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Joint Mobilization for the Lower Extremity

Michelle C. Robert

University of North Dakota

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JOINT MOBILIZATION FOR
THE LOWER EXTREMITY

by

Michelle C. Robert
Bachelor of Science in Physical Therapy
University of North Dakota, 1996

An Independent Study
Submitted to the Graduate Faculty of the
Department of Physical Therapy
School of Medicine
University of North Dakota
in partial fulfillment of the requirements
for the degree of
Master of Physical Therapy

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1997
This Independent Study, submitted by Michelle C. Robert in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Faculty Preceptor)

(Graduate School Advisor)

(Chairperson, Physical Therapy)
PERMISSION

Title Joint Mobilization for the Lower Extremity
Department Physical Therapy
Degree Master of Physical Therapy

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# TABLE OF CONTENTS

LIST OF FIGURES ........................................................................................................ vi

ACKNOWLEDGEMENTS ................................................................................................. vii

ABSTRACT ........................................................................................................................ viii

CHAPTER

I  INTRODUCTION ........................................................................................................ 1

II  PAST AND PRESENT VIEWS ................................................................................. 3

III  BIOMECHANICAL PRINCIPLES .......................................................................... 9

   Kinematics .................................................................................................................. 9
   Concave-Convex Rule .............................................................................................. 10
   Stress Strain Curve .................................................................................................. 15

IV  TECHNIQUES .......................................................................................................... 19

   Hip Joint ................................................................................................................... 21
   Tibiofemoral Joint .................................................................................................. 21
   Patellofemoral Joint ............................................................................................... 22
   Proximal Tibiofibular Joint .................................................................................... 22
   Distal Tibiofibular Joint .......................................................................................... 22
   Talocrural Joint ...................................................................................................... 23
   Subtalar Joint .......................................................................................................... 23
   Calcaneocuboid Joint ............................................................................................. 24
   Talonavicular Joint ................................................................................................ 24
   Cuneonavicular Joint ............................................................................................. 24
   Tarsometatarsal Joints ............................................................................................ 25
   Intermetatarsal Joints 1 - 5 .................................................................................... 25
   Metatarsophalangeal Joints 1 - 5 ........................................................................... 25
   Interphalangeal Joints 1 - 5 .................................................................................... 26

V  CONCLUSION ........................................................................................................... 27

 iv
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Motion occurring at joint surfaces</td>
<td>11</td>
</tr>
<tr>
<td>2. Pictures of treatment planes</td>
<td>13</td>
</tr>
<tr>
<td>3. Grades of mobilizations</td>
<td>14</td>
</tr>
<tr>
<td>4. Stress strain curve</td>
<td>16</td>
</tr>
</tbody>
</table>
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ABSTRACT

In the field of physical therapy there are a number of therapeutic techniques used for evaluation and treatment of dysfunction. There is one technique that is seen especially in the orthopedic setting and has been around since ancient Egyptian times.\textsuperscript{1,2} This technique is joint mobilization and even though there are limited studies on its usefulness, it can not be ignored as a treatment technique. Due to the complexity of the techniques, students often need additional resource materials to assist in the learning process.

Therefore, the purpose of this paper is to introduce theoretical background, terminology, and an explanation of the techniques that surround joint mobilization. The accompanying video is designed to give step by step instruction along with visual demonstrations that can be used as a learning guide in understanding the proper techniques of joint mobilization which will enhance professional development.
CHAPTER I

INTRODUCTION

In physical therapy, there are a number of therapeutic techniques used for evaluation and treatment of disorders. There is one technique which has been used since the time of Hippocrates with its usefulness seen chiefly in orthopedic settings. This technique deals specifically with arthrokinematics, or the motion that occurs between two articulating surfaces and is referred to as joint mobilization. Taber defines joint mobilization as “passive therapeutic techniques that are applied specifically to joint structures and utilize principles of increased arthrokinematics to increase joint play and range of motion (ROM) or treat pain.” Joint mobilization is used for all joints of the body from a patient’s cervical spine down to the interphalangeal joints of the feet. In order for a therapist to be effective when using joint mobilization as a treatment option, they must have a thorough grasp of this manual technique.

Therefore, the purpose of this paper is to introduce the theoretical background, the terminology, and an explanation of the techniques that surround joint mobilization. The accompanying video tape is designed to give step by step instructions along with visual demonstrations that can be used as a learning guide in understanding the proper techniques of joint mobilization which will enhance professional development.
A brief overview of the historical perspectives along with current views on the use of joint mobilization will be presented. Following that chapter are chapters on the terminology surrounding the application of joint mobilization and an explanation of each mobilization used. A glossary of terms used in this paper is found in Appendix A. The terms found in bold print throughout this paper are those contained in the glossary. Since joint mobilization is used today by therapists for evaluation and treatment, it is essential to understand not only the terminology surrounding this technique but also how it has evolved.
CHAPTER II

PAST AND PRESENT VIEWS

Many practitioners throughout the years from Hippocrates to McKenzie have contributed to the present day knowledge of joint mobilization. Through their work and application of the principles of joint manipulation, the techniques behind joint mobilization evolved. Limited studies have been published on the use of joint mobilization but the effectiveness cannot be ignored due to the successfulness shown in these studies. The next two sections will discuss the history and some of the present studies of joint mobilization to the lower extremities.

History

The first recorded person that utilized joint mobilization was Hippocrates (460 - 355 B.C.)\textsuperscript{5} He developed thrust techniques and manual traction for treatment of back disorders.\textsuperscript{6} Thrust techniques were also developed to treat dysfunction in the extremities and the cervical region. Following the works of Hippocrates were people such as his most famous successor Galen (A.D. 131 - 202), an Arabian physician Abu Ali ibn Sina (980 - 1037), Thomas Sydenham (1624 - 1689), Samuel Hahnemann (1755 - 1843), and Herman Boerhaave (1668 - 1738).\textsuperscript{5}

After the work of Hippocrates came another technique in which forces are applied to bones that put them back in place resulting in a clicking noise.\textsuperscript{6} The people who performed this type of technique were referred to as Bonesetters. These manipulative
techniques were handed down through families for centuries and were effective in
decreasing pain and deformity. Similar techniques were advocated by practitioners of
Osteopathic and Chiropractic medicine which arose in the late 19th and early 20th
century. The Osteopaths and Chiropractors believed that manipulation healed all
forms of disease and pain.

The work of the practitioners covered so far set the foundation that was used to
build what today are referred to as the theories and techniques behind joint mobilization.
Although the work of these practitioners cannot be ignored due to what they have
carried out, most of the well known theories that are applied today have emerged during
the mid to late 20th century. In 1949, James Mennell, MD, developed the theory of
accessory motions. Mennell was the first clinician to study the function of joints and
then developed a method of mobilization applied to the joints.

Following Mennell was James Cyriax, MD, (1957) who defined manipulation as
“a method of treatment that consists of different sorts of passive movements performed
by the hands in a definite manner for a prescribed purpose.” He believed that
manipulation should be used to fix internal derangement. In addition he also stated that
there is a resistance at the end of the range in all joints. He called this resistance an end
feel which can be normal or abnormal.

Instead of manipulation being used for internal derangement, John Mennell
(1960), son of James Mennell, believed that manipulation will only affect joint
dysfunction. Like his father, he disagreed with the notion of back pain being the result
of intervertebral discs. John believed that joint play must first be assessed before any
manipulation is applied. He stated that joint play, which allows tolerance for abnormal movements or abuse is important, no matter how small, and in every joint there is certain amount of movement allowed for proper function. After this movement is extended passively to its limit, there is an end feel which is the resistance encountered when the limit of this movement is met.

The following year Freddy Kaltenborn (1961), from Norway, was the first to “relate manipulation to the knowledge of arthrokinematics and development of its philosophies”. He was the first to describe the appropriate direction of a glide by use of the concave-convex rule.

In contrast to Mennell and Cyriax, Stanley Paris (1963) thought that results were made from treating dysfunction not pain. He also believed that back pain resulted from facet problems rather than disc protrusions. Paris developed the concept of component motion which is movement in a joint that facilitates active motion. Paris took the notion of accessory motion and divided it into two categories, component motion and joint play. Both of these motions are required for proper function. The aim of Paris’ treatment is to restore joint play which will result in normalizing joint motion and decreased pain.

Rather than being focused on pain or dysfunction, Geoffrey Maitland (1964) believed that “reproducible signs” from active and passive motions could be treated with oscillations. He mainly concentrated on the spine where he would locate a painful joint, apply oscillations, and then reassess the level of pain. Oscillations would be continued if pain had lessened. Maitland’s techniques were geared towards treating signs and symptoms. He believed that a diagnosis was not as important as relieving signs and
symptoms. Maitland assessed effectiveness by using comparable signs. For example, if a certain test reproduced the patient’s signs and symptoms, he would apply treatment to that area then go back and retest to see if anything had changed.

The latest technique that has contributed to the development of joint mobilization arose during the late 1970’s. McKenzie developed a popular technique which concentrates on decreasing pain by repetitive movements into extension to relocate the disc. McKenzie’s protocol attempts to centralize signs and symptoms by decreasing the amount of referred peripheral pain. The treatment of back pain is divided in three diagnostic categories: 1) postural syndrome, 2) dysfunction syndrome, and 3) derangement syndrome which determines treatment applied.

From the earlier work of Hippocrates utilizing manipulation to McKenzie’s latest work of repetitive movement, the techniques of joint mobilization have arisen. Joint mobilization is used in clinics throughout the world as a form of therapeutic treatment. Today physical therapists use joint mobilization as a treatment option, so they need to be knowledgeable about the techniques used for proper application. Not only do therapists need to be knowledgeable about the techniques but they also should know if joint mobilization is beneficial to the patients being treated. The following section will not only review some of the published studies but also the success of mobilizations applied to the lower extremities.

**Present Studies**

In addition to the historical perspective, there is also recent literature to support the use of joint mobilization to the lower extremities. Even though there are limited
studies published on the use, those done have shown the benefits of mobilization. In a study of congenital clubfoot, Harris and Samson\textsuperscript{10} state that alternative therapies should be considered before surgery. These alternatives would be such things as splinting, taping or adhesive strapping, exercises that would strengthen structures involved, stretching, casting, and manipulation.

Ikeda\textsuperscript{11} tested 25 subjects of idiopathic clubfoot who had been treated with taping, manipulation and a series of casting and found that 95\% of subjects outcomes were either excellent or good. In another study, Bensahel and colleagues\textsuperscript{12} reported that 86\% of subjects treated with physiotherapy for idiopathic clubfoot had good results. This report was done after conducting a long-term study consisting of 338 cases of idiopathic clubfoot. To prove joint mobilization is useful, Modesto and colleagues\textsuperscript{13} state, in one study, that use of mobilization resulted in a slight increase in external rotation at the hip for a patient with adhesive capsulitis of the hip joint.

These studies are limited due to the fact that a patient suffering from an injury will be treated with a combination of techniques. Therefore it is hard to single out the effectiveness of just one. Although, from these studies it is shown that joint mobilization is successful in the treatment of dysfunction, more studies need to be published to support this treatment technique.

Proper technique and understanding of joint mobilization is important for treatment to be effective. The following chapter will touch upon the biomechanical aspects that surround joint mobilization and then proceed onto the proper procedures.
used. In order to perform the techniques properly, the therapist must have an understanding of the biomechanics of joint mobilization.
CHAPTER III

BIOMECHANICAL PRINCIPLES

Throughout the day a person is constantly moving. No matter what kind of movement is produced there is always a force, either internal or external, applied to the moving segment. Kinetics is the study of the forces involved during movement of a segment. On the other hand kinematics is the study of the movement of segments without regard to the forces. For joint mobilization, it is the kinematics that are most important, therefore this will be discussed in more detail.

Kinematics

When referring to the motion that occurs at a joint it is necessary to understand the kinematics of the joint. At any joint there are two types of motion, accessory and physiologic. Accessory motion can be separated into two different types of motion. The first is joint play which is used by the therapist to assess the amount of movement within the joint. The second is component motion which is described by Kisner et al\textsuperscript{15} as “motion such as upward rotation of the scapula and clavicle, which occur with shoulder flexion.”\textsuperscript{14} Although accessory motion is not measured, it is assessed and can be thought of as millimeters of motion.\textsuperscript{3}

Physiologic motion refers to the osteokinematics of the joints, whereas accessory motion refers to the arthrokinematics. It is necessary for a joint to have both physiologic and accessory motion in order to achieve full and painless range of motion (ROM).\textsuperscript{3,16}
Although physiologic motion is important, it is the arthrokinematics of the joint that will be focused on in this section.

The purpose of joint mobilization is to restore the normal arthrokinematics of the joint. Therapists cannot restore normal osteokinematic motion or strengthen the surrounding structures of a joint before the normal arthrokinematics of a joint are restored because doing so may result in capsule laxity, pain, inflammation, hemarthrosis, or fractures.

**Concave-Convex Rule**

In order to restore the normal arthrokinematics of a joint, the therapist must apply a force to a portion of the joint to promote movement. Joints are structured so that movement can occur without damaging the surfaces. In joints, one surface will act as the base and the adjoining surface will then move on this base. The movement allowable at the joint surface can be described as **rolls**, **glides**, or **spins** (Figure 1). These motions can occur alone or in combinations to permit the joint to carry out smooth painless motion.

Most of the time one joint surface is convex and the other is concave. Identifying the concave or convex portion of the joint will enable the therapist to apply a force in the proper direction to eliminate the dysfunction, thus applying the principles of the concave-convex rule. The convex-concave rule states that passive movement that is externally applied to the concave portion of the joint will occur in the same direction as the physiologic motion. Passive movement that is externally applied to the convex portion of the joint will occur in the opposite direction of the physiologic motion.
Fig 1.—Motion occurring at joint surfaces. A, rolling; B, gliding; C, spinning.
After identifying the concave or convex portion of the joint the therapist should put the joint in open pack position before mobilization is begun.\textsuperscript{1,8,9} In most cases, joints are mobilized in the open pack position, although there are cases when the joint is mobilized in a different position. There are a few examples on the video tape which will demonstrate mobilizations performed when the joint is not in open pack position.

Once a therapist has placed the joint in open pack position, the treatment plane should be identified so that movement applied to a joint occurs in the proper direction (Figure 2).\textsuperscript{9,15} There are two types of mobilization which can be applied to a joint, distraction and oscillation. Distraction (Figure 2) is a force applied perpendicular to the treatment plane.\textsuperscript{9,15} There are three grades of distraction. Grade I is when the surfaces are unweighted, performed by bunching up the skin. Grade II is when a force is applied such that the slack is taken up between the two surfaces. When the joint capsule is stretched, then a grade III distraction has been applied.

Oscillatory mobilizations occur parallel to the treatment plane and have been divided into five grades.\textsuperscript{9} Maitland\textsuperscript{17} defined each grade as a portion of the available joint play. These five grades are as follows: 1) grade I - small amplitude oscillations at the beginning of available motion, 2) grade II - large amplitude oscillations from the beginning to midrange of available motion, 3) grade III - large amplitude oscillations from midrange to the end of available motion, 4) grade IV - small amplitude oscillations that are at the end range of available motion, and 5) grade V - quick thrust of small amplitude at the end of range, usually accompanied by popping sounds (Figure 3).\textsuperscript{3,9,16} According to Maitland\textsuperscript{17}, grades I and II should be used when pain is the cause of
Fig 2.—Pictures of treatment planes. A, normal treatment plane; B, distraction will be carried out perpendicular to the treatment plane; C, glides will be carried out parallel to the treatment plane.
Fig 3. Grades of mobilization. A, mobilization of normal tissue; B, mobilization of tissue with pathological restriction in joint play.
restriction. Grades III and IV should be used when resistance is the cause of decreased motion, and the goal is to stretch the surrounding structures. Only trained professionals should use a grade V mobilization since it is a more highly skilled technique. When oscillatory mobilizations are applied, there is always a grade I or II distraction force applied.

Whenever mobilizations are applied, the therapist should be aware of the effectiveness of the treatment. During a treatment session, decreases in pain and lengthening or stretching of tissues that surround a joint should be assessed to determine the success of joint mobilization. Assessment of treatment results is an ongoing process and should be carried out before, during, and after every treatment session. If goals are being achieved, then the treatment is effective; if goals are not achieved, then the therapist must change the treatment protocol or check the technique to make certain it is correct.

**Stress Strain Curve**

An aspect of joint mobilization which helps the therapist understand the logic behind stretching the structures surrounding a joint is the stress-strain curve. Every solid object, including soft tissue around joints, has a unique stress-strain curve that fits its tissue characteristics. During joint mobilization, stress is applied to the tissues of the joint. From this applied stress, the tissues will lengthen which is referred to as strain. (Figure 4) The first phase is referred to as the toe region. This is the phase in which slack is taken up within the joint capsule. During the second phase or the elastic phase, the force will be greater than the amount of length change in tissues. In this phase, if the force (stress) is taken away then the length (strain) of the tissue will also be...
Fig 4. Stress-strain curve.
decreased, returning to its original length.\textsuperscript{18}

The plastic phase is the third phase of the stress strain curve. This is where strain of the tissue is disproportionate to the applied stress. This phase is characterized by permanent tissue deformation; once the stress is taken away, the tissue will remain in its lengthened position.\textsuperscript{1,9} If the therapist’s goal is to stretch structures, then the plastic phase would be appropriate.\textsuperscript{18} Therapists must be careful in the plastic phase because if there is too much force applied the tissue could reach the failure or breaking point. When the goal is to disrupt adhesions or scar tissue, taking the tissues to the failure point is appropriate. This is the last phase which is characterized by the tissues being separated.

Other factors which affect stretching of the structures are temperature and speed.\textsuperscript{9} The warmer the structure is the more elastic properties it has and the easier it is to stretch. The faster a structure is moved the more likely it is to break. Therefore, in order to stretch structures, the therapist will normally apply heat to the surrounding structures so that they are more elastic and willing to lengthen.

To maintain the lengthened position, the biologic memory of the tissue must be overcome.\textsuperscript{9} Biologic memory is that property of all biologic tissues to return to their previous length after begin stretched into the plastic range. For joint mobilization to be successful, the patient needs to take an active role in performing a home stretching program in order to keep the gains achieved through mobilization. In addition, mobilization may have to be applied more than once to oppose the effects of the biologic memory.

This chapter has shown that there are many different aspects of joint mobilization
to remember. These include the kinematics of the joint, the concave-convex rule, the open pack position, the treatment plane, the types of mobilization, and factors associated with lengthening of the tissues. Understanding these concepts are important to the therapist applying mobilization in order to effectively treat a dysfunction. The next chapter contains a list of the joints covered in the video along with the mobilizations applied at each joint.
CHAPTER IV

TECHNIQUES

The importance of the video is to demonstrate proper technique, patient position, and hand placement and can be used as a learning tool to enhance professional development. This paper is intended to be used as a supplement to the video in clarifying any misunderstandings whether in meanings of terms or in the purpose of each mobilization applied. The following section will list joints in the lower extremity that are demonstrated on the video. Under each category, the mobilizations for each joint will be stated along with the purpose and open pack position. The anatomy will also be covered in order to identify the concave and convex portions of the joint. But before introducing specific mobilizations for each joint of the lower extremity there are a few more important facts to cover.

It is important for the therapist to know the indications and contraindications of joint mobilization so that dysfunction is decreased without causing harm to the patient. By keeping the indications and contraindications in mind, the therapist will be able to better treat a patient who is suffering from dysfunction because they will know when and when not to apply mobilizations to a joint. The indications for applying joint mobilizations to a joint would be to: 1) increase extensibility of joints, 2) increase the nutrition of the joint, 3) decrease pain, 4) increase muscle relaxation, and 5) decrease
stiffness. The contraindications would be: 1) rheumatoid arthritis, 2) malignancy, 3) congenital bone deformation, 4) vascular disorders, 5) infections, 6) hemarthrosis, and 8) osteoporosis.

The therapist is advised to use joint mobilizations with caution if the patient has hypermobile joints, spondylolisthesis, severe pain, muscle guarding, a fracture in the area to be mobilized, is taking anticoagulants, is pregnant or has had a joint replacement. The best advise is that if the therapist is unsure about a situation then do not mobilize the joint.

It is also important to remember to place the joint in open pack position and that a grade I or II distraction must be applied prior to any grade of oscillatory mobilization. This will allow the joint to move freely without the surfaces being rubbed together. Since distraction is always applied, it will not be listed along with the mobilizations applied to each joint.

Before mobilizing any joint, the treatment plane has to be considered. The treatment plane is always going to be parallel to the concave bone. This will be true for all joint of the lower extremity except in the case of mobilizing the tarsal bones in the foot which are planar joints.

The lower extremity mobilizations that will be covered in this paper will start proximally at the hip joint and end distally with the interphalangeal joints of the foot. Patient positioning, therapist hand placement, and proper technique is covered in the accompanying video.
Hip Joint

The hip joint is made up of the articulation between the acetabulum of the pelvis and the rounded head of the femur. Forces will be applied to the femur, therefore all mobilizations applied will follow the convex rule. The open pack position is 30° of hip flexion, 30° of abduction, and 20° of external rotation.

- **Inferior Glide** - purpose is to promote hip abduction.
- **Posterior Glide** - purpose is to promote hip flexion and internal rotation.
- **Anterior Glide** - will promote hip extension and external rotation.
- **Lateral Glide** - will increase internal rotation and adduction.

Tibiofemoral Joint

The tibiofemoral joint is made up of the articulation between the femur and tibia, the femur is the convex portion and the tibia is the concave portion. For the anterior glide at this joint the force can be applied to either bone, therefore if the force is applied to the tibia the mobilization will follow the concave rule and if the force is applied to the femur then the convex rule is followed. Force is only applied to the tibia when performing a posterior glide, therefore the rule followed is the concave. The open pack position is 25° of flexion.

- **Anterior Glide** - promotes knee extension when the tibia is moved anterior or if the femur is moved posterior causing an anterior glide of the tibia on the femur.
- **Posterior Glide** - promotes knee flexion when the tibia is moved posterior.
Patellofemoral Joint

This joint is the articulation between the patella and the femur. In order for proper movement of the knee joint, the patella must be mobile and permit movement. Open pack position is 0-5° of tibiofemoral flexion.

- **Inferior Glide** - promotes knee flexion.1,2
- **Superior Glide** - will promote knee extension.1
- **Medial Glide** - promotes knee flexion.1,2
- **Lateral Glide** - will promote knee flexion.1

Proximal Tibiofibular Joint

The proximal tibiofibular joint consists of the articulation between the proximal tibia and fibula.1 The convex portion is the tibia, and the concave portion is the fibula. The open pack position is 25° of knee flexion along with 10° of plantarflexion.

- **Anterior Glide** - increases joint play and increases the joint’s nutrition.
- **Posterior Glide** - increases joint play and increases nutrition to the joint.

Distal Tibiofibular joint

The distal tibiofibular joint is made up of the articulation between the distal tibia and fibula.1 The tibia is the concave portion and the fibula is the convex portion. Open pack position is 10° of plantarflexion and 5° of inversion.

- **Anterior Glide** - promotes dorsiflexion at the ankle joint.
- **Posterior Glide** - promotes ankle plantarflexion.1,2
Talocrural Joint

The talocrural joint is the articulation between the head of the talus and the tibia and fibula.\textsuperscript{1,15} The talus is the convex portion and the tibia and the fibula form the concave portion. Open pack position is 10\(^\circ\) of plantarflexion and neutral inversion and eversion.\textsuperscript{1}

- **Posterior Glide** - promotes dorsiflexion at this joint when the talus is moved in a posterior direction or if the tibia is moved in an anterior direction.\textsuperscript{1,2}

- **Anterior Glide** - plantarflexion will be increased when the talus is moved in an anterior direction or if the tibia and fibula are moved in a posterior direction causing the talus to move anterior to the tibia and fibula.\textsuperscript{1}

Subtalar Joint

The subtalar joint is made up of the articulation between the calcaneous and the talus.\textsuperscript{1,15} Open pack position is neutral with regards to inversion and eversion and 10\(^\circ\) of plantarflexion.\textsuperscript{1} Mobilization to this joint will follow the concave rule.

- **Eversion Glide** - eversion will be increased.

- **Inversion Glide** - inversion will be increased.

- **Medial Glide** - increases inversion.

- **Lateral Glide** - increases eversion.

As mentioned earlier, mobilizations are carried out in a direction parallel to the treatment plane. The joints of the feet are planar joints, therefore movement applied will be in a straight plantar or dorsal direction staying parallel to the joint surfaces.
Calcaneocuboid Joint

The calcaneocuboid joint consists of the articulation between the calcaneous and the cuboid. Open pack position is neutral supination and pronation with 10° of plantarflexion. This is a planar joint.

- **Dorsal Glide** - increases eversion and plantarflexion.\(^1\)\(^,\)\(^2\)
- **Dorsal Lateral Glide** - will promote eversion and plantarflexion.\(^1\)
- **Plantar Glide** - increases inversion and dorsiflexion.
- **Plantar Medial Glide** - increases inversion and dorsiflexion.

Talonavicular Joint

The talonavicular joint consists of the articulation between the talus and the navicular. The open pack position for this joint is neutral supination and pronation and 10° of plantarflexion. This is a planar joint.

- **Dorsal Glide** - increases inversion and dorsiflexion.
- **Dorsal Lateral Glide** - promotes dorsiflexion and inversion.
- **Plantar Glide** - increases plantarflexion and eversion.\(^1\)\(^,\)\(^2\)
- **Plantar Medial Glide** - promotes plantarflexion and eversion rotating more into pronation.

Cuneonavicular Joint

The cuneonavicular joint consists of the articulation between the navicular and the cuneiforms. This is a planar joint.

- **Dorsal Glide** - increases the joint play in the medial longitudinal arch.\(^2\)\(^,\)\(^8\)
• **Plantar Glide** - increases the joint play in the medial longitudinal arch.

**Tarsometatarsal Joint**

The tarsometatarsal joint consists of the articulation between the tarsal bones and the metatarsal bones. The tarsal bones are the convex portion and the metatarsal bones are concave. When mobilizing these bones, the concave rule will be followed. Open pack position is in neutral supination and pronation.

  - **Dorsal Glide** - increases dorsiflexion and joint play.  
  - **Plantar Glide** - increases plantarflexion and joint play.

**Intermetatarsal Joints 1 - 5**

The intermetatarsal joints consist of the articulation between the metatarsal bones. Open pack position is not described. Mobilizations will follow the direction of the bones involved in straight planar motions. The therapist should move the first metatarsal on the second, the third on the second, the fourth on the third, and the fifth on the fourth.

  - **Dorsal Glide** - decreases the transverse arch.  
  - **Plantar Glide** - increases the transverse arch.

**Metatarsophalangeal Joints 1 - 5**

The metatarsophalangeal joints consist of the convex heads of the metatarsal bones and the concave base of the phalanges. Mobilizations to these joints will follow the concave rule. Open pack position is in neutral abduction and adduction, and flexion and extension.

  - **Dorsal Glide** - increases toe extension.
- **Plantar Glide** - increases toe flexion.

- **Medial Glide** - increases toe abduction of the first and second toe and adduction of the third, fourth, and fifth toe.

- **Lateral Glide** - increases adduction of the first toe, and abduction of the second through fifth toe.

**Interphalangeal Joints 1 - 5**

The interphalangeal joints consist of the articulation between the proximal and the distal portion of the phalanx. In the first digit, there is only one joint, but in the remaining digits there are two interphalangeal joints - the proximal and distal. The proximal portion of the joint is convex and the distal portion is concave. This holds true for the proximal interphalangeal and the distal phalangeal joints. The concave rule is followed since the distal concave portion is moved. Open pack position is slight flexion. The following mobilizations are carried out the same for the proximal and distal interphalangeal joints.

- **Dorsal Glide** - increases toe extension.

- **Plantar Glide** - increases toe flexion.
CHAPTER V

CONCLUSION

The purpose of this paper is to introduce the reader to joint mobilization and clarify questions relating to proper technique. After reading the last few chapters and viewing the video tape, there should be an increased knowledge about the techniques of joint mobilization.

Limited studies have been published in the area of joint mobilization, but the fact is that joint mobilization is just one therapy applied for treatment. In physical therapy, this method of treatment is never used alone; there are always accompanying strengthening and stretching exercises. In this respect, it is hard to run studies on the benefits of one technique versus another. With this in mind, the current literature points out that the use of joint mobilization in conjunction with other treatment methods has been effective.

This paper has gone through the historical perspectives, current use, terms associated with, and listed the purposes of each mobilization shown on the video. By filming the proper joint mobilization techniques applied to the lower extremity the hopes are to enable future students in the physical therapy program at UND to see correct hand placement and the procedure followed. This video tape will be a benefit to the reader in regard to having visual input that can be used as a learning guide outside of class to enhance professional development towards proper techniques used in joint mobilization.
GLOSSARY

Accessory Motion - A motion within a joint that is not under voluntary control but will facilitate active motion and is necessary for normal movement.\(^4\,16\) Separated into two types:\(^15\)

1) **joint play** - Occurs as a result of an external force such as applied by a therapist. This describes the amount of motion that is allowed within the joint capsule.

2) **component motion** - Movement that takes place in joints to allow active range of motion (AROM). An example given by Kisner et al\(^15\) describes it as “motion such as upward rotation of the scapula and clavicle, which occur with shoulder flexion.”\(^6\,14\,18\)

Closed Pack - This is the description of a joint in its most stable position.\(^14\,20\) The ligaments and capsule surrounding the joint are taut allowing minimal motion.

Concave-Convex Rule - Passive movement that is externally applied to the concave portion of the joint will occur in the same direction as the physiologic motion.\(^1\) Passive movement that is externally applied to the convex portion of the joint will occur in the opposite direction of the physiologic motion.

Distraction - Describes separation of joint surfaces. A distractive force is applied perpendicular to the treatment plane.\(^1\)

End-feel - The resistance that is felt at the end range of passive motion which can be normal or abnormal.\(^14\)

Glide - A type of motion which describes the moving part of a joint as it relates to one surface sliding across the other.\(^14\) Each point on the moving surface will contact one point on the stable surface.\(^9\) An example is if you hit the brakes on the car during winter when the road was slick, one point on your tire would come into contact with many points on the road.

Joint manipulation - Defined as passive movements carried out by thrusts at the end range while sustaining a stretch.\(^3\,17\) Patients are unable to stop this motion from occurring.\(^17\)

Joint mobilization - Defined as “passive therapeutic techniques that are applied specifically to joint structures and utilize principles of increased arthrokinematics to increase joint play and range of motion or treat pain.”\(^14\,109\)
Kinematics - The study of movement occurring at a limb without pertaining to the forces which evoke change.\textsuperscript{16}

1) \textbf{arthrokinematics} - A "description of the movement of the bone surfaces within a joint when a bone moves through a range of motion."\textsuperscript{4(p155)}

2) \textbf{osteokinematics} - A "description of bone movement when a bone swings through a range of motion around the axis in a joint, such as with flexion, extension, abduction, adduction, and rotation."\textsuperscript{4(p1383)}

Kinetics - The study of the forces applied to a limb while moving.\textsuperscript{16} Examples of kinetic forces are inertia, gravity, and acceleration of segments caused by muscle action.\textsuperscript{14}

Open Pack "Resting Position" - The joint surfaces are in their most relaxed position.\textsuperscript{14,20} The ligaments and capsule that surround the joint are slack allowing maximal amount of motion.

Oscillation - Passive pendulum-like movements applied to a joint that can be large or small and are parallel to the treatment plane.\textsuperscript{1,4}

Physiologic Motion - Motion which compromises the major part of a joint’s normal range of motion (ROM) and is under voluntary control.\textsuperscript{3,19}

Roll - Motion which describes the moving part of a joint as it relates to one surface rolling over another.\textsuperscript{14} As one surface is moved over a stable surface new points will make a single contact with one another.\textsuperscript{9} An example would be driving down the road and each point on your tire would make a single contact with a new point on the road.

Spin - Motion which describes the moving part of a joint as it relates to one surface rotating over the other.\textsuperscript{14} An example would be a tire of your car spinning around on a slick surface because there isn’t enough friction.

Treatment Plane - An imaginary line passing through the joint that is parallel to the concave surface.\textsuperscript{5,19} Joint play or mobilization is therefore carried out either perpendicular or parallel to this line.
APPENDIX B
AUDIO-VISUAL STANDARD RELEASE FORM

I hereby give my permission to the University of North Dakota Department of Physical Therapy, its agents, successors, assigns, clients, and purchasers of its services and/or products, in addition to other outside agents, to use my photograph (whether still, motion, or television) for educational and public awareness purposes.

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DEPARTMENT OF PHYSICAL THERAPY

SCHOOL OF MEDICINE

UNIVERSITY OF NORTH DAKOTA

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REFERENCES


