

INSTRUCTION MANUAL FOR  
TWIN BASKETBALL GAMES

- FOR PEOPLE WITH CERVICAL CORD INJURIES -

Editor  
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NATIONAL REHABILITATION CENTER  
FOR PERSONS WITH DISABILITIES  
JAPAN

(WHO COLLABORATING CENTRE)

March, 2005

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- 3 To undertake studies of community-based rehabilitation (CBR), primary health care, and other social support systems for PWDs.
- 4 To undertake research and development of affordable assistive technologies in collaboration with PWDs.
- 5 To prepare manuals for education and training of professionals in health, medical welfare services for PWDs.
- 6 To support organization of conferences and / or seminars on rehabilitation of PWDs.

National Rehabilitation Center for Persons with Disabilities  
WHO Collaborating Centre for Disability Prevention and Rehabilitation

Rehabilitation Manual 16

Instruction Manual for Twin Basketball Games

- For People with Cervical Cord Injuries -

March 31, 2005

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## **PREFACE**

Sport is of significant benefit to the health of people with and without disabilities. Today, lifestyle-related diseases, such as obesity, diabetes and hypertension, which are associated with insufficient exercise, have become major health problems in Japan. Due to mental depression and physical restraints, it is difficult for those with disabilities to do physical exercise, especially aerobic exercise, which is effective in preventing lifestyle-related diseases. In addition, it is difficult for such individuals to find environments where they can exercise regularly and only a few individuals can benefit from sport while enjoying it.

Sport for people with disabilities began as a means of functional recovery training in hospitals. To date, various games have been created for people with disabilities and some of these games have developed into championship competitions on a national scale. Wheelchair basketball has a long history as a sport that wheelchair users can enjoy. Twin basketball has been devised to allow even those incapable of throwing the ball to a high basket goal the ability to participate in and enjoy basketball. Another feature of this sport is that those capable of throwing the ball to a higher basket and those not capable of doing so can both participate in the game. This sport was created in 1977 and has since become widespread.

This manual aims to improve the health of wheelchair users with severe motional disabilities and to encourage such individuals to increase their pleasure in life by participating in twin basketball. It covers topics such as the structure of the wheelchair, the posture of the player in the wheelchair, basic techniques and how to learn twin basketball, all of which are important topics for beginners to keep in mind. I hope this manual will be of use to those who, through twin basketball, have become accustomed to doing exercise to improve their health, those who wish to increase their competitiveness and enjoy games, and those who are sports instructors for people with disabilities.

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Note: Photographs of faces are put in this manual with the approval of the players.

## Introduction

Twin basketball is a team sport that was created for quadriplegic patients in Japan in 1977. It began in the rehabilitation field of hospitals, where it was used as a means of functional recovery training for people with cervical cord injuries. Now also popular with the general public, twin basketball has developed into a championship competition sport and vies for a Health and Welfare Ministry cup; the Japanese championship competition has been held 19 times.

For people with cervical cord injuries, it is, depending on injury level, physically impossible to shoot the ball to a basket goal placed 3.05m from the floor. In twin basketball, a pair of baskets with a height of 1.2m are added and each team uses the two baskets so that even players with serious injuries, not only in the legs but also in the trunk and arms, can enjoy basketball. That is why it is called twin basketball (Photo 1).

Twin basketball is played by people with disabilities such as cervical cord injuries, spina bifida, cerebral palsy and Charcot-Marie-Tooth disease. Since 90% of such players have cervical injuries, this manual describes the method of coaching for players with these injuries.



Photo 1 Court (lines and upper and lower baskets)

## **Chapter 1.**

### **Background Knowledge of Disabilities for People with Cervical Cord Injuries**

Twin basketball instructors for people with cervical cord injuries do not have to be acquainted with specialized medical details. However, they do need to have background knowledge and an understanding of the disabilities..

People with cervical cord injuries vary widely, from those requiring electric powered wheelchairs to those capable of walking. However, in the case of complete paralysis due to transverse injury of the cervical cord, the patient develops motor paralysis and numbness in the hands, the legs, and in the trunk as well as a breathing disorder, autonomic disorder and vesicorectal disorder, and, as a result, is forced to regularly use a wheelchair. Moreover, in addition to these basic disorders, secondary disorders or complications such as contractures, bedsores, osteoporosis, heterotopic ossification, urinary tract infections and calculus also develop in many cases. Therefore, knowledge of these disorders is required to ensure adequate consideration for patients is achieved.

#### **1. Understanding the Injury Level, Upper Limb Function and the Achievable Level of Daily Activity**

Table 1 shows the remaining upper limb functions of people with complete paralysis from cervical cord injuries by the level of the injured spinal segment; Table 2 shows the achievable functional consequences based on the ADL independence level. The instructor must attempt to grasp the limitations of the remaining functions to understand the physical condition of the players they are coaching.

Table 1 Cervical cord injury level and upper limb functions <sup>Reference 1)</sup>

| Spinal segment | Major muscle groups controlled   | Remaining level of Upper limb function  |
|----------------|--|---|
| C4             |  | Only capable of elevating the shoulders<br>(Complete paralysis from shoulder joint to fingers)                                |
| Higher         |  | Above function is strong<br>Capable of bending/externally rotating the shoulder joint and bending the elbow joint, but weakly |
| C5             | M. Trapezius   | Above function is stronger<br>Capable of supinating the forearm, but weakly   |
| Lower          |  |   |
| Higher         |  | Above function is stronger<br>Capable of dorsiflexing the wrist joints, but weakly  |
| C6             | M. Deltoid   | Above function is stronger<br>Capable of pronating the forearm, but weakly  |
| Lower          |  |   |
| Higher         |  | Above function is stronger<br>Capable of volar flexing the wrist joints and extending the elbow, but weakly                   |
| C7             | M. Biceps brachii<br>M. Brachioradialis<br>M. Supinator  | Above movement is more certain  |
| Lower          |  |   |
| C8             |  | Finger flexion develops<br>Capable of pinching and grasping things  |
| T1             |  | Intrinsic muscles of the hand are effective, and the player is capable of skilled motion of the fingers                       |
|                | M. ext. carpi. rad. long.<br>M. ext. carpi. rad. brev.<br>M. pronator teres<br>M. flex. carpi. rad.<br>M. triceps brachii.<br>M. ext. carpi. uln.<br>M. ext. digitorum<br>M. flex. carpi. uln.<br>M. ext. pollicis long / brev.<br>M. flex. digit. sup./prof.<br>M. flex. pollicis long.<br>Lumbricalis M.<br>Thenar M.<br>Interosseus M.<br>Hypothenar M. |   |

Table 2 Functional consequences for people with spinal cord injuries (complete paralysis) <sup>Reference 2)</sup>

| High level | Transfer onto the bed         | Depressurization  | Transfer to/from the wheelchair  | Handling the wheelchair  | Walking  | Self-help device/brace   | Automobile  |  |
|------------|-------------------------------|---|--|--|--|--|---|--|
| C3-C4      | Fully dependent               | Dependent on the bed/wheelchair (independent when using a motorized reclining system)             | Fully dependent  | Special control method (independent if using a motorized wheelchair with expiration/jaw control)   | Not adaptive   | External motorized brace, wrist dorsal flexion brace, BFO        | Not able to drive a car   |  |
| C5         | Uses assistance and equipment | Mostly assisted (capable of tilting the body by holding the grip with the forearm)                | Assisted by one person (with/without a transfer board)   | Independent in a motorized wheelchair indoors/outdoors. Capable of independently traveling a short distance indoors if using an anti-slip device, such as a plastic hand rim and knob. |  |  | Self-help devices equipped with a mechanical grasping splint or a universal cuff                              | Capable of driving a van-type car equipped with a special device |
| C6         | Independent using equipment   | Partially assisted (capable of tilting the body by holding the wheelchair with the wrist/forearm) | Partially assisted (may be independent if using a transfer board)                              | Independent indoors if using an anti-slip device, such as a plastic hand rim and knob. Needs assistance outdoors.  |  |  |   |  |
| C7         | Independent                   | Independent   | Independent (capable of transferring to/from a car; assisted when transferring from the floor) | Independent indoors and outdoors (except on curbs and stairs)  |  | Combined use of KAFO and a forearm stick (both arms) or a walker |   |  |
| C8-T1      |                               |   | Independent (in all horizontal/vertical transfers)   | Independent  |  |  | Independent indoors and outdoors (also capable of traveling on curbs, using escalators and descending stairs) | Can only train with assistance (not functional)                  |
| T2-T10     |                               |   |  |  | Training only (not functional; may not require assistance)                     |  |   |  |
| T11-L2     |                               |   |  |  | May be independent if using an assisting device                                |  | Combined use of KAFO (or AFO) and a forearm stick   |  |
| L3-S1      |                               |   |  |  | Capable of independently walking in the community if using an assisting device |  | Combined use of AFO and a forearm stick (both arms) or a stick (both hands)                                   |  |

## **2. Health Management Precautions**

### **1) Prevention of Bedsores and Depressurization**

Bedsores may be caused by bruises, abrasions, skin injuries, blisters, folliculitis, local uncleanliness or infection. Therefore, it is necessary to encourage patients to keep their skin clean and to prevent injury whilst playing twin basketball.

The pressure applied on the buttocks during excise and games repeatedly decreases and increases due to movement of the upper body. Therefore, it is important that players become accustomed to intentionally performing depressurization during intervals. In addition, since bruises from falling are the most common cause of bedsores, it is necessary to oblige players to attach an anti-tip bar. Slipping of the buttocks and repeated slight front-to-back and side-to-side movements will graze the protruding part of the bone, leading to bedsores. Therefore, it is important to avoid using excessively slippery material for the wheelchair cushion cover and for the uniform pants.

### **2) Water Intake and Urination**

As a guideline, the water intake of people with cervical cord injuries is roughly 1,500 cc for those using self-catheterization and 2,000 cc for those using a catheter and other methods of collecting urine. If the outside air temperature or humidity is high during exercise or a game, it is necessary to adjust water intake. To prevent the autonomic hypertonic reaction progresses, it is necessary that the player urinate regularly.

### **3) Defecation**

If feces remain in the body, unexpected incontinence may occur in situations such as transfer to/from the wheelchair and forward flexion of the trunk. Therefore, it is important to check if any feces remain.

It is important that defecation is controlled in relation to the exercise and games schedule.

### **4) Body Temperature Regulation**

If the outside air temperature is high or if a player produces heat through exercise, his/her body temperature will rise and headache, generalized fatigue or disturbance of consciousness will occur. If playing twin basketball in a high-temperature/humid season, it is necessary to take measures to minimize the rise in body temperature, such as frequently taking breaks, spraying water on the body, cooling the body with a cooling agent (take care not to cause frostbite due to paresthesia), drinking cold water, using an electric fan and taking refuge in an air-conditioned area. In a cold season, the player will have difficulty maintaining a favorable body temperature. Therefore, it is necessary to move to an air-conditioned area before the body becomes chilled.

### **5) Orthostatic Hypotension**

The blood pressure of a person with a cervical cord injury frequently ranges from a minimum of 40 to 50 mmHg to a maximum of 90 mmHg. If he/she suddenly rises from the bed, blood stays in the abdomen and the lower limbs and causes orthostatic hypotension. In such a case,

anteflexing the body, applying abdominal pressure using his/her own weight and lowering the head will gradually recover the blood pressure. If he/she cannot bend the body forward caused by hip joint problem, make him/her breath in deeply in the wheelchair, after that, the team staff make the player to breath out and press his/her body from middle part of throat to abdomen like narrow the waist with both hands. The blood pressure will recover by such transitive abdominal muscle pressure. If orthostatic hypotension occurs, it is important to stop the exercise and take enough rest.

#### 6) Symptoms Similar to Orthostatic Hypotension

##### (1) “Belly-pushing Movement” during Exercise and Games

If exercise stress increases in a player whose vasoconstrictive function is lowered due to autonomic disorder and a symptom similar to orthostatic hypotension may occur. If such excessive exercise stress is applied to the cardiovascular system, it is necessary for the player to take adequate breaks. We often see players pushing or hitting their abdomens. It appears that they are promoting a temporary rise in blood pressure by increasing their abdominal pressure. However, the act of pushing the belly while playing in international competitions is increasingly regarded as doping to boost performance by intentionally inducing autonomic hypertonic reaction.

##### (2) Hypoglycemic State

For most people with cervical cord injuries, daily food intake is small. They frequently develop transient hypoglycemia. To avoid such states, they need to take sugar supplements. As a temporary measure to cope with these symptoms, it is preferable to ingest sugar-containing foods such as chocolate, candy, brown sugar and bananas.

Even if a player is talented and has good physical strength and playing techniques, his/her constant exercise or practices will not be rewarded without thorough self-management of their nutrient intake. Therefore, it is important to establish balanced nutrition and calorie intake while taking into account daily activities and games.

#### 7) Taping and Gloves

To prevent grazing and friction burns on their upper limbs, the player must to stabilize their wrists (the range of motion of which will have become excessively large due to hard use in everyday life), and deformed or contracted fingers from sprains. Although tapes and gloves are essential items for protecting paralyzed upper limbs, it is important to ensure that ischemia does not develop from over-tightening (Photo 2).

## **Chapter 2.**

### **Wheelchairs for Twin Basketball**

An error of 1 cm in length or 1 degree in the angle of the backrest and seat of the wheelchair will not only affect the seating posture and mobility of a player with a cervical cord injury but also his/her overall performance. Therefore, it is necessary consider the remaining functions available to the player, their kinetic ability and body type. It is also important to consider the role of the player in the team and to confer with the members and coach in order to produce a wheelchair that can maximize the player's performance.

#### **1. Design**

##### **1) Height of the Backrest**

Since individuals with complete paralysis caused by a cervical cord injury must maintain their balance by leaning on the backrest of the wheelchair. When producing a wheelchair, the manufacturer must keep the height of the backrest as high as possible without limiting the motion of the shoulder blades.

##### **2) Angle of the Backrest**

If the angle of the backrest is too large (has a backward tilt), it will cause hunchback posture of the spine and adjusts their trunk balance by sticking their face forward. As a result, the motion of the cervical spine is exposed to excessive force and the injured area will likely be adversely affected. If the angle of the backrest is too small, the trunk will frequently lean forward. It cannot be easily repaired or adjusted. Therefore, it is necessary to determine the correct angle of the backrest while considering the use of straps for the pelvis region, the abdomen and the chest.

##### **3) Position of the Axle**

Players with cervical cord levels 5 and 6 (C5, C6) injuries use a group of elbow hamstrings to maneuver for forward movements and for backward movements. To allow the elbow flexors to work effectively both in forward and backward movement, it is necessary to position the axle anterior to the backrest. If it is positioned too far backwards, the front wheels will be raised off the ground, thus increasing the risk of a backwards fall.

##### **4) Front-to-back Difference in the Seat Height**

If the forward tilt of the seat is large, it will cause the trunk to tip forward frequently and inhibit the movement of both upper limbs. In addition, it will likely cause the pelvis to slide forward and unstable posture. If the backward tilt is large, the trunk balance will be more stable, but the front wheels will be raised off the ground, making it impossible to prevent the player from falling backwards.

##### **5) Rubber-coated Hand Rim**

People with cervical cord injuries wear rubber or leather gloves for strength the friction resistance to

transmit the force of hands to hand rims. Furthermore, it is necessary to use coated hand rims to effectively transmit the force of upper limbs to the hand rims when the player drives the wheelchair (Photo 2).

As an alternative to coating, the instructor should employ a measure such as cutting a rubber hose in half and wrapping it around the rim or wrapping a rubber tube around the rim.

#### 6) Attaching the Anti-tip Rear Caster

Backwards falls can occur easily, not only because of structural problems in the wheelchair, but also because of contact during play. Therefore, it is necessary that the player be obliged to attach an anti-tip rear caster (Photo 2).

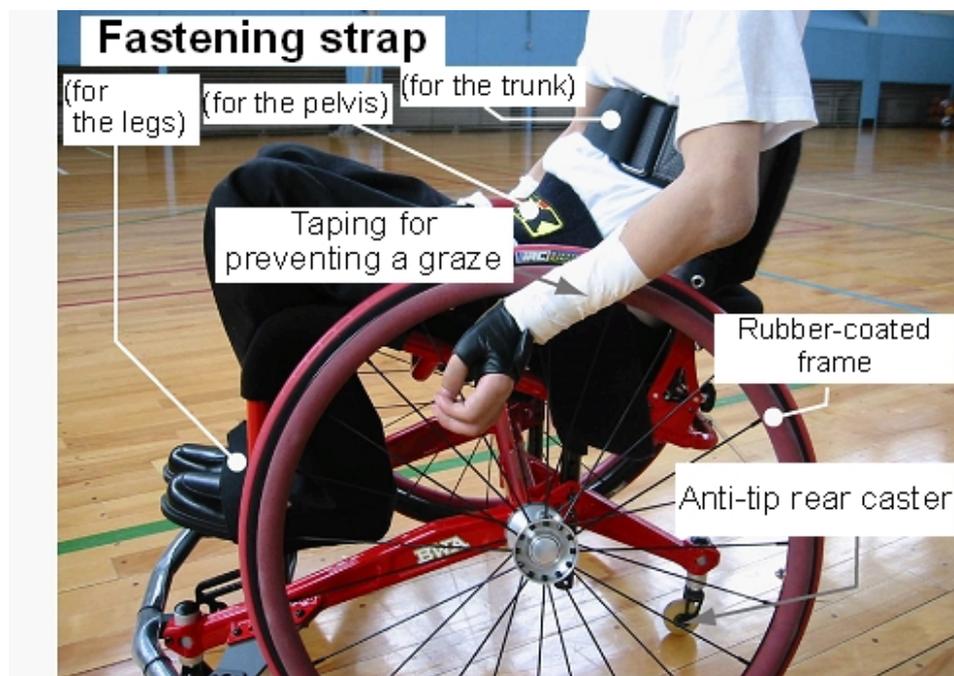


Photo 2 Taping for preventing a graze, gloves, fastening straps and the wheelchair

## 2. Transfer to the Wheelchair

Since wheelchairs used for twin basketball must not have a brake, a player with C5 or C6 injury requires assistance when he/she transfers from a daily-use wheelchair to a wheelchair for twin basketball.

## 3. Posture on the Wheelchair

Bad posture caused muscle imbalance by paralysis, spasticity, articular contracture, ossification and bed sore makes unstable seating posture in the wheelchair.

If the player remains in an inappropriate posture in the wheelchair for a prolonged period, the pelvis position will be twisted and the neck settling at an inappropriate incline (Photo 3). This will affect not only the trunk but also several joints. Therefore, it is necessary to constantly check a player's seating posture in the wheelchair in order to prevent excessive bending of the spine; if necessary, correct the seating position so that a horizontal line connects both anterior superior iliac spines and adjust the trunk

position so that the spine is placed in the middle of the wheelchair (Photo 4).



Photo 3 Inappropriate posture



Photo 4 Corrected posture

#### 4. Fastening

People with cervical cord injuries have poor seating balance and they are at risk of falling. It is necessary for the player to wear straps on the chest, pelvic area and thighs in order to secure the body to the wheelchair (Photo 2). Although such straps limit the range of kinetic mobility, they allow the player to perform without fear of falling, thus making them an essential item.

#### 5. Rising from Stooped Posture

Since it is difficult to rise from stooped posture, people with cervical cord injuries maintain sitting posture with fixing belt and strap. If such a state occurs during a game, team staff will help the player to sit upright.

Players with C6 injured can sit upright without help, even if the trunk is bent forward (Photo 5)①.

A player whose elbow joint extension muscle is paralyzed but whose wrist extension muscle is strong should first raise one arm backwards and hook the grip of the wheelchair with the wrist ②. Next, they should pull up the trunk by bending the forearm grasping the wheelchair ③. At the same time, they should hold the other elbow between their thighs and push their wrist towards the inside of their knee while pressing down on the thigh with the elbow until the elbow joint is locked ④. Then they should bend the trunk obliquely backward while keeping rhythm using the neck. It is necessary to bend the trunk obliquely backwards right and left since the nearly upright trunk will become unstable immediately after rising ⑤. By repeating this step several times, the pelvis will move forward and the player can return to their original seating position ⑥.

A C6 injured player with a slightly functional elbow joint extension (Photo 6) should: ① support their trunk by holding the front part of the frame of the seat rail with both hands ② move their center of

gravity to one side and internally swivel the opposite shoulder joint ③. Next, they should extend the elbow of the arm on the same side as the shoulder ④ until the elbow joint locks ⑤. Then they should lock their other elbow joint ⑥ and push up with that hand to return to their original seating position ⑦. It is important to practice it to acquire the technique.

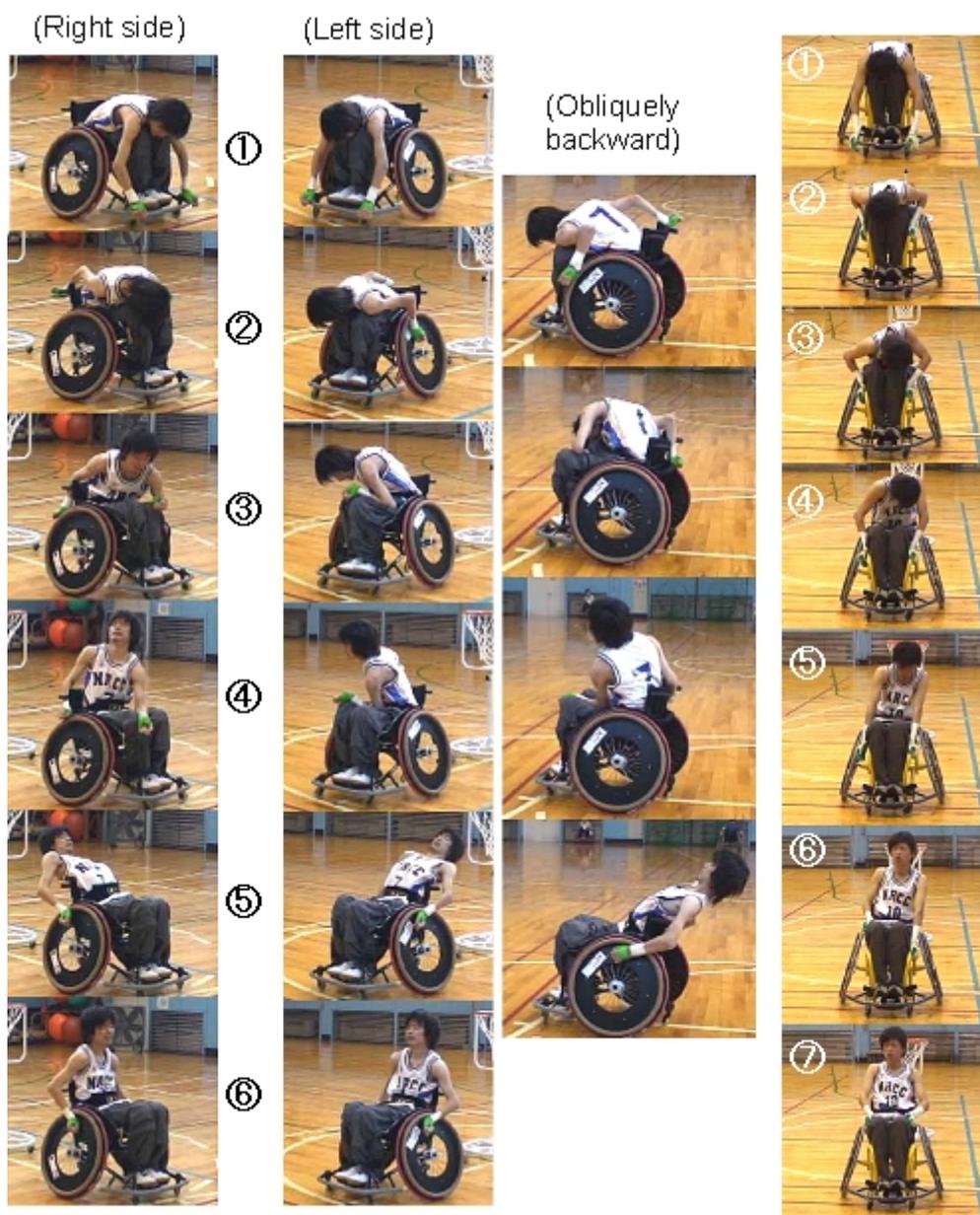


Photo 5 Rising of a player whose elbow joint extension muscle is paralyzed

Rising of a player who retains slight use of the elbow joint extension muscle Photo 6

### Chapter 3.

### Elements that Improve Competitiveness in Twin Basketball

So-called top players integrate their physical, mental, technical and tactical abilities. (Fig. 1).

To improve his/her competitiveness, it is preferable for a player to become acquainted with the game rules and to become familiar with the techniques of ordinary basketball to enhance his/her physical and mental strength and to master skills in maneuvering the wheelchair. In addition, mutual trust among players and between each player and the instructor is a factor that determines how a player's competitiveness improves. Therefore, it is important to foster and maintain a favorable team relationship.

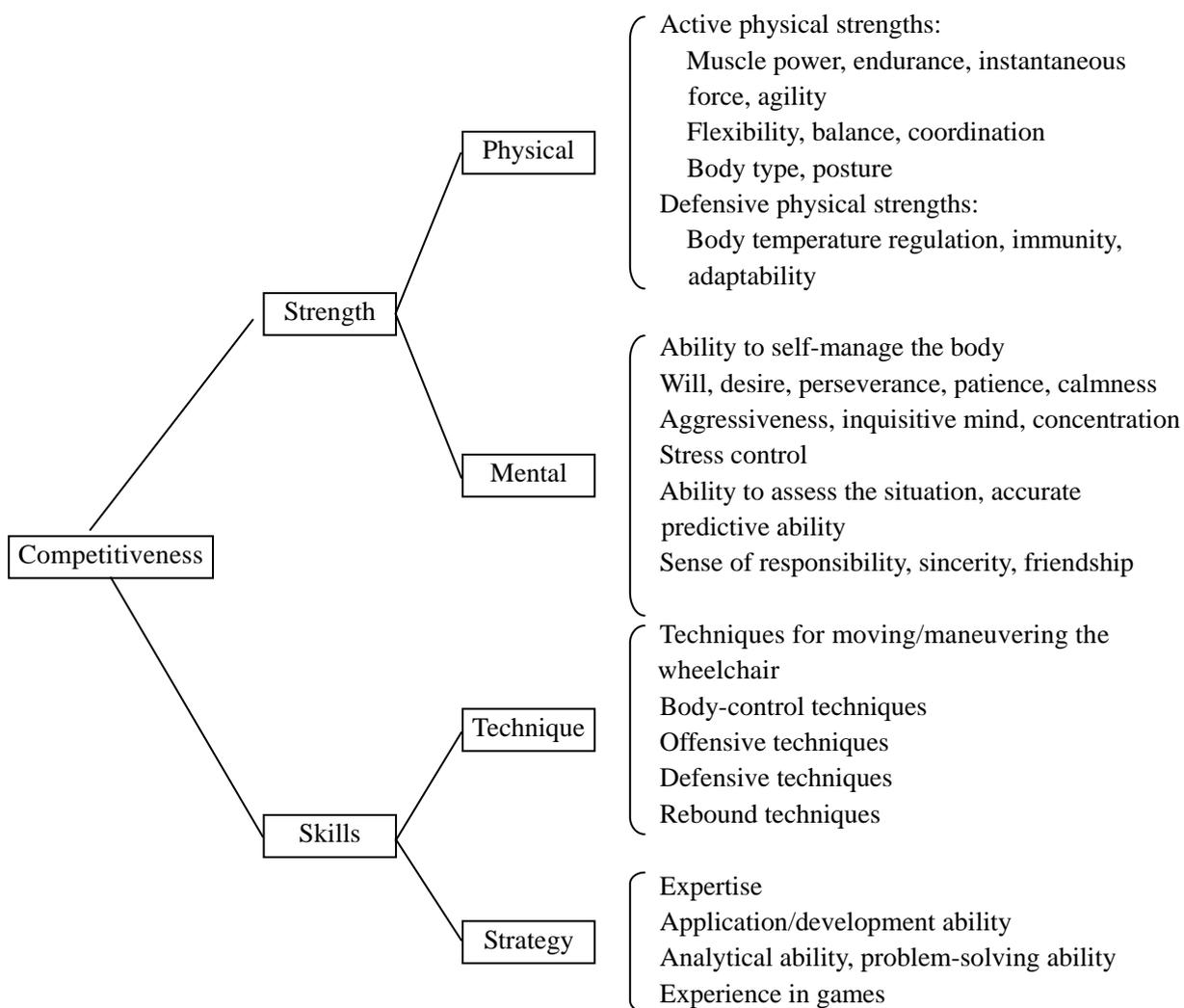


Figure 1 Elements for improving competitiveness

## Chapter 4.

### Basic Techniques in Twin Basketball

To enable all players with cervical cord injuries, who will vary in their amount of remaining upper limb function, to enjoy basketball, co-operation with teammates is essential.

Wheelchair twin basketball has many aspects in common with ordinary basketball.

This section mainly describes basic techniques required for C5 and C6 injured players.

#### 1. Strengthening the Remaining Muscles

For C5 and C6 injured players whose triceps for extending the elbow joint do not function, it is essential that they employ their upper limb girdle muscles such as the trapezius muscle, rhomboid muscle, subclavius muscle, smaller pectoral muscle, serratus anterior muscle and levator scapulae muscle to play passing, shooting and dribbling (Photo 7). The key to improving the technique of C5 and C6 injured players is to strengthen their upper limb girdle muscles and enable free movement of their shoulder blades.



Photo 7 Muscle force of the shoulder girdle and flexibility around the scapula

#### 2. Using the Wheelchair Handle to Expand the Range of Reach

In the action related to the ball, it is necessary to master the techniques of bend the trunk, expand the range of reach of upper limbs and control a ball by one hand.

C5 injured players need to bend their elbow and hook it onto the grip (Photo 8). C6 injured players can bend their wrists backwards and their range of reach is therefore larger (Photos 9 and 10).



Photo 8  
C5 injured Player  
triceps MMT-0



Photo 9  
C6 injured Player  
triceps MMT-0



Photo 10  
C6 injured Player  
triceps MMT-2

### 3. Picking up the Ball

#### 1) While the Wheelchair is Moving

Since C5 injured players cannot pick up a ball on the floor. C6 or lower injured players can pick up the ball while driving the wheelchair (Photo 11).

This can be done as follows: Bend the trunk laterally by hooking the back hand around the grip or the backrest ②. Next, extend the elbow and lock the elbow joint. Then catch the ball, holding it against the hand rim of the wheelchair with the lower part of the forearm ③. The ball will move backwards as the wheel rotates. Keep the ball from moving backward by adducting the shoulder joint with the elbow joint extended and locked ④. Press the ball between the hand rim and the tire with the lower part of the forearm, and wait for the ball to rise behind the wheel ⑤. Let the ball run along the tire in the direction of the upper part of the forearm as the wheel rotates ⑥. When the ball has reached the elbow joint ⑦, move the ball onto the knee by holding it with the forearm and the

upper arm and raising the trunk with the back hand ⑧.



Photo 11 Picking up the ball (while the wheelchair is moving)

## 2) While the Wheelchair is Stationary

There are two ways to pick up the ball while the wheelchair is stationary. The first method is to hold the ball against the hand rim of the front part of the wheel and to use the supinator of the forearm to roll the ball up the hand rim several times (Photo 12). The second method is to drop the ball onto the floor after rolling it part-way up the hand rim, hit the top of the bouncing ball to cause it to bounce again, then catch the ball and hug it to the chest as it bounces up (Photo 13).



Photo 12  
Picking up the ball while the wheelchair is stationary



Photo 13  
Picking up the ball while the wheelchair is stationary

#### 4. Chair-work (Footwork)

Stamina to keep going throughout a game and to move and maneuver the wheelchair is required.

For this to be achieved, the player must be trained so that he/she can perform the chair-work required to achieve the different actions such as speedy linear movement and turns, remaining stationary to attract the opponent, and rapid start-stop movements used to avoid the opponent in a contention with the mark man of the opposing team throughout the court.

The player perform the chair-work required to move into the shooting position, such as sharp turns, advance and reverse movements.

Photo 14 shows a player moving into the shooting position by making a dummy pass to the left and then making a reverse turn.

Photo 15 shows a player moving into the shooting position by making a sharp advance and cutting off the path of the opponent.



Photo 14

Photo 15

## 5. Catching the Ball

Players with C5 or C6 injuries must use their chest in addition to their upper limbs to catch a fast pass. Since the players cannot turn their trunk, they can't catch a ball from the side. They need to predict the course of the passed ball and move their wheelchair into position in order to catch it successfully.

The following sections explain the characteristic performance of three categories of players with C5 and C6 injuries using photos (Table 3).

Table 3 Categories of remaining upper limb function for players with C5 and C6 injuries

| Category | Remaining upper limb function  |
|----------|--|
| (A)      | C5 injured player with no or weak function of the wrist extensor                               |
| (B)      | C6 injured player with a strong wrist extensor, but the elbow joint extensor is MMT-0          |
| (C)      | C6 injured player with a strong wrist extensor, but the elbow joint extensor is MMT-3 or below |

## 6. Holding the Ball

(Category "A" players)

In principle, the player should hold the ball with both hands ①. The player can hold the ball with one arm by keeping it in the V shape between the inside of the forearm and the upper arm ②. If the player makes a forceful movement with the elbow joint flexor, the ball will fall. When loses the flexor, the ball will likely be stolen by the defender. Therefore, most players use their forearm to hug the ball to their trunk or chest ③. Alternatively, the player can hold the ball by using an upper limb to press the ball down on a thigh and maneuver the wheelchair with the other upper limb. In either case, the player will need to use their trunk and support the ball using an elbow, shoulder or jaw (Photo 16).



Photo 16 A category “A” player holding a ball

(Category “B” players)

These players can hold the ball in a triangle shape of their back of the hands, forearm and upper arm with extension of their wrist joint and flexion of elbow joint①. When such players hold the ball using one arm, the ball is more stable and controlled than is the case with category “A” players. In addition, category “B” players can also hold the ball using both hands ②, thereby providing a greater range of control ③ (Photo 17).



Photo 17 A category “B” player holding a ball

(Category “C” players)

Category “C” players can use their elbow extensor muscle so when they hold a ball, the ball is more stable and controlled than is the case with category “B” players (Photo 18).



Photo 18 A category “C” player holding a ball away from a defender

## 7. Passes

When a player with cervical cord injuries moves upper limbs forward in the wheelchair, his/her trunk will bend forwards. Therefore, when such a player passes the ball forward, his/her trunk will inevitably lean forward against the chest-fastening strap. C5 or C6 injured player can't pass the ball with long carry to forward. However, passing the ball laterally or obliquely backward while keeping the trunk leaning against the backrest will result in stable trunk balance, and achieve a longer carry than passing the ball forward.

### 1) Front Pass (Chest Pass) (Photo 19)

(Category "A" players)

These players hold the ball by both forearms with the left and right elbow joint are close, and raise the ball by adducting the shoulder blades and raising the shoulder. Subsequently, they should relax flexion force of the elbow joint and fling up the upper limbs to pass the ball forward.

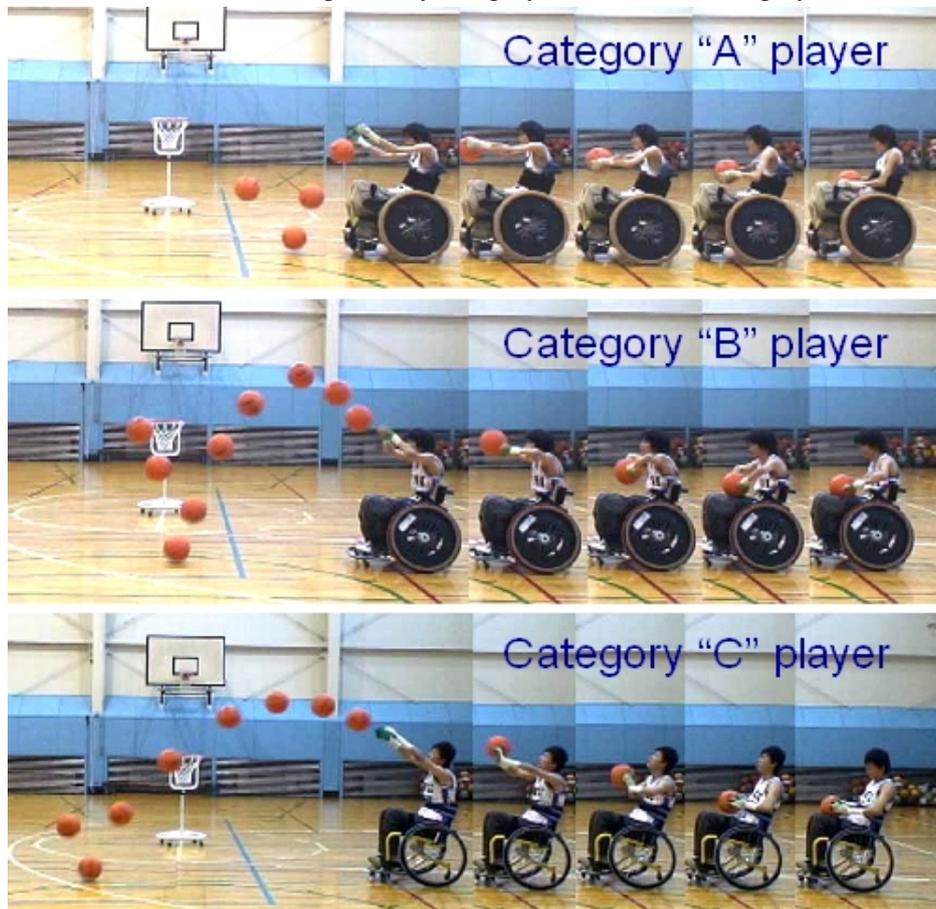
(Category "B" players)

These players can hold the ball with the back of their hand by pronating both forearms (see the center of Photo 17 ②). Therefore, they should extend both elbows outward and pull the ball toward the trunk with the forearms, then pass the ball forward by supinating the forearms.

(Category "C" players)

These players can almost make a chest pass, but their trajectory angles and carries are smaller than that of players with C7 and C8 injuries since their elbow joint extensor is weak.

Photo 19 Chest passes by category "A," "B" and "C" players



2) Front Pass (Overhead Pass) (Photo 20)

(Category “A” players)

Since these players can’t raise the ball to the height, overhead pass is not practical for them.

(Category “B” players)

These players raise the ball to the height of their head using the shoulder blade adductor while relaxing elbow flexors muscle, in order to extend the elbows. Since their elbow joint extensor does not have adequate endurance. These players throw the ball forward from their raised arms with bringing down.

(Category “C” players)

These players can make a form close to an overhead pass. However, since their elbow extension is weak, the distance of the pass will be short.

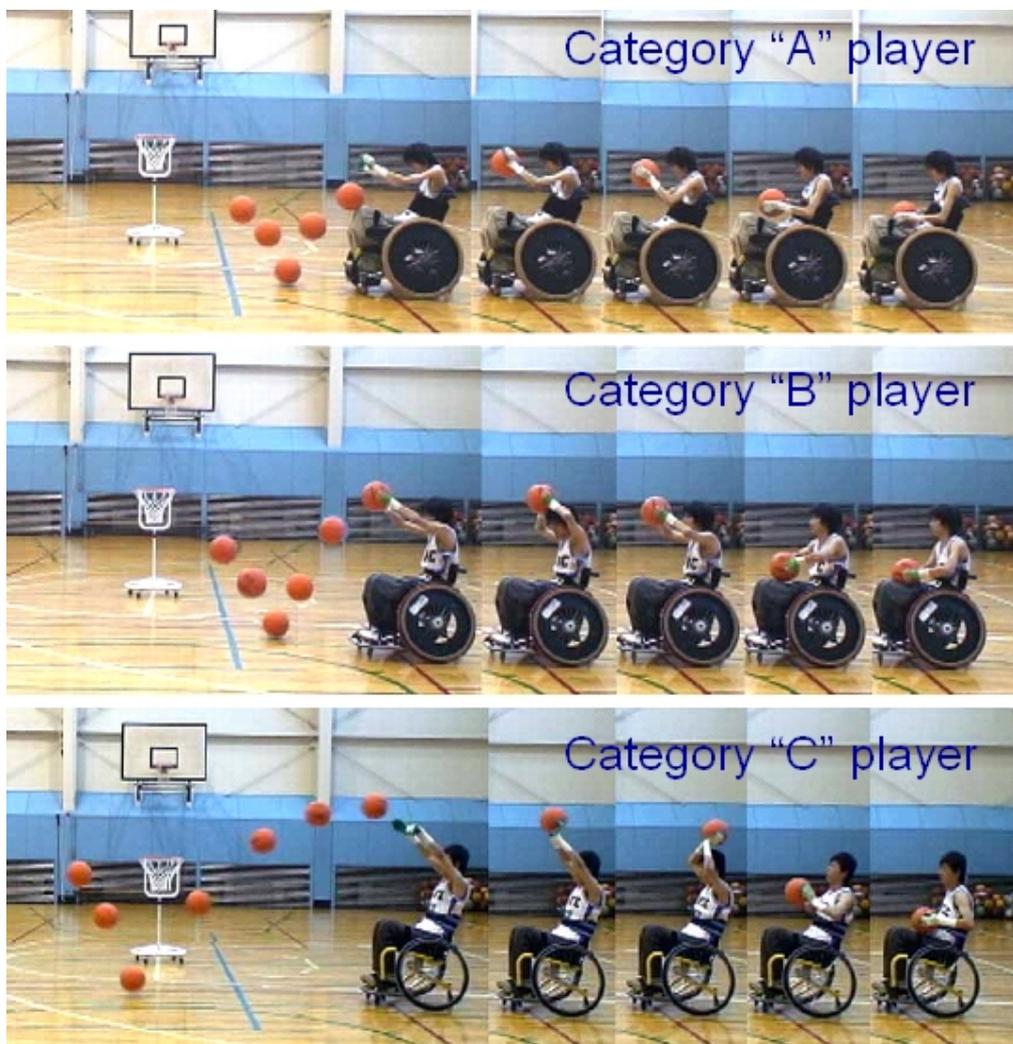


Photo 20 Overhead passes by category “A,” “B” and “C” players

### 3) Front Pass (Under Pass)

(Category “A” players)

This type of passing is not practical for these players.

(Category “B” players)

These players need to shift the ball from both hands to either hand, and relaxing the elbow flexor to fling the upper limbs forward. But it is difficult to control the ball.

(Category “C” players)

Since these players can control the ball by both hands with forward flexion posture①. They make an under pass even with the trunk in a forward flexion posture ② (Photo 21).

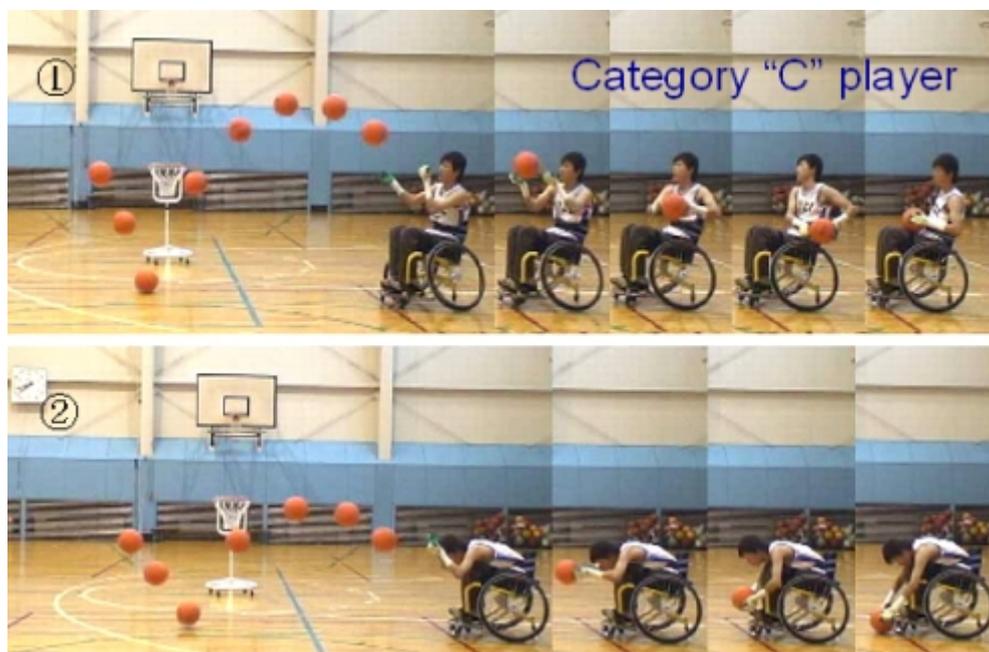


Photo 21 Under pass by a category “C” player

### 4) Front Pass (One-hand Pass)

(Category “A” players) and (category “B” players)

These players can't hold the ball in their palms and are therefore unable to make a one-handed pass.

(Category “C” players)

These players hold the ball in the palm at the height of the shoulder with flexing elbow and pronating forearm. Then, they pass the ball forward by thrusting the arm forward (Photo 22).



Photo 22 One-hand pass by a category “C” player

5) Side Pass (Side Pass Using Both Hands) (Photo 23)

(Category “A” players)

These players hold the ball and lean against the trunk on the pipe of the backrest, then pass the ball sideways using elbow flexion force.

(Category “B” players)

These players pass the ball same way as category “A” players. They achieve a longer carry and higher arch than category “A” players.

(Category “C” players)

They push the ball with the arm opposite to the direction of the pass. Therefore, the arch is low but the carry is long.

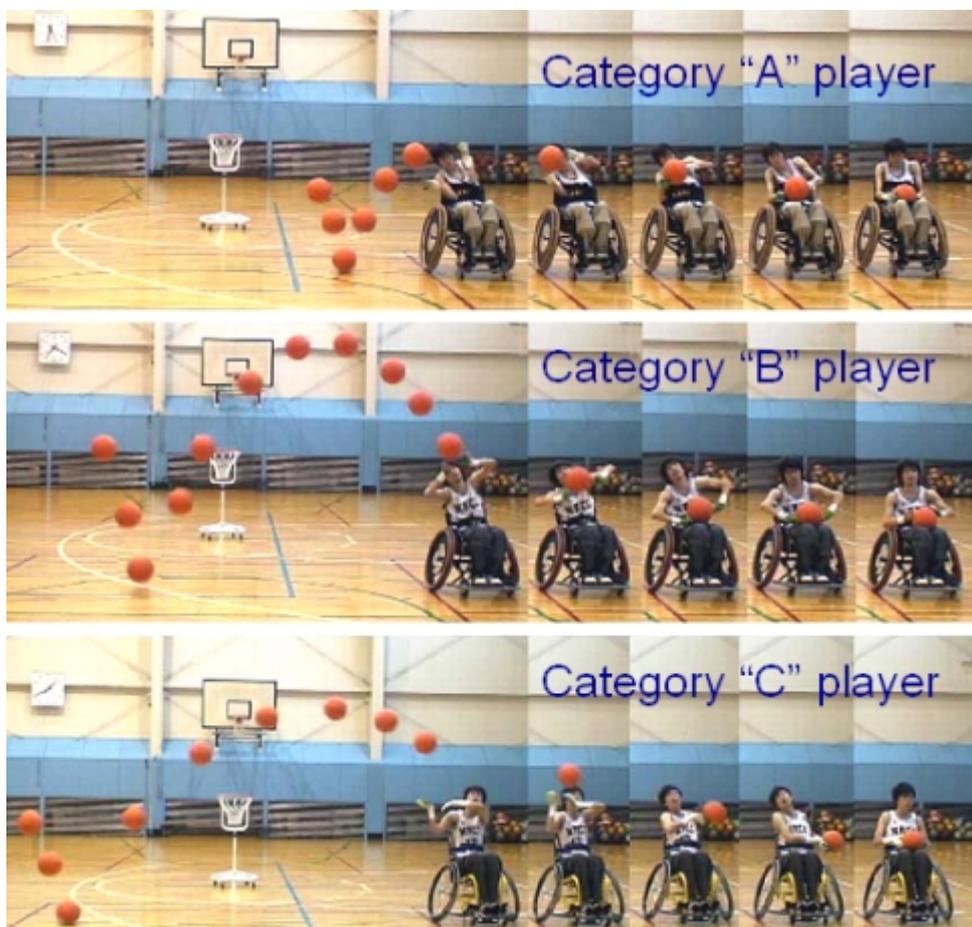


Photo 23 Side passes using both hands by category “A,” “B” and “C” players

6) Side Pass (Side Pass Using One Hand) (Photo 24)

(Category “A” players)

This type of pass is not practical for these players.

(Category “B” players)

These players can throw the ball using one hand for same direction. The players hold the ball on their knee and push the ball forwards with the outside of their pronated forearm by rotating the shoulder joint outwards and the shoulder blade inwards ①.

(Category “C” players)

These players can throw the ball like hook pass using one hand that is on the opposite side to the direction of the pass arch depending on the timing of the ball release.

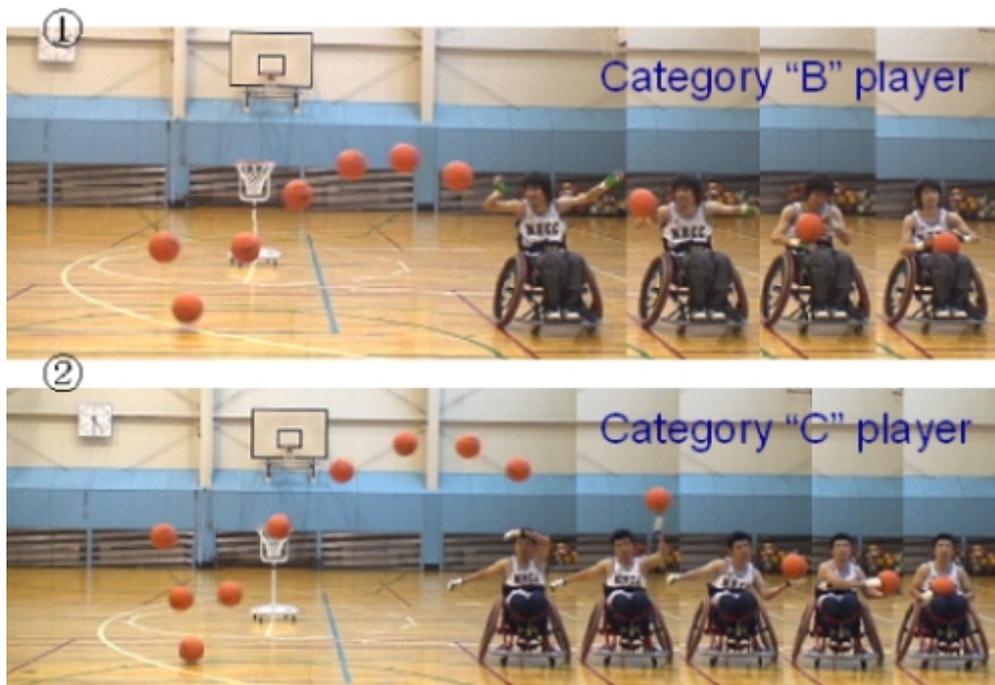


Photo 24 Side passes using one hand by category “B” and “C” players

## 8. Dribble

Under the rules, a player must bounce the ball one time or more within two drives of the wheelchair. The player needs to practice dribbling with both left and right hands. Twin basketball is allowed two dribbling methods depend on remaining nerve function of the players.

(Category “A” players) and (category “B” players)

Under the rules, category “A” and “B” players are allowed to lift a ball placed on their knees to a height equal to or higher than their forehead as an alternative play to bouncing the ball on the floor (Photo 25). The rules state that when the ball is on the thighs of a player, a defender must not steal the ball. However, a defender is allowed to steal the ball when it is held in a player’s hands.



Photo 25 Dribbling by category “A” and “B” players

(Category “C” players)

There are two dribbling methods: bouncing the ball on the spot and bouncing the ball by throwing it forwards or sideways. To dribble by throwing the ball, the player is allowed any number of wheelchair drives while his/her hand is away from the ball (Photo 26).



Photo 26 Dribbling by throwing by a category “C” player

## 9. Shooting

The charm of basketball is the moment of shooting. The player must practice to shoot while stationary or moving, in various forms and from any position or angle.

Category “A,” “B” and “C” players shoot for the lower goal. However, the lower goal does not have a backboard, making it difficult to assess distance. Under the rules, category “A” and “B” players are allowed to shoot within the circle, while category “C” players must shoot from outside the circle.

(Category “A” players) and (Category “B” players)

In fast offensive play, a player shoots from the side while running (Photo 27).



Photo 27 Different types of shooting by a category “B” player

(Category “C” players)

The player must shoot from outside the circle. Therefore, he/she must learn high-arch shots in order to prevent his/her shot from being cut off by a defender playing inside the circle.



Photo 28 Different types of shooting by a category “C” player

## **Chapter 5.**

### **About the Rules**

In March 2001, the Rehabilitation Manual 9 “Wheelchair Twin Basketball Rules” was issued. Therefore, this manual does not cover these in detail. Revisions/modifications since the original issue are as follows:

- A 4-quarter system, with 10 minutes for each quarter, is adopted.
- Toss up for starting a game shall be made only in the 1<sup>st</sup> and 3<sup>rd</sup> quarters.
- The time limit within the restricted area is changed from 10 seconds to 8 seconds.

For details of the rules in general, contact the Japanese Wheelchair Twin Basketball Federation.

## **Afterword**

In the early stages of twin basketball, the lower basket was literally a simple “ball basket.” Since it was too easy to make a successful shot, a hoop using a wire or the like was added later to slightly increase the height of the basket. It then became incredibly difficult for players to make a shot and such failures led to great amusement. Among other things, the most amusing factor was that players shared the moment of achieving a goal after competing to get the ball in what should be called a ball chasing game rather than twin basketball. It is beautiful to see that one ball game can connect people by inducing laughter and can foster the growth of friendship and trust among the players. This manual provides technical guidance mainly for players with C6 injury, which is considered to be the lowest level at which people with cervical spinal cord injuries can become self-sustainable. However, even people with C5 injury can use sport in their daily life, so long as they make an effort, have the willpower to do so, and have the support of their families. Although it will take a few years to master this sport, continual practice will lead to improvement. Begin by playing with a ball, moving your body and enjoying the game.

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