

Ankle Plantar Flexors and Dorsiflexors: Strength and Flexibility for Dance

Summary Handout

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Presented at National Dance Association's Best Practices Forum: Dance Education
2011 AAHPERD Convention: March 31, 2011

Anatomy of the Ankle and Foot

- Bones and Movements of the Ankle (Clippinger, 2007, p.298-300)
 - The ankle joint is the articulation between the distal tibia and fibula and the talus (central bone between lower leg and foot)
 - The ankle joint functions to transfer forces and movement between the leg and foot
 - The ankle joint is a hinge joint; flexion and extension are the only possible actions
 - **Plantar flexion: extension of the ankle joint, pointing the foot** downward or lifting the heel
 - **Dorsiflexion: flexion of the ankle joint, flexing the foot** upwards or lowering the heel.
- Bones and Movements of the Foot
 - Tarsus Region
 - Consists of 7 tarsal bones around the ankle: calcaneus (heel bone), talus, navicular, cuboid, 3 cuneiforms (Fitt, 1996, p.27-28)
 - Possible actions of tarsal joints are inversion, eversion, abduction, adduction, pronation, and supination (Clippinger, 2007, p.302, 306; Fitt, 1996, p.30).
 - **Inversion: lifting inner border of foot, "sickling" when non-weight bearing**
 - **Eversion: lifting outer border of foot, "winging" when non-weight bearing**
 - Abduction: move forefoot away from midline
 - Adduction: move forefoot towards midline
 - **Supination: inversion and abduction of tarsus + ankle plantar flexion when weight bearing = rolling onto outside (lateral border) of foot**
 - **Pronation: eversion and adduction of tarsus + ankle dorsiflexion when weight bearing = rolling onto inside (medial border) of foot**
 - Metatarsals (Clippinger, 2007, p.305-306)
 - 5 slender bones mid-foot, from tarsus to toes
 - Metatarsophalangeal Joints: between heads of metatarsals and base of toes
 - Ellipsoid (condyloid) joints
 - Possible actions are flexion, extension, abduction, and adduction
 - Flexion: point base of toes downward, curl underside of ball of foot
 - Extension: straight or pull toes upward, flatten underside of ball of foot
 - Abduction: move toes away from 2nd toe
 - Adduction: move toes towards 2nd toe
 - Toes (Clippinger, 2007, p.306)
 - Comprised of 14 phalange bones
 - Interphalangeal joints: between phalanges of toes
 - Hinge joints
 - Flex and extend toes
 - **Flexion of toes: curl or point toes downward**
 - **Extension of toes: straighten or flatten toes**

Table 1 summarizes these joint movements and functional actions of the ankle and foot.

Table 1: Joint Movements and Actions of the Ankle and Foot

<u>Region of Ankle-Foot</u>	<u>Action</u>	<u>Joint Movement</u>	<u>Non-Weight Bearing Action</u>	<u>Weight Bearing Action</u>
<u>Ankle</u>				
	Plantar flexion	Extension of ankle joint	Pointing foot	Lifting heel, rising onto balls of feet Pushing foot off floor for propulsion or jumps
	Dorsiflexion	Flexion of ankle joint	Flexing foot	Lowering foot (heel) onto ground Pulling lower leg towards foot, as when the knees bend Shifting body weight forward on foot
<u>Foot</u>				
<u>Tarsus</u>				
	Inversion	Lifting inner border of foot	Sickling	Lifting medial side (longitudinal arch) of foot
	Eversion	Lifting outer border of foot	Winging	Lifting lateral side of foot
	Abduction	Move forefoot away from midline		
	Adduction	Move forefoot towards midline		
	Supination	Inversion + abduction + plantar flexion		Roll onto lateral border of foot
	Pronation	Eversion + adduction + dorsiflexion		Roll onto medial border of foot
<u>Metatarsals/Toes</u>				
Metatarsophalangeal Joints (metatarsal heads + proximal phalanges of toes)	Flexion	Curl toes and underside of ball of foot	Point toes down	Placing foot on ground
	Extension	Straighten toes and flatten underside of ball of foot	Straighten toes	Lift toes up Flatten toes when on ball of foot
	Abduction	Move toes away from 2 nd toe	Spread toes apart	Widen toes on floor
	Adduction	Move toes towards 2 nd toe	Bring toes together	Move toes closer together on floor
Interphalangeal Joints (between phalanges of toes)	Flexion	Curl toes	Point or scrunch toes down	Placing foot on ground
	Extension	Straighten toes	Straighten or lengthen toes	Lift toes up Flatten toes when on ball of foot

Source for Table 1: Clippinger, 2007, p. 300-306

Muscles of the Ankle and Foot

- 24 muscles total (Clippinger, 2007, p.309)
 - 12 **extrinsic** muscles originate on the lower leg and insert into the underside of the foot
 - 12 **intrinsic** muscles originate and insert entirely within the foot
- General Patterns of Locations and Actions (Fitt, 1996, p.121, 129)
 - **Posterior** muscles, on the back of the lower leg, **plantar flex the ankle**
 - **Anterior** muscles, on the front of the lower leg, **dorsiflex the ankle**
 - **Medial** muscles (run and insert medially) also **invert the foot**
 - **Lateral** muscles (run and insert laterally) also **evert the foot**

Tables 2-3 outline the positions and actions of the extrinsic muscles that move the ankle and foot.

Table 2: Extrinsic Ankle-Foot Muscle Attachments and Actions

<u>Location on Lower Leg</u>	<u>Muscle</u>	<u>Origin</u>	<u>Insertion</u>	<u>Action</u>
<u>Anterior muscles</u> front of lower leg				Dorsiflex ankle
	Tibialis anterior	Upper tibia	Medial side of plantar surface (underside) of foot	Dorsiflex ankle Invert foot
	Extensor hallucis longus	Upper fibula	Base of big toe (hallux)	Dorsiflex ankle Invert foot Extend big toe (hallux)
	Extensor digitorum longus	Upper lateral fibula	Toes 2-5 (digits)	Dorsiflex ankle Evert foot Extend toes 2-5 (digits)
	Peroneus tertius	Lower lateral fibula (below extensor digitorum longus)	Base of 5 th metatarsal	Dorsiflex ankle Invert foot
<u>Posterior muscles</u> back of lower leg	Calf muscles (triceps surae)			Plantar flex ankle Prime movers in plantar flexion
	Gastrocnemius	Back of knee	Back of calcaneus (heel bone) via Achilles tendon	Plantar flex ankle Produce powerful plantar flexion for forceful, propulsive movements (e.g. jumps)
	Soleus	Back of upper tibia & fibula	Back of calcaneus via Achilles tendon	Plantar flex ankle Maintain plantar flexion Stabilize lower leg on foot
<u>Posteromedial muscles</u> Medial side of back of lower leg	“Tom, Dick, and Harry”			Plantar flex ankle Invert foot Support medial longitudinal arch
	Tibialis posterior	Back of upper tibia	Medial side of plantar surface (underside) of foot	Plantar flex ankle Invert foot Support medial longitudinal arch
	Flexor hallucis longus	Back of lower fibula	Under big toe (hallux)	Plantar flex ankle Invert foot Support medial longitudinal arch Flex big toe (hallux)
	Flexor digitorum longus	Back of lower tibia	Under toes 2-5	Plantar flex ankle Invert foot Support medial longitudinal arch Flex toes 2-5 (digits)
<u>Lateral muscles</u> Lateral side of lower leg	Peroneals			Plantar flex ankle Evert foot
	Peroneus longus	Lateral upper fibula	Under 1 st metatarsal (medial portion of underside of foot)	Plantar flex ankle Evert foot Depresses head of 1 st metatarsal
	Peroneus brevis	Lateral lower fibula	Under 5 th metatarsal (lateral portion of underside of foot)	Plantar flex ankle Evert foot

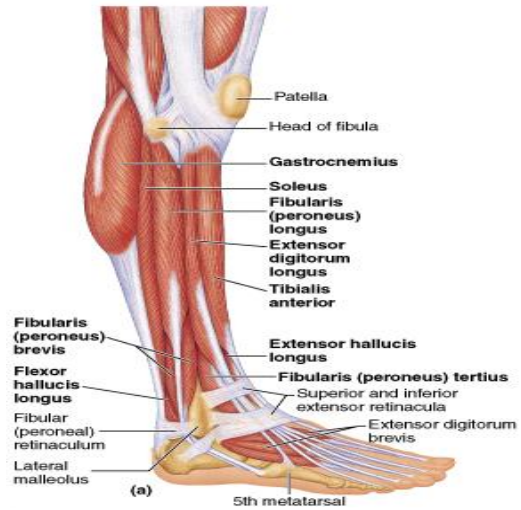
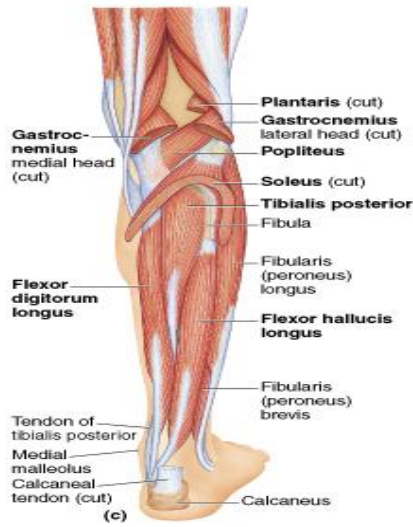
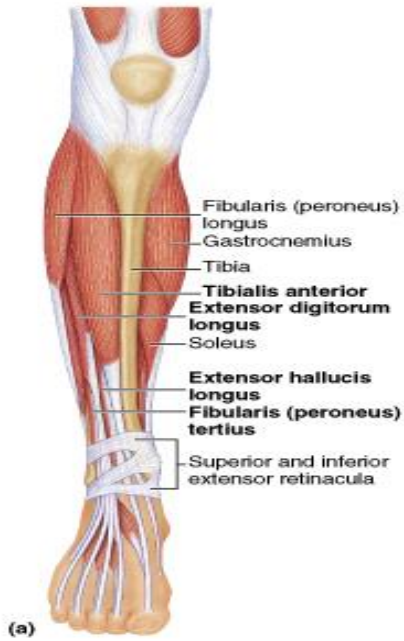
Source for Table 2: Adapted from Clippinger, 2007, p.318-319

Table 3: Extrinsic Ankle-Foot Muscles Grouped by Location and Action

<u>Location on Lower Leg</u>	<u>Movements of Ankle and Foot</u>	<u>Muscles</u>
Anterior-lateral	Dorsiflex ankle Evert foot	Extensor digitorum longus (also extends toes 2-5) Peroneus tertius
Anterior-medial	Dorsiflex ankle Invert foot	Tibialis anterior Extensor hallucis longus (also extends big toe)
Posterior	Plantar flex ankle	Gastrocnemius and soleus (calf muscles, prime movers in plantar flexion)
Posterior-medial	Plantar flex ankle Invert foot	Tibialis posterior Flexor digitorum longus (also flexes toes 2-5) Flexor hallucis longus (also flexes big toe)
Posterior-lateral	Plantar flex ankle Evert foot	Peroneals: peroneus longus, peroneus brevis

Source for Table 3: Adapted from Fitt, 1996, p.129

Diagrams of Extrinsic Ankle-Foot Muscles



The Ankle and Foot in Dance

Table 4: Ankle/Foot Actions in Dance

Ankle/Foot Movement	Actions in Dance
Ankle Plantar Flexion	Ankle extends, heel lifts off floor, foot points downward <ul style="list-style-type: none"> • Point feet • Articulate through feet to lift heel • Brush feet on floor (tendus, degagés) • Rise onto balls of feet: relevés • Rise onto toes: pointe • Push feet off floor for propulsion <ul style="list-style-type: none"> • Jumps • Running • Roll through feet and cushioning descent when landing from jumps
Ankle Dorsiflexion	Ankle flexes, heel lowers towards floor, foot flexes upward <ul style="list-style-type: none"> • Flex feet • Lower heel • Stand on feet, maintain standing balance • Return from a brush <ul style="list-style-type: none"> • Closing from a tendu or degagé • Lower from balls of feet (relevé) or toes (pointe) • Pull lower leg toward foot when weight bearing and bending knees <ul style="list-style-type: none"> • Pliés • Shift body weight forward on foot before lifting heel
Foot Inversion	Inner (medial) border of foot lifts <ul style="list-style-type: none"> • “Sickle” foot • Raise and maintain medial longitudinal arch • Distribute weight to lateral side of foot • Prevent excessive pronation
Foot Eversion	Outer (lateral) border of foot lifts <ul style="list-style-type: none"> • “Wing” foot • Raise and maintain lateral and transverse arches • Distribute weight to medial side of foot • Prevent sickling and excessive supination

Source for Table 4: Clippinger, 2007, p.314-315, 317, 331-332

- Dance requires both strength and flexibility in the muscles of the ankle and foot
 - Strength needed for advanced propulsive and weight-bearing forces (e.g. leaps, locomotor skills, balances, *en pointe* positions)
 - Flexibility needed for fine articulation through feet and desired aesthetic lines (e.g. highly pointed foot, high *relevé*)
 - Balanced strength and flexibility needed in ankle plantar flexors/dorsiflexors and foot inverters/everters
- Optimal ranges of motion (Clippinger, 2007, p.336)
 - 90°-100° of plantar flexion at ankle
 - Needed for balancing on ball of foot, high *relevé*, and rising to toes *en pointe*
 - 90° of extension of big toe at 1st metatarsophalangeal joint
 - Needed to create a flat supporting surface when on ball of foot and sustain a high *relevé*
- Proper Ankle Alignment
 - Straight vertical line from center of knee to center of ankle to 2nd toe (Grieg, 1994, p.102)
 - Foot inverters and everters need to contract synergistically to maintain correct alignment of ankle over 2nd toe (Clippinger, 2007, p.337)
 - Stabilizes ankle and foot (Fitt, 1996, p.133)
 - Prevents sideways wobbling of ankle (Fitt, 1996, p.133)
 - Distributes weight correctly on big toe, little toe, and heel (tripod of foot)
 - Prevents excessive pronation or supination
 - Prevents rolling in or out on *relevé*
 - Requires additional strength in foot inverters and everters that also plantar flex ankle

Strength and Flexibility Conditioning for Ankle Plantar Flexors and Dorsiflexors

- Long-term strengthening and stretching of ankle/foot muscles essential for
 - Efficiently meeting demands that dance places on the ankle-foot
 - Achieving desired dance aesthetics
 - Balancing strength and flexibility around ankle
 - Plantar flexors often stronger than dorsiflexors as a result of ballet training (Clippinger, 2007, p.352)
 - Preventing injury
 - Dance generates very large forces at the ankle-foot (Clippinger, 2007, p.298)
 - Need muscular strength and flexibility to bear these large forces at the joints
 - Ankle-foot is the most frequently injured body part in dancers (Clippinger, 2007, p.359)
 - Ankle plantar flexor strength helps to prevent Achilles tendonitis, flexibility supports proper balance on *relevé* (Clippinger, 2007, p.342)
 - Ankle dorsiflexor strength decreases risk of shin splints, flexibility increases depth of *demi-plié* (Clippinger, 2007, p.352; Grieg, 1994, p.97)
 - Foot inverter strength prevents pronation, which can lead to bunions and knee stress (Fitt, 1996, p.237)
 - Foot everter strength prevents supination during jump landings, which can lead to ankle sprains and 5th metatarsal fractures (Grieg, 1994, p.103)
- Strengthening Exercises
 - At least 1 set of 8-12 repetitions
 - Start with 1 set and gradually add repetitions when the muscle no longer feels challenged (Clippinger, 2007, p.65)
 - Perform at least 2-3 times per week (Clippinger, 2007, p.360)
 - Include Theraband exercises with ankle plantar flexion & dorsiflexion and foot inversion & eversion as well as functional, dance specific movements such as *relevés* and balances
- Flexibility Exercises
 - Hold each stretch for at least 30 seconds (Fitt, 1996, p.393)
 - Increase stretch gently with each exhale (Fitt, 1996, p.393)
 - Stretch until feeling a mild pull, not pain
 - Perform stretches daily and when warm- after dancing is best (Clippinger, 2007, p.360)
 - Do not bounce in a stretch
- Maintain proper body alignment and form throughout all exercises (Clippinger, 2007, p.66; Fitt, 1996, p.390)
- Continue to perform exercises as a sustained conditioning program for optimal performance and injury prevention

Strength and Flexibility Program for Ankle Plantar Flexors and Dorsiflexors

Strengthening Exercises for Ankle Plantar Flexors

Exercise	Description	Muscles Targeted
1. Ankle/Tarsus Series in Plantar Flexion (Fitt, 1996, p. 408)	-sit up straight with legs extended straight in front of you -plantar flex ankles -evert feet: press (“wing”) soles of foot outward without externally rotating at hip joint -invert feet: “sickle” soles of feet inward without internally rotating at hip joint -alternate foot eversion and inversion 10-15 times while keeping ankles in plantar flexion	-Ankle plantar flexors: gastrocnemius, soleus -Foot inverters: tibialis posterior, flexor digitorum longus, flexor hallucis longus -Foot everters: peroneus longus, peroneus brevis
2. Theraband Sitting Plantar Flexion with Inversion and Eversion (Clippinger, 2007, p. 344; Franklin, 2004, p. 157; http://www.therabandacademy.com/exercises/showExercise.asp?exID=160)	-sit up straight with legs extended straight in front of you -place theraband under ball and over toes of 1 foot -with 1 hand on each end of the band, pull back on the band with both hands so it is taut and provides resistance -slowly plantar flex ankle and point foot, leading with ball of foot and articulating through all parts of the foot to the toes -slowly return to starting position, articulating through all parts of the foot to dorsiflex the ankle -repeat 8-12 times <i>Important Notes: do not let the toes “snap” back without controlled resistance, extend the toes back slowly to initiate dorsiflexion; articulate slowly through all parts of foot in both plantar flexion and dorsiflexion</i> -on last repetition, maintain ankle in plantar flexed position: <ul style="list-style-type: none"> ▪ Extend and flex toes (pull toes back slowly and then reach them out in line with metatarsals) ▪ Pull both ends of band medially towards you, evert foot, and return to neutral ▪ Pull both ends of band laterally towards you, invert foot, and return to neutral ▪ Perform each of the above variations 8-12 times <i>Important Notes: extend and flex toes slowly and with control; isolate inversion and eversion at foot, do not rotate hip joint</i>	-Ankle plantar flexors: gastrocnemius, soleus -Foot inverters: tibialis posterior, flexor digitorum longus, flexor hallucis longus -Foot everters: peroneus longus, peroneus brevis -Toe flexors: flexor hallucis longus, flexor digitorum longus -Toe extensors: extensor hallucis longus, extensor digitorum longus
3. Elevés and Relevés (heel raises)		
2 feet (Watkins, 1990, p.83)	<i>Elevés:</i> -standing on 2 straight legs, lift heels and rise onto balls of feet, then slowly lower heels to ground <i>Relevés:</i> -starting from a demi plié, lift heels and rise onto balls of feet, then slowly lower heels to ground Perform 8 elevés and relevés in parallel first position and then 8 of each in turned out first position. Hold arms in 2 nd position or lightly hold onto a barre or chair for balance. <i>Important Notes: Maintain ankle alignment- center of ankle over 2nd toe, weight on 1st 3 toes, no inversion (rolling out) or eversion (rolling in); rise up high onto balls of feet</i>	-Primarily ankle plantar flexors: gastrocnemius, soleus -Foot inverters and everters to stabilize ankle alignment Foot inverters: tibialis posterior, flexor digitorum longus, flexor hallucis longus Foot everters: peroneus longus, peroneus brevis
1 foot (Clippinger, 2007, p. 343)	Stand on 1 turned out foot with the other leg against the ankle of the supporting leg in <i>coupé</i> . Slowly rise onto the ball of the foot, pause, and slowly lower the heel. Perform 8-12 <i>elevés</i> on each leg. <i>Important Notes: Maintain ankle alignment- center of ankle over 2nd toe, weight on 1st 3 toes, no inversion (rolling out) or eversion (rolling in); rise up high onto ball of foot</i>	-Primarily ankle plantar flexors: gastrocnemius, soleus -Foot inverters and everters to stabilize ankle alignment Foot inverters: tibialis posterior, flexor digitorum longus, flexor hallucis longus Foot everters: peroneus longus, peroneus brevis

Exercise	Description	Muscles Targeted
4. Strengthening the Peroneus Longus (Franklin, 2004, p. 154)	<ul style="list-style-type: none"> -stand with your weight equally distributed on both feet and the legs in parallel first position -lift the heels and rise up onto the balls of the feet (elevé) -visualize the peroneus longus working to support the outside of the foot and bring your weight over the 2nd toe -while on the balls of the feet, roll out towards your pinky toes (move the ankles to the outside, inverting the feet), and then return the ankle to its centered alignment over the 2nd toe. Visualize the peroneus longus lengthening to evert the foot and return the ankle from inversion to its aligned position. -repeating rolling out and returning to centered ankle alignment 8 times, staying on the balls of the feet -slowly lower the heels 	Ankle everters: peroneus longus, peroneus brevis
5. Fondu Forched Arch (Clippinger, 2007, p. 343)	<ul style="list-style-type: none"> -stand on 1 turned out foot with the other leg against the ankle of the supporting leg in <i>coupé</i> -bend the supporting knee (<i>fondu</i>) -rise as high as possible onto the ball of the supporting foot, keeping the knee bent (forced arch) -straighten the supporting knee, trying to keep the heel as high as possible -pause in the high <i>relevé</i> position -slowly lower the heel of the supporting leg to the ground, keeping the knee straight -perform 8-12 times on each leg <p><i>Important Notes: Maintain ankle alignment- center of ankle over 2nd toe, weight on 1st 3 toes, avoid ankle wobbling from side to side and inversion (rolling out) or eversion (rolling in); rise up high onto ball of foot; articulate through all parts of foot; align knee over middle toes in fondu</i></p>	<ul style="list-style-type: none"> -Primarily ankle plantar flexors: gastrocnemius, soleus -Foot inverters and everters to stabilize ankle alignment Foot inverters: tibialis posterior, flexor digitorum longus, flexor hallucis longus Foot everters: peroneus longus, peroneus brevis
6. Ankle Disk Relevé (1 foot relevé on wobble board) (Clippinger, 2007, p. 351)	<ul style="list-style-type: none"> -stand with one foot on wobble board and the other foot in <i>coupé</i> next to the ankle of the supporting leg; keep both legs in parallel -lower the heel of the supporting foot towards the floor so the back edge of the wobble board moves towards the ground -slowly rise onto the ball of the supporting foot and hold for 4 counts -smoothly lower to the starting position -repeat 8-12 times on each leg -hold arms in 2nd position or down by sides for balance <p><i>Important Notes: Maintain ankle alignment- center of ankle over 2nd toe, weight on 1st 3 toes, avoid ankle wobbling from side to side and inversion (rolling out) or eversion (rolling in); rise up high onto ball of foot; articulate through all parts of foot</i></p>	<ul style="list-style-type: none"> -Primarily ankle plantar flexors: gastrocnemius, soleus -Foot inverters and everters to stabilize ankle alignment Foot inverters: tibialis posterior, flexor digitorum longus, flexor hallucis longus Foot everters: peroneus longus, peroneus brevis
7. Single Leg Jumps (Clippinger, 2007, p. 345)	<ul style="list-style-type: none"> -stand on one turned out leg with the other foot by the supporting ankle in <i>coupé</i> -bend the supporting knee and jump -roll through the foot to land -hold arms in <i>bras bas</i>, 2nd position, or lightly touching a barre if necessary -perform 8-12 jumps on each leg <p><i>Important Notes:</i> MAKE SURE YOU ARE ADEQUATELY WARMED UP. PERFORM JUMPS AS THE LAST EXERCISE IN THE PLANTAR FLEXOR STRENGTHENING SERIES. <i>Maintain knee and ankle alignment- center of knee over center of ankle, center of ankle over 2nd toe; do not pronate (roll in) or supinate (roll out) when landing; articulate through all parts of foot</i></p>	<ul style="list-style-type: none"> -Primarily ankle plantar flexors: gastrocnemius (emphasized in jumps), soleus -Foot inverters and everters to stabilize ankle alignment Foot inverters: tibialis posterior, flexor digitorum longus, flexor hallucis longus Foot everters: peroneus longus, peroneus brevis

Strengthening Exercises for Ankle Dorsiflexors

Exercise	Description	Muscles Targeted
1. Ankle/ Tarsus Series in Dorsiflexion (Fitt, 1996, p.408)	-sit up straight with legs extended straight in front of you -dorsiflex ankles (flex feet) -evert feet: press (“wing”) soles of foot outward without externally rotating at hip joint -invert feet: “sickle” soles of feet inward without internally rotating at hip joint -alternate foot eversion and inversion 10-15 times while keeping ankles dorsiflexed	Ankle dorsiflexors Ankle dorsiflexors and foot inverters: tibialis anterior, extensor hallucis longus Ankle dorsiflexors and foot everters: extensor digitorum longus, peroneus tertius
2. Theraband Sitting Dorsiflexion with Inversion and Eversion http://www.therabandacademy.com/exercises/showExercise.asp?exID=158	-sit up straight with legs extended straight in front of you -loop theraband around the middle of 1 foot and grasp the ends of the band -press other foot down onto the band to stabilize the band -dorsiflex the ankle in the band, lifting the toes and foot upward -slowly return to starting position -repeat 8-12 times <i>Important Notes: do not let the toes “snap” back without controlled resistance, extend the toes back slowly to initiate dorsiflexion; articulate slowly through all parts of foot</i> -on last repetition, maintain ankle in dorsiflexed position: <ul style="list-style-type: none"> ▪ Pull both ends of band medially towards you, evert foot, and return to neutral ▪ Pull both ends of band laterally towards you, invert foot, and return to neutral Perform each of the above 8-12 times <i>Important Note: isolate inversion and eversion at foot, do not rotate hip</i>	Ankle dorsiflexors, primarily tibialis anterior Ankle dorsiflexors and foot inverters: tibialis anterior, extensor hallucis longus Ankle dorsiflexors and foot everters: extensor digitorum longus, peroneus tertius
3. Theraband Ankle Dorsiflexion (http://www.therabandacademy.com/exercises/showExercise.asp?exID=157)	-sit up straight with legs extended straight in front of you -make a loop with the band and securely attach 1 end of the loop near the floor -place exercising foot inside loop -dorsiflex ankle of foot inside loop, slowly pulling the foot upward -hold dorsiflexed position for 4 counts -slowly return to starting position -perform 8-12 times with each foot	Ankle dorsiflexors, primarily tibialis anterior
4. Theraband Ankle Dorsiflexion Sitting in Chair (http://www.therabandacademy.com/exercises/showExercise.asp?exID=159)	-sit towards edge of chair -loop middle of band around 1 foot -place other foot on top of band to stabilize it -grasp free ends of band -dorsiflex ankle of foot inside band, slowly pulling foot upward -slowly return to starting position -perform 8-12 times with each foot	Ankle dorsiflexors, primarily tibialis anterior
5. Standing Foot Wobble (Fitt, 1996, p.409)	-stand in parallel with feet hip width apart -shift weight to lateral border of feet: supinate (invert) feet -shift weight to medial border of feet: pronate (evert) feet -wobble back and forth between lateral and medial borders of feet, from one extreme position to the other -gradually decrease amount of deviation until foot stops in centered position: center of the ankle in line with the 2 nd toe and weight distributed evenly on the front, back, and sides of feet -as an extra challenge for balance, perform exercise standing on wobble board	Ankle dorsiflexors and foot inverters: tibialis anterior, extensor hallucis longus Ankle dorsiflexors and foot everters: extensor digitorum longus, peroneus tertius

<u>Exercise</u>	<u>Description</u>	<u>Muscles Targeted</u>
6. One Legged Demi Plié (Fitt, 1996, p. 410)	<ul style="list-style-type: none"> -stand in parallel with feet hip width apart -shift weight onto 1 foot -slowly bend knee (demi pli�) on supporting leg -slowly straighten knee of supporting leg -repeat in turned out position -repeat on other foot -perform 8-12 pli�s on each leg <p><i>Important Notes: use centered position of foot established in previous exercise; keep feet, knees, hips, and ankles aligned; do not let knees roll in; do not let ankles roll out (supinate) or in (pronate)- stabilize ankle joint in correct alignment</i></p>	<ul style="list-style-type: none"> -Ankle dorsiflexors, primarily tibialis anterior, to balance on supporting foot -Foot inverters and everters contract synergistically to maintain neutral ankle alignment: Ankle dorsiflexors and foot inverters: tibialis anterior, extensor hallucis longus Ankle dorsiflexors and foot everters: extensor digitorum longus, peroneus tertius

Strengthening Exercises for Both Ankle Plantar Flexors and Dorsiflexors

<u>Exercise</u>	<u>Description</u>	<u>Muscles Targeted</u>
1. Theraband Sitting Ankle Plantarflexion and Dorsiflexion (Franklin, 2004, p.157)	<ul style="list-style-type: none"> -sit up straight with legs extended straight in front of you -place theraband under ball and over toes of 1 foot -with 1 hand on each end of the band, pull back on the band with both hands so it is taut and provides resistance -slowly plantar flex ankle and point foot, leading with ball of foot and articulating through all parts of the foot to the toes -slowly return to starting position, articulating through all parts of the foot -dorsiflex the ankle, pulling the foot and toes backward past the starting position. Keep band taut, pulling elbows back next to ribs to maintain resistance -return to starting position -repeat plantar flexion-dorsiflexion sequence 15 times <p><i>Important Notes: provide controlled resistance during dorsiflexion- do not let the toes "snap" back without control, extend the toes back slowly to initiate dorsiflexion; articulate slowly through all parts of foot in both plantar flexion and dorsiflexion; keep pulling back on band so it is taut, keep elbows next to ribs; maintain alignment of center of ankle over 2nd toe</i></p>	<p>Ankle plantar flexors:</p> <ul style="list-style-type: none"> -primary muscles: gastrocnemius and soleus -secondary muscles: tibialis posterior, flexor hallucis longus, flexor digitorum longus, peroneals (peroneus longus and brevis) <p>Ankle dorsiflexors:</p> <ul style="list-style-type: none"> -primary muscle: tibialis anterior -secondary muscles: extensor digitorum longus, peroneus tertius, extensor hallucis longus
2. Ankle Circles (Fitt, 1996, p.408)	<ul style="list-style-type: none"> -sit with knees bent and legs parallel -place hands on backs of thighs with elbows lifted out to sides -lift feet off floor -circle ankles clockwise and then counterclockwise, at least 6-8 times in each direction <p><i>Important Note: move ankle smoothly through all parts of circle</i></p>	<p>Ankle Plantar Flexors, Foot Inverters/ Everters:</p> <ul style="list-style-type: none"> -ankle plantar flexors: gastrocnemius and soleus -ankle plantar flexors and foot inverters: tibialis posterior, flexor digitorum longus, flexor hallucis longus -ankle plantar flexors and foot everters: peroneals (peroneus longus and brevis) <p>Ankle Dorsiflexors, Foot Inverters/ Everters:</p> <ul style="list-style-type: none"> -Ankle dorsiflexors and foot inverters: tibialis anterior, extensor hallucis longus -Ankle dorsiflexors and foot everters: extensor digitorum longus, peroneus tertius

<u>Exercise</u>	<u>Description</u>	<u>Muscles Targeted</u>
3. Ankle Disk Circles (ankle circles on wobble board) (Clippinger, 2007, p.350)	-stand on 1 parallel foot in center of wobble board -hold other foot in parallel <i>coupé</i> next to ankle of supporting leg -slowly move ankle joint in a circle around the supporting foot, shifting body weight in a circle around the foot and making a circle with the wobble board -perform 6 circles counterclockwise and then 6 circles clockwise <i>Important Notes: make circles as smooth and symmetrical as possible, moving ankle smoothly through all parts of the circle; emphasize use of ankle-foot muscles to make the circle</i>	Ankle Plantar Flexors, Foot Inverters/ Everters: -ankle plantar flexors: gastrocnemius and soleus -ankle plantar flexors and foot inverters: tibialis posterior, flexor digitorum longus, flexor hallucis longus -ankle plantar flexors and foot everters: peroneals (peroneus longus and brevis) Ankle Dorsiflexors, Foot Inverters/ Everters: -Ankle dorsiflexors and foot inverters: tibialis anterior, extensor hallucis longus -Ankle dorsiflexors and foot everters: extensor digitorum longus, peroneus tertius

Flexibility Exercises for Ankle Plantar Flexors

<u>Stretch</u>	<u>Description</u>	<u>Muscle(s) Targeted</u>
1. Standing Lunge Calf Stretch (Clippinger, 2007, p.356; Watkins, 1990, p.86; Fitt, 1996, p.411)	-stand in a lunge position with the front leg bent and the back leg straight -make sure both legs are parallel (toes point straight ahead) -shift hips and pelvis forward until feeling a stretch in the calf of the back leg -place hands against wall or down by sides -hold for at least 30 seconds -repeat with other leg forward <i>Important Notes: keep legs and feet parallel, with both feet and toes pointing straight forward; do not pronate (roll in) or point toes outward; align knees and ankles over center of toes; keep back heel down on ground; keep neutral pelvic alignment, do not tip pelvis forward or back; do not hyperextend (arch) lower back; maintain one long diagonal line from back of head to back foot</i>	Gastrocnemius
2. Standing Lunge Bent Knee Calf Stretch (Soleus Stretch) (Clippinger, 2007, p.357; Watkins, 1990, p.86; Fitt, 1996, p.411)	-assume same position as standing lunge calf stretch: -stand in a lunge position with the front leg bent and the back leg straight -make sure both legs are parallel (toes point straight ahead) -shift hips and pelvis forward until feeling a stretch in the calf of the back leg -bring back foot in closer to you about 8 inches (20 cm) -bend back knee until feeling a stretch low in the calf -hold for at least 30 seconds -repeat with other leg forward <i>Important Notes: keep legs and feet parallel, with both feet and toes pointing straight forward; do not pronate (roll in) or point toes outward; align knees and ankles over center of toes; keep back heel down on ground; keep neutral pelvic alignment, do not tip pelvis forward or back; do not hyperextend (arch) lower back</i>	Soleus

Flexibility Exercises for Ankle Dorsiflexors

<u>Stretch</u>	<u>Description</u>	<u>Muscle(s) Targeted</u>
1. Standing Pointe Stretch (Clippinger, 2007, p. 358)	<ul style="list-style-type: none"> -stand on 1 foot turned out -place same arm as standing foot on a barre or against a wall for support -place top of foot to be stretched on floor, turned out and to the side of the standing foot -shift weight over onto stretching foot, pressing the heel forward and pushing the top of the foot over towards the toes, until a stretch is felt across the top of the foot (upper instep) -to increase stretch in upper foot, slightly bend supporting knee and bend knee of stretching leg further -hold for at least 30 seconds -repeat on other side <p><i>Important Notes: do not overly curl or "knuckle" onto toes of stretching foot; maintain neutral ankle alignment, with weight evenly across the toes of the stretching foot, and avoid rolling in or out; do not shift body weight onto stretching foot so much that pain is felt in toes or top of foot</i></p>	Ankle dorsiflexors: tibialis anterior, extensor hallucis longus, extensor digitorum longus, peroneus tertius Extensor digitorum longus emphasized
2. Sitting Pointe Stretch (Clippinger, 2007, p.358)	<ul style="list-style-type: none"> -sit with right foot on ground and left knee bent, with left ankle resting on right thigh -use left hand to grasp left heel and hold it in place -use right hand to gently pull left foot into further plantar flexion until a stretch is felt across the upper instep -hold for at least 30 seconds -repeat on other side <p><i>Important Notes: on hand that is pulling foot into plantar flexion, focus on using thumb to press arch of foot upward as other fingers pull forefoot slightly "out and then down;" do not invert (sickle) or evert foot that is being stretched, maintain neutral ankle alignment; maintain good posture, do not "sink" or overly round spine</i></p>	Ankle dorsiflexors: tibialis anterior, extensor hallucis longus, extensor digitorum longus, peroneus tertius Extensor digitorum longus emphasized

Flexibility Exercise for Both Ankle Plantar Flexors and Dorsiflexors

<u>Stretch</u>	<u>Description</u>	<u>Muscle(s) Targeted</u>
Shin Splint Stretch (Fitt, 1996, p.409)	<ul style="list-style-type: none"> -kneel and sit back on heels -place hands to sides of knees -shift body weight onto hands and tops of feet -allow gravity to increase ankle plantar flexion -hold for at least 30 seconds <p><i>Important Notes: maintain neutral ankle alignment, do not pronate (roll in) or supinate (roll out); keep toes extended flat on floor, do not curl or "crunch" toes into bent position</i></p>	Ankle plantar flexors: <ul style="list-style-type: none"> -primary muscles: gastrocnemius and soleus -secondary muscles: tibialis posterior, flexor hallucis longus, flexor digitorum longus, peroneals (peroneus longus and brevis) Ankle dorsiflexors: <ul style="list-style-type: none"> -primary muscle: tibialis anterior -secondary muscles: extensor digitorum longus, peroneus tertius, extensor hallucis longus

References

- Clippinger, K. (2007). *Dance anatomy and kinesiology*. Champaign, IL: Human Kinetics.
- Fitt, S. (1996). *Dance kinesiology*. New York, NY: Schirmer Books.
- Franklin, E. (2004). *Conditioning for dance*. Champaign, IL: Human Kinetics.
- Thera-Band Academy. (March 3, 2008). *Thera-band academy ankle exercises*. Retrieved December 4, 2009 from http://www.thera-bandacademy.com/exercises/exercise_search.asp.
- Thera-Band Academy. (March 3, 2008). *Thera-band academy ankle dorsiflexion exercises*. Retrieved December 4, 2009 from http://www.thera-bandacademy.com/exercises/exercise_search.asp.
- Thera-Band Academy. (March 3, 2008). *Thera-band academy ankle plantar flexion exercises*. Retrieved December 4, 2009 from http://www.thera-bandacademy.com/exercises/exercise_search.asp.
- Thera-Band Academy. (March 3, 2008). *Thera-band ankle dorsiflexion*. Retrieved December 4, 2009 from <http://www.thera-bandacademy.com/exercises/showExercise.asp?exID=157>.
- Thera-Band Academy. (March 3, 2008). *Thera-band ankle dorsiflexion*. Retrieved December 4, 2009 from <http://www.thera-bandacademy.com/exercises/showExercise.asp?exID=158>.
- Thera-Band Academy. (March 3, 2008). *Thera-band ankle dorsiflexion sitting*. Retrieved December 4, 2009 from <http://www.thera-bandacademy.com/exercises/showExercise.asp?exID=159>.
- Thera-Band Academy. (March 3, 2008). *Thera-band ankle plantar flexion*. Retrieved December 4, 2009 from <http://www.thera-bandacademy.com/exercises/showExercise.asp?exID=160>.
- Watkins, A., & Clarkson, P (1990). *Dancing longer dancing stronger: A dancer's guide to improving technique and preventing injury*. Hightstown, NJ: Princeton Book Company.

