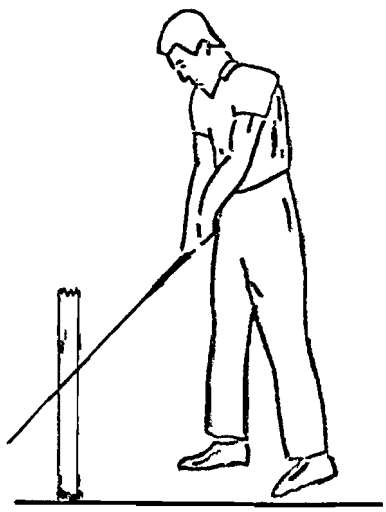


12. Wrist roll

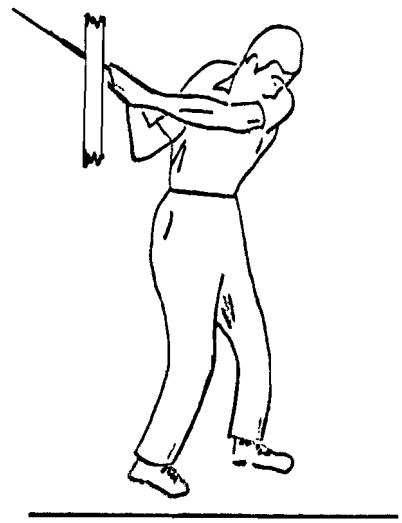
APPENDIX B

ILLUSTRATIONS OF ISOMETRIC EXERCISES

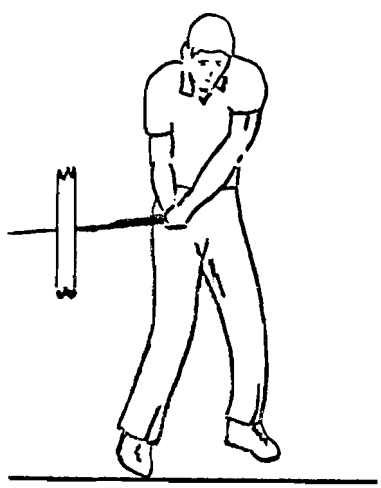
ISOMETRIC EXERCISES



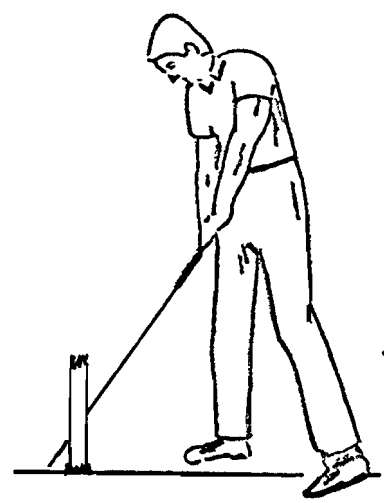
1. Back swing



2. Downswing top

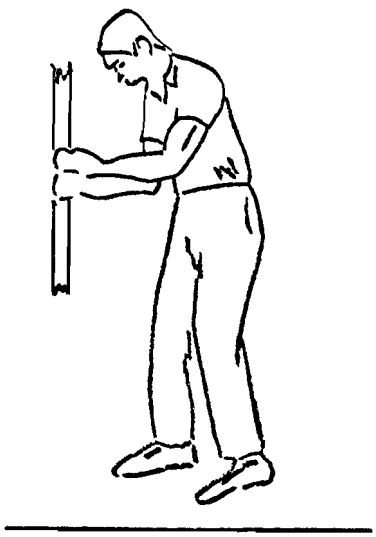


3. Downswing middle

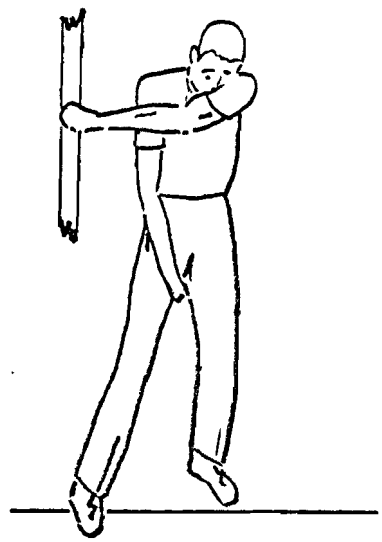


4. Downswing bottom

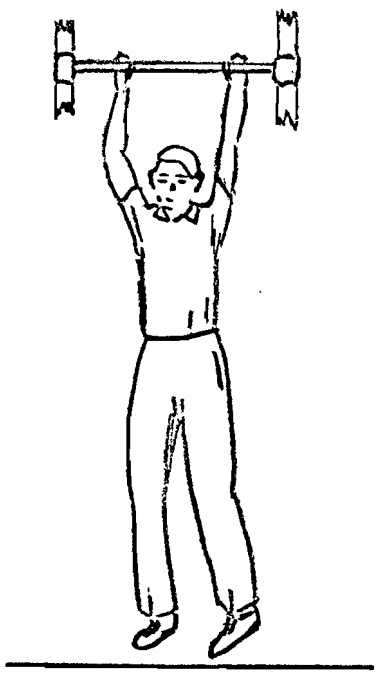
ISOMETRIC EXERCISES (continued)



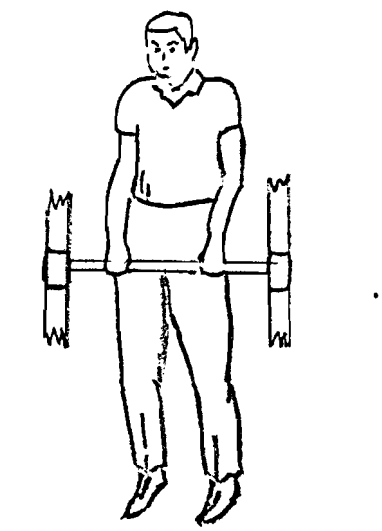
5. Hip pivot



6. Left side pull

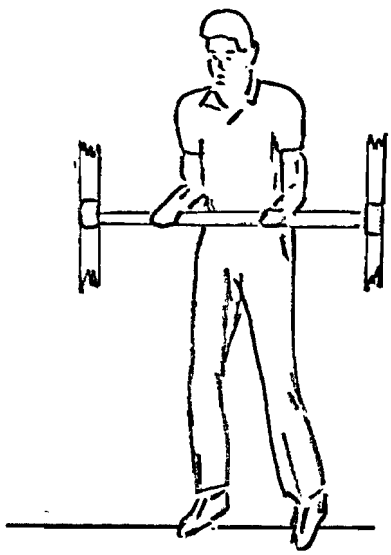


7. Press lockout

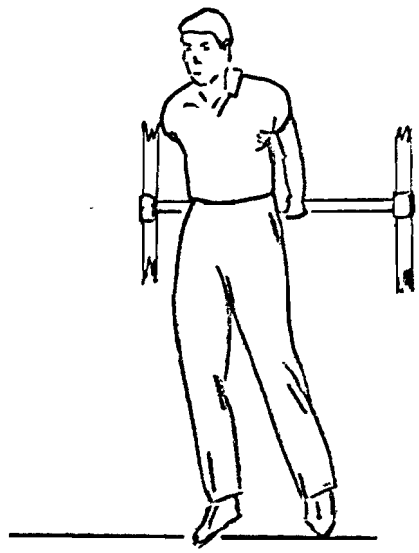


8. Pull

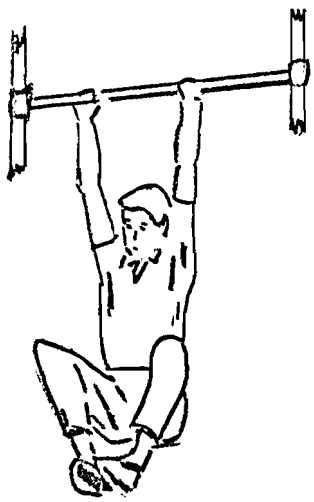
ISOMETRIC EXERCISES (continued)



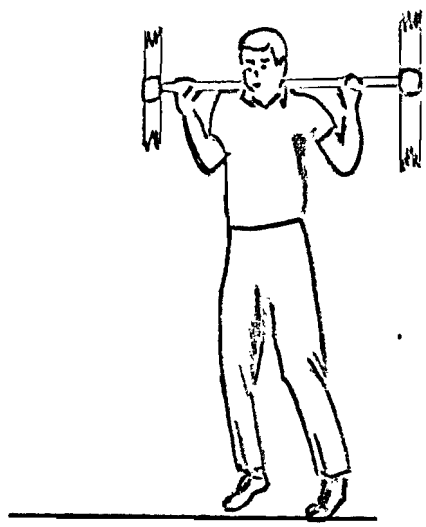
9. Curl



10. Backward arm raiser



11. Frog kick



12. Rise on toes

APPENDIX C

LETTER IN THE STUDY

March 4, 1965

Dear Mr. :

I am in the process of doing a research problem on the "effect of isometric and isotonic exercises has on golf performance."

I would appreciate any information you have on this subject and any other related literature you may have available. This information will be vitally important to our study.

I am conducting this study in hopes that we may improve our golf program on the high school level. Your information will be a contributing factor in the outcome of this research.

Hoping to hear from you in the near future.

Sincerely,

Ed Kriwiel
Head Golf Coach

EK:kt

Enclosure

APPENDIX D

RECIPIENTS OF LETTER

Armour, Tommy
Grosuenor Apt. 506
720 North Ocean Blvd.
Delay Beach, Florida

Consolver, Tex
Golf Professional
MacDonald Municipal Golf Course
840 N. Yale Avenue
Wichita, Kansas

Elliott, Tom
Rawlings Sporting Goods Company
2300 Delmar Boulevard
St. Louis 66, Missouri

Gwin, Ted
Golf Professional
Crestview Country Club
4201 East 21st Street
Wichita, Kansas

Harris, Labron
Golf Coach
Oklahoma State University
Stillwater, Oklahoma

Kirkpatrick, Bob
Golf Coach
Wichita State University
Wichita, Kansas

Moore, Bob
Golf Coach and Athletic Director
Friends University
Wichita, Kansas

National Golf Foundation
Room 804
Merchandise Mart
Chicago 54, Illinois

Navarro, Auggie
Golf Professional
Sim Park Municipal Golf Course
Wichita, Kansas

O'Brien, Gene
Golf Professional
Rolling Hills Country Club
223 Westlink
Wichita, Kansas

Overby, John
Golf Professional
Clapp T.W. Golf Course
4611 East Harry
Wichita, Kansas

Schloss, Irv
2053 Harvard Avenue
Dunedin, Florida

Thomas, Bob
Golf Professional
Wichita Country Club
8501 East 13th Street
Wichita, Kansas

U.S. Golf Association
40 East 38th Street
New York 16, New York

Walsh, Frank
813 North Lighthouse Drive
North Palm Beach, Florida

(Replies received from twelve of the above addressees)