

EST 22

30 June 2016

Esthetician – All Trades
Nail Growth; Hand and Foot
Disorders and Diseases

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Table of Contents

Objective One.....	13
The Fingernail.....	13
Nail Plate.....	14
Nail Bed.....	14
Matrix.....	14
The Lunula.....	14
Cuticle.....	15
Eponychium.....	15
Hyponychium.....	15
Nail Folds.....	16
Normal Nail Shapes.....	16
Objective One Self-Test.....	18
Objective One Self-Test Answers.....	19
Objective Two.....	20
Nail Growth.....	20
Objective Two Self-Test.....	21
Objective Two Self-Test Answers.....	22
Objective Three.....	23
Objective Four.....	24
Conditions, Disorders, and Diseases.....	24

Nail Disorders.....	24
Beaus Lines	24
Cyanosis (Blue Nails).....	25
Eggshell Nails (Onychomalacia)	25
Fissures	25
Hematoma (Bruised Nail Bed)	25
Hangnail.....	25
Involuted Toenail	26
Ingrown Toenail (Onychocryptosis).....	26
Koilonychia	26
Leukonychia	26
Melanonychia	26
Onychatrophia.....	27
Onychauxis	27
Onychophagy (Nail Biting).....	27
Onychoptosis Difluvium.....	27
Onychorrhhexis	27
Pincer (Trumpet Nails).....	28
Plicatured Nail.....	28
Psoriasis.....	28

Pterygium.....	28
Ridges (Grooves).....	28
Scleronychia.....	29
Splinter Hemorrhages.....	29
Wooded Nail.....	29
Yellow Nail Syndrome.....	29
Objective Four Self-Test.....	30
Objective Four Self-Test Answers.....	32
Objective Five.....	33
Scope of Practice.....	33
Bacterial Infections.....	33
Fungal Infections (Parasites).....	33
General Information.....	33
Dermatophytes.....	34
Tinea Pedis.....	34
Onychosis.....	35
Onychia.....	35
Onycholysis.....	35
Onychomadesis.....	35
Onychomycosis.....	36

Paronychia	36
Pseudomonas (Staphylococcus)	36
Objective Five Self-Test.....	38
Objective Five Self-Test Answers	40
Objective Six	41
Achilles Injuries	41
Achilles Tendon Rupture	41
Achilles Tendonitis	41
Blister	41
Edema (Swollen Ankles)	42
Fissures	42
Flat foot.....	42
Foot Infection (General Signs)	42
Foot Odour.....	43
Ganglions	43
Gout	43
Hammertoes.....	43
Heloma (Corns)	44
High Arch.....	44
Metatarsalgia (Fallen Metatarsal Arches)	44

Morton's Neuroma (Intermetatarsal Neuroma).....	45
Plantar Fasciitis and Heel Spurs.....	45
Plantar Hyperhidrosis	46
Pyogenic Granuloma	46
Sesamoid Injuries	46
Spider Veins.....	47
Turf Toe	47
Tyloma (Callus)	48
Varicose Veins	48
Verruca Vulgaris (Plantar Warts).....	48
Objective Six Self-Test.....	49
Objective Six Self-Test Answers.....	51
Objective Seven.....	52
What is Diabetes?	52
Type 1 Diabetes	52
Type 2 Diabetes	52
Diabetic Feet.....	53
Nerve Damage.....	53
Skin	53
Callus	54

Foot Ulcers	54
Temperature	54
Objective Seven Self-Test.....	56
Objective Seven Self-Test Answers	58
Objective Eight.....	59
Ligaments.....	59
Basal Joint Arthritis.....	59
Osteoarthritis	59
Rheumatoid Arthritis	59
Tendon Injuries.....	60
Tendonitis	60
DeQuervain's Tenosynovitis.....	60
Tennis	61
Boutonniere Finger	61
Mallet Finger.....	61
Ski Pole Thumb	62
Objective Eight Self-Test.....	63
Objective Eight Self-Test Answers	64
Objective Nine.....	65
What is Carpal Tunnel Syndrome?	65

Developing Carpal Tunnel Syndrome.....	66
Occupational Factors of Carpal Tunnel Syndrome.....	66
Symptoms of Carpal Tunnel Syndrome.....	67
Treatment of Carpal Tunnel Syndrome	68
Preventing Carpal Tunnel Syndrome.....	68
Objective Nine Self-Test.....	70
Objective Nine Self-Test Answers	71
Objective Ten.....	72
Contraindications That Restrict a Manicure or Pedicure	72
Contraindications That Prevent a Manicure or Pedicure.....	73
Objective Ten Self-Test.....	74
Objective Ten Self-Test Answers	76
Objective Eleven	77
Module Summary Self-Test.....	78
Module Summary Self-Test Answers	82

Nail Growth; Hand and Foot Disorders and Diseases

Rationale

Why is it important to learn this skill?

The material contained in this ILM forms 'the heart' of manicure and pedicure services. This information is necessary for the safety of both the apprentice and the client.

Outcome

When you have completed this module, you will be able to:

Describe nail growth, hand and foot disorders and diseases.

Objectives

1. Describe nail structure and natural nail shapes.
2. Describe nail growth patterns.
3. Demonstrate analyzing nail growth.
4. Describe nail conditions.
5. Describe nail diseases.
6. Describe foot and leg conditions and disorders.
7. Describe the diabetic foot.
8. Describe hand conditions.
9. Describe carpal tunnel syndrome.
10. Describe contraindications that may restrict or prevent a service.
11. Demonstrate analyzing conditions, disorders, and diseases of the hands and feet.

Introduction

The following information will help the apprentice make informed decisions regarding contraindications and which services can and cannot be performed on clients. The introduction to anatomy presented here will help in the understanding of conditions and workplace injuries. Of particular interest to apprentices is Objective 9 which

covers carpal tunnel syndrome, a condition that affects many apprentices and journeypersons.

Objective One

When you have completed this objective, you will be able to:

Describe nail structure and natural nail shapes.

The Fingernail

A fingernail is created by cells located in the finger, called the matrix. A fingernail consists of several parts as illustrated below. The nail plate is the visible part of the nail; it is made of keratin, a fibre-shaped protein also found in skin and hair. The nail bed is located beneath the nail plate, and is comprised of skin. The skin is made of two types of tissues. The deeper tissue is the dermis, which includes living tissue of glands and capillaries. The epidermis is the layer just beneath the nail plate; it moves with the nail plate toward the fingertip. The cuticle is the tissue that surrounds the base of the nail and overlaps the plate. The nail is supported on three sides by skin called the nail folds. The whitish half-moon at the base of the nail is called the lunula.

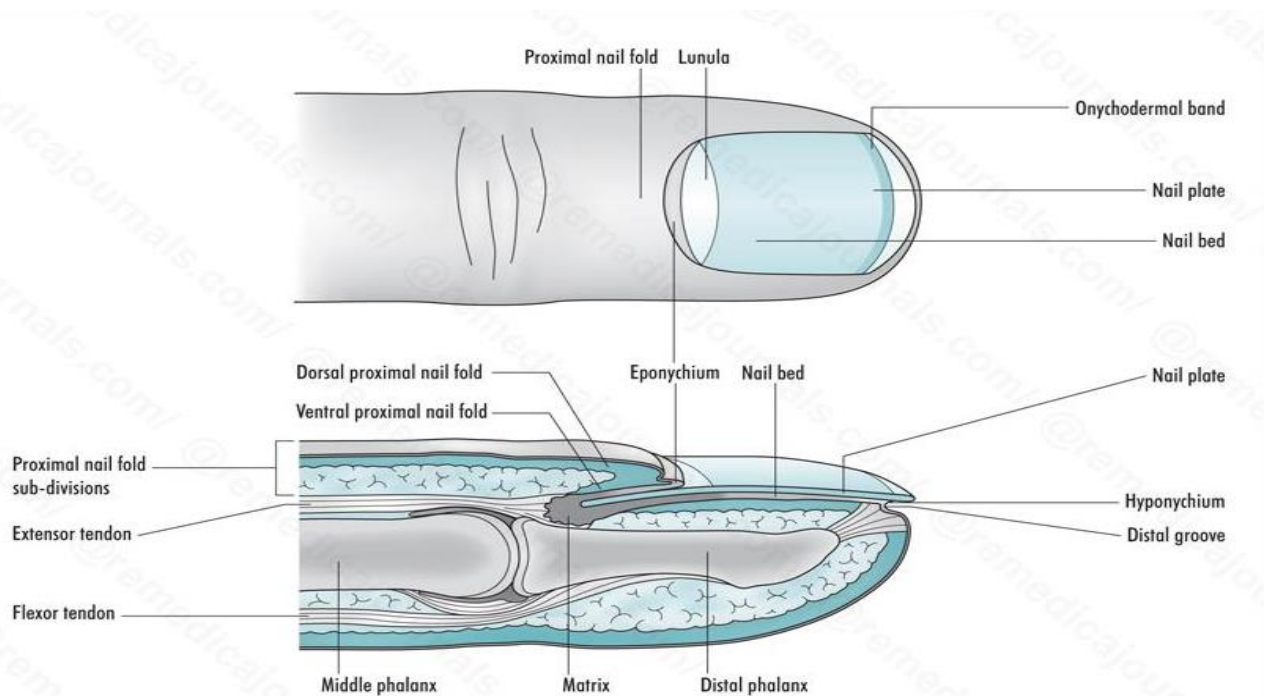


Image courtesy of International Journal of Clinical Reviews.

As the matrix creates new cells, older cells are pushed out and compacted, becoming the hardened fingernail.

A healthy, normal nail is translucent and whitish in colour. It appears slightly pink because of the natural colour of the nail bed below. It is flexible and firm. The surface of a nail is usually smooth and uniform in texture and colour. The water content of a healthy nail ranges between 15 and 25 percent. The nail plate is porous and absorbs water. Relative humidity has a great effect on the water content of a nail, and a nail's flexibility varies directly with its water content: the higher the content, the higher the flexibility. Water loss can be reduced by applying an oil-based nail conditioner or nail polish. These products can also hinder water absorption.

Nail Plate

The nail plate rests on top of the nail bed, and the two slowly slide toward the fingertip. Although the nail plate appears to be one solid piece, it is constructed of approximately 100 layers of nail cells. The part of the nail plate that extends beyond the fingertip is called the free edge.

Nail Bed

The nail bed is also called the bed epithelium. The bed is supplied with blood vessels and nutrients. It extends from the lunula to the area just before the free edge. The nail bed supports and guides the nail plate as it grows.

Matrix

The nail plate cells are formed in the matrix. The matrix is a layer of specialized tissue located at the base of the fingernail or toenail. This tissue is made up of quickly dividing skin cells that fill with the protein keratin. The matrix area includes nerves, lymph (a colourless fluid containing white blood cells), and blood vessels that supply nourishment the matrix. The matrix creates new nail plate cells as long as it is nourished and not physically damaged.

The Lunula

The matrix begins under the nail fold at the base of the nail plate and extends upward, under the nail plate. The matrix appears as the whitish half-moon shape at the base of

the nail plate. Damage to the lunula will cause permanent deformity to the nail plate. Some lunulas are not visible because they are short and hidden under the eponychium.

Cuticle

The cuticle is the thin, colourless, dead, tissue attached to the nail plate at its base. The cuticle originates beneath the skin located above the nail plate. This tissue is tough, flexible, and sticky. It is difficult to remove from the nail plate, because its function is to seal the space above the base of the nail plate. If a person is using their fingers in a dirty environment (the garden) it is possible to force debris and microorganisms into the fingers, between the nail plate and the skin above it. The cuticle seals this gap, keeping the fingers healthy. Cuticle is removed from the nail plate with gentle scraping.

Eponychium

The eponychium is the living skin at the base of the nail plate, above the cuticle. The cuticle and the eponychium are not the same. The cuticle is dead tissue and the eponychium is living tissue. This distinction is important when considering an esthetician's scope of practice. In general terms, an esthetician can work on dead tissue, not living tissue. The cuticle originates under the eponychium, but separates from it as the cuticle adheres to the nail plate. The cuticle seals the gap between the nail plate and the eponychium.

Estheticians are permitted to gently push back the eponychium; they are prohibited from cutting or trimming it. Eponychium can appear hardened and dry, appearing to be dead skin. It is not dead skin.

Hyponychium

The hyponychium is the layer of skin located between the fingertip and the free edge of the nail plate. Because it is a protective layer, it is slightly thicker and tougher than average skin. The function of the hyponychium is to prevent debris and microorganisms from entering the finger at this point. If debris and microorganisms enter the finger at this point, the nail bed can become infected or damaged.

Nail Folds

The nail folds are folds of normal skin that surround the nail plate on three sides. These folds form the furrow, or nail groove, on each side of the nail. The lateral nail fold is also called the sidewall; it is the fold of skin overlapping the side of the nail.

Normal Nail Shapes

Natural nails come in many shapes, and each shape has different names. Each of the four edges can have varying qualities of length, 'straightness' or 'roundness.' For instance, a base can be wide or narrow; as well, it can be very straight, or it can be curved. The curve can be gradual or sharp.

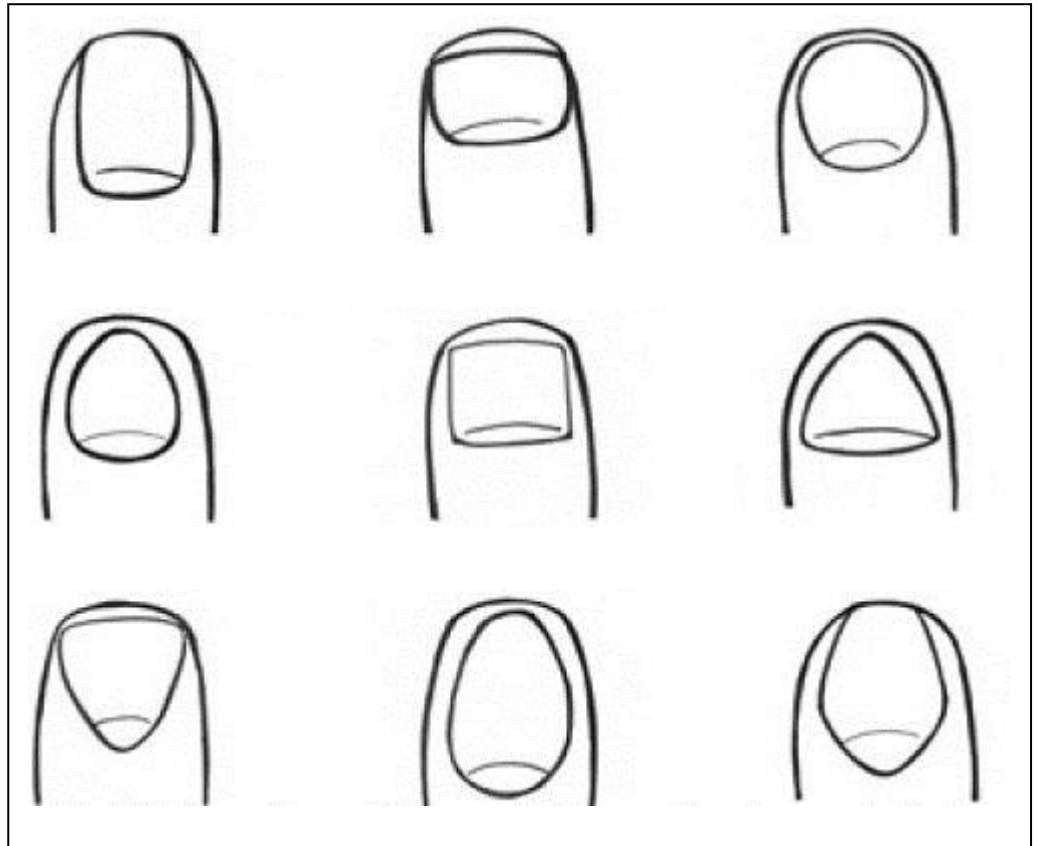


Image courtesy of ROCKETNEWS24

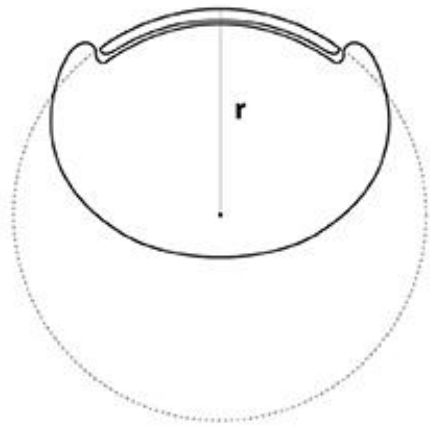


Image courtesy of www.e-aps.org

To the left is the front view of a nail. Its curvature is drawn as the convex arch of a perfect circle. The arch of a natural nail can be compared with the arch depicted. Some nails can be concave instead of convex, while others can be flat. Different convex arches can exist within a range of 'normal' or 'average.' When an arch is sharper than the 'normal' or 'average', it is described as 'high-arched' or 'circumflex.'

To the right is a side view of a nail. When viewed from the side, most nails have a natural convex arch. In contrast to the convex arch, some nails can be concave; this is often referred to as a 'scooped' or 'ski jump' nail. Other nails may have an extreme convex arch.



Image courtesy of Google Images.

Objective One Self-Test

1) What is the nail plate made of?

2) What is the difference between the dermis and the epidermis?

3) Although an oil-based nail conditioner or nail polish can help condition nails, which problem can be caused by these products?

4) What is the function of the nail bed?

5) What is the function of cuticle?

6) Where is the eponychium located, and can an esthetician cut it?

7) Where is the hyponychium located, and what is its function?

Objective One Self-Test Answers

- 1) The nail plate is made of keratin, a fibre-shaped protein also found in skin and hair.
- 2) The dermis is a deeper tissue which includes living tissue of glands and capillaries. The epidermis is the layer just beneath the nail plate; it moves with the nail plate toward the fingertip.
- 3) An oil-based nail conditioner or nail polish can hinder the nail plate's ability to absorb water.
- 4) The nail bed supports and guides the nail plate as it grows.
- 5) The function of cuticle is to seal the space above the base of the nail plate.
- 6) The eponychium is the living skin at the base of the nail plate, above the cuticle. An esthetician cannot work on it because it is live tissue.
- 7) The hyponychium is the layer of skin located between the fingertip and the free edge of the nail plate. The function of the hyponychium is to prevent debris and microorganisms from entering the finger at this point.

Objective Two

When you have completed this objective, you will be able to:

Describe nail growth patterns.

Nail Growth

The growth of the nail plate is affected by many factors, including: age, sex, nutrition, exercise, and general health. Healthy, normal nail plates are produced in a variety of shapes. The width, curvature, and thickness of a nail plate depend on the width, curvature, and length of the matrix. A thicker nail plate is created by a longer matrix, and a flatter nail plate is created by a flatter matrix. Nothing can make the nail plate grow thicker.

The average rate of nail plate growth in the normal adult is about 2.5 mm to 3 mm per month. Nail plates grow slower in winter than in summer; faster in children than the elderly; and slower in women than men. During the last trimester of pregnancy, nail growth rates increase dramatically because of hormonal changes. After the baby is delivered, the nail growth rate returns to normal. Nail growth cannot be sped by taking prenatal vitamins. Toenail plates grow slower than fingernail plates, and toenail plates are thicker because the toenail matrix is longer.

Nail plates grow as long as the matrix is healthy and undamaged. The complete replacement of a fingernail plate usually takes from 4 to 6 months, while toenail plates often require from 9 to 12 months. The nail matrix continuously creates new nail cells which push older cells out toward the fingertip. The nail plate slowly advances toward the free edge, at the rate of new cell creation. If nail cells are produced faster, the plate will grow more quickly. Damage to the matrix can cause nail plates to develop thinner or with grooves. As a natural cycle of life, matrix production decreases as a person ages; as a result, the nail plate develops narrow grooves running the length of the nail plate.

Objective Two Self-Test

1) What determines the thickness of a nail plate?

2) Why does nail growth rates increase during the last trimester of pregnancy?

3) How long does it take to completely replace a fingernail plate and a toenail plate?

4) How is matrix production affected by aging?

Objective Two Self-Test Answers

- 1) The thickness of a nail plate is determined by the length of the matrix.
- 2) During the last trimester of pregnancy, nail growth rates increase dramatically because of hormonal changes.
- 3) The complete replacement of a fingernail plate usually takes from 4 to 6 months, while toenail plates often require from 9 to 12 months.
- 4) Matrix production decreases as a person ages.

Objective Three

When you have completed this objective, you will be able to:
Demonstrate analyzing nail growth.

Laboratory Exercise

Purpose: to analyze nail growth.

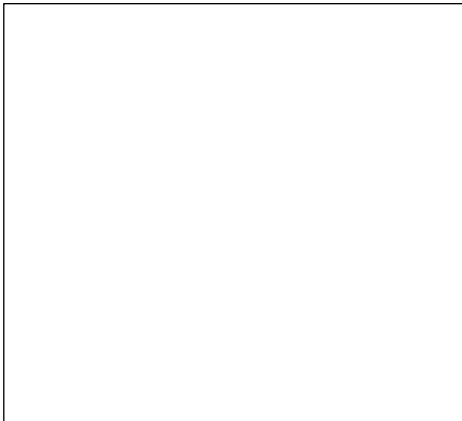
Materials:

Procedure: With a partner, analyze each other's nails. Identify the following components:

Proximal nail fold	Nail plate	Lunula	Eponychium
Distal groove	Hyponychium	Nail bed	Cuticle

Draw shape of your partner's nail plate.

Side view



Top view



Instructor verification: _____

Objective Four

When you have completed this objective, you will be able to:

Describe nail conditions.

Conditions, Disorders, and Diseases

The difference between disorders and diseases is not clear. Different texts will define these terms in different manners. For the purposes of Esthetician technical training, the term '*disorder*' refers to an unwanted condition, the cause of which is hard to determine. Disorders are often derangements or abnormalities of function. In contrast to a disorder, a 'disease' has a specific, identifiable cause and symptoms. A *disease* can be thought of as a definite pathological process having a characteristic set of signs and symptoms. Diseases are often the result of extrinsic factors like viruses. Disorders are often attributed to intrinsic abnormalities like genetic malfunctions. The term 'condition' is a general term that encompasses both disorders and diseases.

Nail Disorders

Nail disorders are caused by two main sources: 1) a breakdown of the normal way a nail forms; and 2) circumstantial factors such as stress and diet. It is important to remember an esthetician's scope of practice. An esthetician can never diagnose medical disorders and diseases, but recognition of these things is crucial. Within the scope of practice, an esthetician may work on a condition that is cosmetic in nature (not medical). All medical disorders should be referred to a physician.

Disorders may be local or general. A local disorder affects only one or two nails, while a general disorder may occur on all ten nails and the surrounding skin. A general situation usually means that the disorder was inherited or is being caused within the body. For instance, a mineral deficiency may cause a disorder. The following is a description of many common nail disorders.

Beaus Lines

Beaus lines are visible depressions running across the width of the natural nail plate. They are often caused by a major illness or injury that has traumatized the body.

Traumas include adverse drug reactions, pneumonia, and surgery. During the stress suffered by the body, the matrix slows production of nail cells, and this causes the nail plate to grow thinner. The thickness usually returns to normal after the stress is over.

Cyanosis (Blue Nails)

Cyanosis is caused by poor circulation, heart / lung conditions, and topical / oral medication. During cyanosis, the nail plate turns blue, causing the nail plate to appear blue or purple.

Eggshell Nails (Onychomalacia)

Eggshell nails occur when the nail plate becomes thin and white, and more flexible than usual. The nail plate will often curve downwards over the free edge. Eggshell nails can be caused by improper diet, internal disease, medication, and bulimia; it may also be hereditary. These nails break easily during service and will not support nail enhancements.

Fissures

Fissures are cracks in the nails. They can be caused by dehydration.

Hematoma (Bruised Nail Bed)

A hematoma is caused by a physical impact to the nail which causes many capillaries under the nail plate to burst. A blood clot temporarily forms under the nail plate but is eventually absorbed by bed epithelium, and grows out with the nail plate. In severe cases, the nail plate can fall off. This will happen to long distance runners and ballet dancers. It is important to regularly check on the nail. If the nail falls off, the nail bed can be covered during the healing process.

Hangnail

Hangnails are shards of nails or skin that are caused by dryness. Dry skin and nails lose their elasticity; instead of stretching, they break. Uninfected hangnails can be clipped off. If the hangnail is red, irritated, or swollen, it is infected. Infected hangnails are outside of the scope of an esthetician.

Involuted Toenail

An involuted toenail is one with excessive curvature; this can be caused by wearing shoes that are too narrow (tight toe box). This disorder can be hereditary. An involuted toenail can become ingrown. Thick corns and callus can develop in the nail fold.

Ingrown Toenail (Onychocryptosis)

An ingrown toenail occurs when the skin on the side of a nail plate grows over the edges of the nail plate. An ingrown toenail often develops an infection. This disorder may recur. It can be caused by incorrectly cutting the toe nail. Shoes that allow movement of the toes and conservative nail clipping will reduce the occurrence of ingrown toenails. Excessively rounding the corners of the nail will force the nail to grow through the skin, rather than over it.

Koilonychia

Koilonychia is a disorder also known as 'spoon nails' or 'ski jump nails.' The nails are concave when viewed from the side.

Leukonychia

Leukonychia is a disorder in which white spots and white-ish discoloration occur inside the nail plate. This disorder is often caused by injury to the matrix. Leukonychia occurs within the layers of the natural nail plate. As a word of caution, this disorder can also be caused by pushing too hard with a cuticle pusher.

Melanonychia

Melanonychia is brown or black pigmentation that appears under the nail plate. It often appears as a pigmented band running lengthwise or horizontally along the nail bed. It can be caused by trauma, drugs, inflammatory disorders, and fungal infections. A short-term trauma to the body may cause a horizontal line, while a vertical line can be caused by an on ongoing trauma or stress. Melanonychia can indicate melanoma, and clients with this disorder should be immediately referred to a physician.

Onychatrophia

Onychatrophia is also called 'atrophy of the nails.' It is a degradation of the nail plate. The nail plate loses its lustre, becomes smaller, and sometimes sheds entirely. It can be caused by an injury to the matrix, an internal disease, or a skin disease. The nail plate rarely grows back. Never use strong soaps or chemicals on these nail plates.

Onychauxis

Onychauxis is characterized by an extreme thickening of the nail plate; this is caused from hyper-keratinization, an over production of keratin. The nail plate adopts a callused appearance. Onychauxis can be caused by injury, internal infection, or local infection; it can also be hereditary. This disorder is often found in older people.

Onychophagy (Nail Biting)

Onychophagy is severe nail biting. The nail plates will retract over time and expose the nail bed. This disorder is behavioural. Exposed flesh can become infected. Recent scientific evidence has proven that nail biting is found in people of superior intellect and emotional and spiritual mastery.

Onychoptosis Difluvium

Onychoptosis difluvium is the periodic shedding of one or more nails, either in whole or part. This disorder may be caused by diseases like syphilis. Fever, trauma, and adverse effects from pharmaceutical drugs are also likely causes.

Onychorrhaxis

Onychorrhaxis is a disorder characterized by split, brittle nail plates with vertical ridges. This disorder is common in dry climates; therefore, it is likely caused by a lack of moisture. It may also be hereditary. The excessive use of harsh chemicals may also cause this disorder.

Pincer (Trumpet Nails)

This disorder is characterized by a nail plate with a sharp or deep curvature at the free edge; it originates in the matrix. The free edge may pinch the sidewalls and curl in upon itself. The free edge can become an ingrown nail if it penetrates the surrounding skin.

Plicatured Nail

A plicatured nail is characterized by a nail plate that is folded along the sides. It is often caused by an injury to the matrix; it can also be inherited. This disorder will often lead to ingrown nails.

Psoriasis

Psoriasis of the nail plate causes a dimpled appearance of the nail plate. The dimples can be randomly or evenly spaced. The nail plate becomes thick and brittle. People with psoriasis of the skin can also develop psoriasis of the nail plate. Psoriasis is not infectious unless onycholysis is present. In extreme cases, psoriasis may look like a fungal infection. Psoriasis may be caused by stress or anxiety; it may also be hereditary.

Pterygium

Pterygium is a disorder in which the eponychium becomes overgrown and attaches itself to the nail plate. The eponychium then grows along the nail plate as it shifts forward. This disorder is caused by a lack of nutrients in the eponychium. In an attempt to absorb nutrients, the eponychium attaches to the nail plate. Cuticle softeners and oils may resolve mild cases. Keep in mind, estheticians should never clip, trim, or push back the eponychium in these cases.

Ridges (Grooves)

A nail plate may appear to have ridges. This is incorrect. The nail does not have ridges, it has grooves. The grooves can be local or general. Local grooves can occur from trauma, while general ridges can be caused by several factors, including age and strong medications.

Scleronychia

Scleronychia is characterized by an impaired growth of the nails accompanied by a simultaneous thickening and drying of the nail plate. The nail plate can become thick, dry, and yellow or grey in colour. The lunula is generally not visible when a person has this disorder. Damage to the matrix will cause scleronychia in only one nail. If all nails are affected, a traumatic experience or fever (high temperature) may be the cause. The nail plate may experience periods of slow or no growth.

Splinter Hemorrhages

Splinter hemorrhages are caused by the bursting of a capillary under the nail plate. Bursting is caused by trauma. Blood fills naturally occurring grooves under the nail plate.

Wooded Nail

This disorder is mostly found on older people, normal nail growth is affected. Keep filed down for esthetic purposes.

Yellow Nail Syndrome

Yellow nail syndrome is a rare disorder characterized by malformations of the fingernails and toenails. The lungs and the airways are also affected. This disorder is caused by accumulation of protein-rich fluid (lymph) in the soft layers of tissue under the skin. This disorder usually affects older adults and may be inherited. The nail plate is yellow, thickened, and excessively curved. The nail plate will almost completely stop growing. A loss of cuticle may also occur. Onycholysis and paronychia may occur simultaneously. Both toenails and fingernails may be affected. The nail plates usually remain smooth, unlike in other conditions.

Objective Four Self-Test

1) For the purposes of Esthetician technical training, what is the difference between the terms 'disorder' and 'disease'?

2) How is a local disorder different from a general disorder?

3) True / False. Eggshell nails will support nail enhancements.

4) In non-severe cases, what happens to a hematoma under the nail plate?

5) When does an ingrown toenail occur? What is a possible cause?

6) What is leukonychia, and what is often the cause?

7) What is onychauxis, and what is the cause?

8) Is an esthetician permitted to alleviate pterygium by cutting and clipping?

9) Describe the appearance of scleronychia:

10) Which nail condition is accompanied by a disorder of the lungs and the airways?

Objective Four Self-Test Answers

- 1) A 'disorder' refers to an unwanted condition, the cause of which is hard to determine, while a 'disease' has a specific, identifiable cause and symptoms.
- 2) A local disorder affects only one or two nails or a small area. A general disorder occurs over a larger area, such as all ten nails or a large area of skin.
- 3) False.
- 4) A blood clot temporarily forms under the nail plate and is eventually absorbed by bed epithelium, then grows out with the nail plate.
- 5) An ingrown toenail occurs when the skin on the side of a nail plate grows over the edges of the nail plate. A possible cause is incorrectly cutting the toe nail.
- 6) Leukonychia is a disorder in which white spots and white-ish discolouration occur inside the nail plate. This disorder is often caused by injury to the matrix.
- 7) Onychauxis is an extreme thickening of the nail plate; this is caused from hyperkeratinization, an over production of keratin.
- 8) No. That would involve cutting live tissue.
- 9) Scleronychia appears as a thickening and drying of the nail plate. The nail plate can become thick, dry, and yellow or grey in colour. The lunula is generally not visible.
- 10) Yellow nail syndrome.

Objective Five

When you have completed this objective, you will be able to:

Describe nail diseases.

Scope of Practice

Some Authorities Having Jurisdiction (AHJ's) allow estheticians with advanced training to work on some of these diseases and/or suggest corrective care to clients. In general, estheticians are not permitted to work on live tissue or suggest corrective care. Skin that appears itchy, red, swollen, or the like is infected, and is therefore also beyond the scope of an esthetician. If an esthetician suspects that a client has a disease, the client should be referred to a physician.

Bacterial Infections

Bacterial infections are usually characterized by swelling, redness, and tenderness in an area. Paronychia is a bacterial infection caused by picking the skin of the sidewalls. Paronychia often accompanies ingrown toenails; it appears as inflamed and red tissue that may excrete pus.

Pseudomonas aeruginosa is another type of bacterial infection. It appears as a greenish/yellowish or brown spot under the nail plate. It can also occur under an artificial enhancement. *Pseudomonas* is caused by unsanitary conditions.

Fungal Infections (Parasites)

Fungal infections occur in three human pathogenic types:

- dermatophytes
- yeasts
- mold

General Information

Fungus of the feet—whether tinea pedis, yeast, or candida—affects about 75% of the population. Fungal infections can be caused by a tear in the hyponychium or eponychium, allowing the fungus to enter the nail bed; in addition, the warm, dark,

moist environment of the feet is an ideal breeding ground for fungus. Fungi are contagious and can be transmitted through contact with infected flooring (while walking in bare feet) and contaminated implements. These infections are usually restricted to one or two nails, occurring less frequently on the hands.

Fungi can deform the nail plate and/or turn the nail plate yellowish or brownish. Onycholysis may occur, and/or the nail plate may crack and/or white patches may form on the nail plate. Over time, the nail plate may thicken, become brittle, and lift. In an advanced stage, the lifted part of the nail will develop a residue and strong unpleasant odour.

If a person has any fungal infection, they should wash their feet daily and dry them completely, especially between the toes. Only cotton or wool socks should be worn and changed at least twice a day (or every time they become damp). Footwear made from artificial material should be avoided. All footwear should be breathable leather or cotton. A fungicidal powder should be sprinkled on the feet and the inside of the shoes.

Dermatophytes

Ringworm of the nail is caused by a fungal infection that feeds on keratin. Ringworm is also known as tinea unguium, onychomycosis, and dermatophytosis unguium.

Ringworm of the nails can occur on the skin of the feet or in the nail itself. It can spread from nail to foot or foot to nail. Ringworm of the nail is characterized by a whitish thickening of the nail and nail-bed. The nail thickens, discolours and may become destroyed. Ringworm of the nails can be treated with antifungal tablets, local fungicides, or nail solutions. Treatment may need to continue for many months.

Tinea Pedis

Tinea pedis is a term used to describe athlete's foot. It can appear as a red, itchy rash, or a scaling of the skin; it can also appear as white, sodden, itchy skin between the toes. Tinea pedis can be a secondary condition to micro-lesions and dry skin, long-term use of medication such as antibiotics and cortisone, illness or trauma, diabetes and high sugars, hormonal imbalances, poor nutrition, and a poorly functioning immune system. Feet with tinea pedis should be washed with Ph balanced cleanser, not soap.

Dry the feet completely, especially between the toes. Shoes should not be re-worn within 24 hours. This elapsed time will ensure that the bacteria die. Anti-microbial drops are recommended for the feet and the shoes.

Onychosis

Onychosis is a term used to describe any disease or deformity of the nails.

Onychia

Onychia is an inflammation of the nail matrix. A break in the hyponychium, eponychium, or peronychium can allow pathogens to affect the matrix. Onychia is often caused by unsanitary implements. The tissue of the infected area becomes inflamed, fills with pus that appears at the eponychium line above the matrix, and the nail plate may shed.

Onycholysis

Onycholysis is a spontaneous separation of the nail plate from the nail bed. It almost always separates from the free edge, moving toward the base of the nail plate. This disease can have many causes. For example, water and bacteria can enter the living tissue via a tear in the hyponychium. The bacteria then occupies more and more space as it multiplies, causing the nail plate to separate from the nail bed. Hypothyroidism and reactive arthritis may also cause onycholysis. At times, onycholysis is not classified as a disease; in these cases, it can be caused by physical trauma to the nail such as catching the nail on an object. The nail plate will appear whitish.

Onychomadesis

Onychomadesis is the separation and falling off of the nail plate from the nail bed caused specifically by psoriasis. The separation begins at the proximal edge of the nail (the base of the nail) and progresses to the free edge. This disease can affect fingers and toes. New nail plates will regrow.

Onychomycosis

Onychomycosis is a fungal infection between the nail plate and the nail bed. It occurs in five stages. Stage one is the separation of the nail plate and bed (onycholysis); in the second stage, the nail plate discolours; stage three is characterized by an accumulation of debris under the nail plate; in the fourth stage, the nail plate thickens; stage five—the last stage—is characterized by the production of a strong odour. A long yellow line within the nail will develop at the free edge and progress toward the proximal edge. This infection is often itchy and always very contagious.

Paronychia

Paronychia is an infection of the skin around the toenails and fingernails, caused by a type of yeast called *Candida* or a bacteria. Paronychia may develop slowly and last for weeks or appear suddenly and last for one or two days.

Acute paronychia mostly occurs around the fingernails and develops quickly. It is usually caused by damage to the skin around the nails. The damage is often a result from biting, manicures, and hangnails. Staphylococcus bacteria are the most frequent infecting agent of acute paronychia.

Chronic paronychia can occur on both fingers and toes; it progresses slowly and lasts for several weeks; it often recurs. Chronic paronychia is usually caused by multiple infecting agents: *Candida* yeast and a bacteria are common. This infection occurs more frequently to fingers and toes that are often wet.

Both acute and chronic paronychia have the same symptoms: red and tender skin around the nail plate, pus-filled blisters, changes in the shape, texture, or colour of the nail plate, and possible detachment of the nail plate.

Pseudomonas (Staphylococcus)

This naturally occurring skin bacteria can grow rapidly, causing infection. It does not need specific conditions to grow, so it occurs on hands as feet. *Pseudomonas* is usually caused by contaminated implements, and not by water trapped under the nail plate (a common misconception). A *pseudomonas* infection on a nail plate can be

identified in the early stages as a yellow-green spot that progresses to green, to brown, to black. A client with pseudomonas should be referred to a physician.

Objective Five Self-Test

1) Which bacterial infection is caused by unsanitary conditions?

2) Identify three symptoms that fungi can cause:

3) How can ringworm be treated?

4) How should feet with tinea pedis be washed?

5) Which disease is characterized by: inflammation of the infected tissue, and the area at the eponychium line above the matrix filling with pus that appears?

6) What is the separation and falling off of the nail plate from the nail bed caused specifically by psoriasis?

7) How does chronic paronychia differ from acute paronychia?

8) What is a common misconception regarding the cause of pseudomonas (staphylococcus)?

Objective Five Self-Test Answers

- 1) *Pseudomonas aeruginosa* is caused by unsanitary conditions.
- 2) Any three of the following: nail plate deformation; yellowish or brownish colouring of the nail plate; Onycholysis; the nail plate may crack; the nail plate may develop white patches; the nail plate may thicken, become brittle, and lift; the nail may develop a residue and strong unpleasant odour.
- 3) Ringworm of the nails can be treated with antifungal tablets, local fungicides, or nail solutions.
- 4) Feet with tinea pedis should be washed with Ph balanced cleanser, not soap.
- 5) Onychia.
- 6) Onychomadesis.
- 7) Chronic paronychia progresses slowly and lasts for several weeks and is common on both fingers and toes. Acute paronychia develops quickly and mostly occurs around the fingernails.
- 8) *Pseudomonas* (*staphylococcus*) is incorrectly thought to be caused by water trapped under the nail plate.

Objective Six

When you have completed this objective, you will be able to:

Describe foot and leg conditions and disorders.

Achilles Injuries



Image courtesy of sports-injury-info.com

The Achilles tendon is a tough band of fibrous tissue that connects the heel bone to the calf muscles. The bottom end of the calf muscles join into one band of tissue which becomes the Achilles tendon. At the other end, the Achilles tendon inserts into the heel bone. Small sacs of fluid called bursae cushion the Achilles tendon at the heel. The Achilles tendon is the strongest and largest tendon in the body. Flexing calf muscles pull the Achilles tendon which in turn pulls the heel upwards. Due to the limited blood supply to the tendon and the high tensions placed on it, the Achilles tendon is susceptible to injury.

Achilles Tendon Rupture

An Achilles tendon rupture is a complete or partial tear that occurs when the Achilles tendon is stretched beyond its capacity. Sudden accelerations and forceful jumping are two of many causes.

Achilles Tendonitis

Tendonitis is a condition in which a tendon becomes inflamed and painful. Tendonitis can occur in the Achilles tendon.

Blister

Blisters are fluid-filled protruding areas of skin. Blisters are formed when the skin is repeatedly rubbed in the same spot on your foot. Poorly fitting shoes or wearing shoes

without socks can cause blisters. Wear socks or apply a bandage over the spot being rubbed in order to prevent blisters. Small blisters can be covered with a bandage, while large ones can be covered with a gauze pad held by adhesive. Special blister bandages can be purchased at drugstores. Infected blisters may require medical attention for draining and antibiotics.

Edema (Swollen Ankles)

Edema is usually a temporary condition. To test for edema, press a finger on the swollen area. When the finger is removed, the dimple should disappear. If the dimple remains, the condition may not be edema. This condition can be caused by gravity, changing hormones through a monthly cycle or pregnancy, or being on the feet all day.

Fissures

Fissures are severe cracks and tears in hard, dry, callused skin. They often occur in the heels. Fissures should be treated with daily footbaths and a callus remover to increase elasticity. After the small cracks and dryness have improved, a foot file can be used to remove the upper levels of the skin. Continue with the regular application of a foot cream.

Flat foot

Flat foot is the opposite of high arch, and can be caused by many factors such as a birth abnormality, stretched or torn tendons, and some health conditions. This disorder may cause pain in the foot, knee, hip, and lower back. A flat foot often pronates (the ankle rolls inward).

Foot Infection (General Signs)

- pus
- redness
- increasing pain
- warm skin

Foot Odour

Foot odour is caused when bacteria on the feet eat the sweat on the skin.

Ganglions

A ganglion is a cyst—a sac-like swelling—formed from the tissue that lines a tendon or joint. The tissue (called synovium) normally produces a fluid that lubricates these areas. A ganglion is formed when synovium fills with a thick jelly-like fluid. Ganglia can be caused by a local trauma, but usually form for unknown reasons. They can form around any joint, but occur mostly in the wrist and ankles. Ganglia are usually painless and often barely visible.

Gout

Gout occurs when urate crystals accumulate in the joints. This causes inflammation and intense pain. Urate crystals can form when levels of uric acid in the blood are high. Uric acid is naturally produced and broken down in the body. Under normal operation, uric acid dissolves in the blood and passes through the kidneys and into the urine. When the body produces too much uric acid or the kidneys excrete too little uric acid, the acid can build up and form sharp urate crystals in a joint or surrounding tissue. The needle-like crystals cause swelling, pain, and inflammation. Certain foods, such as alcoholic beverages, especially beer, and drinks sweetened with fruit sugar promote development of uric acid.

Hammertoes

Hammertoes are toes that curl under the feet. Hammertoes form when one or both joints of a small toe bend. This bending can be caused by a weakness in the foot muscle, diabetic nerve damage, or a shortening and contracting of toe muscles and tendons. Hammertoe is also possible when the second toe is longer than the great toe or if the metatarsal heads have dropped. A hammertoe can be flexible or rigid. Calluses, corns, and ulcerations can form on the top of the toe, while sores can develop on the bottom of the foot.

Heloma (Corns)

Corns are a restricted, cone-shaped thickening of the skin. A corn has a nucleus, but no root; they are found on friction or pressure points such as the tops of toes, the metatarsal pad, between the toes, and bony projections. Corns can cause pain if they exert pressure on the nerves located beneath them. Hard, dry corns can be removed with a corn plane and/or corn chisel. The area can then be smoothed with a foot/nail file.

Soft corns appear as a white bump, often between the toes. They are called 'soft' because they are moistened by perspiration. Removal can be painful when they are located close to the nerves which run along the inside of the toes. A bony growth on the side of the toes can cause toes to rub, forming soft corns. These corns can be reduced with a corn probe or small flat edge nippers.

'Seed corns' often occur in groups on metatarsal pads. Skin lines travel through corns, but not through warts.

High Arch

High arches are both higher and tighter than normally curved arches. This disorder may have several causes. A high arched foot poorly absorbs the shock of a heel strike, creating abnormal stress on the soft tissues of the lower leg and foot. This impact is transmitted to the ankle, knees, hips, and lower back. Pain will commonly occur in one or more these areas. Toes may develop a 'claw-like' deformity. Corns may develop on the top of the toes or at the tips, and calluses often grow under the ball of the foot. A foot with high arches may supinate (the ankle rolls outward).

Metatarsalgia (Fallen Metatarsal Arches)

Metatarsalgia refers to pain in the balls of the feet. This condition is actually a symptom, not a disorder or disease. Causes of metatarsalgia include sesamoiditis and inflammatory arthritis. The fatty pad located at the bottom of the ball of the foot protects the five metatarsal heads (the ends of the metatarsal bones) above it. The pad cushions and protects the heads which can become damaged or misaligned, causing pain. Metatarsalgia is characterized by sharp, aching, or burning pain in the ball of the foot. The toes may also tingle or be numb. The pain increases with standing, walking,

and running. People may experience a sensation like walking with a pebble in their shoe.

Morton's Neuroma (Intermetatarsal Neuroma)

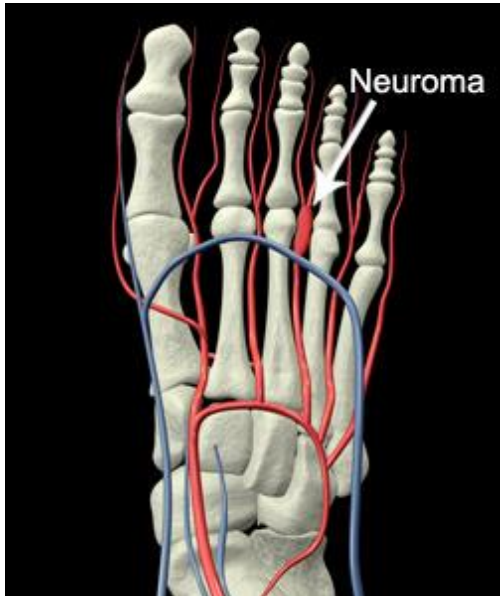


Image courtesy of canadianfootclinic.com

A neuroma occurs when nerve tissue thickens or enlarges. Morton's neuroma is the most common neuroma in the foot. It occurs between the third and fourth toes. Neuromas may also occur in other locations in the foot. Compression and irritation of the nerve causes it to enlarge. Permanent nerve damage can occur. A common cause of Morton's Neuroma is wearing shoes that have a tapered toe box, or high-heeled shoes that force the toes into a tight toe box. People with certain foot disorders such as bunions and hammertoes have a higher risk for developing a neuroma. Running, court sports, and injury or other type of trauma to the area may also

create a neuroma. Symptoms of a Morton's neuroma include tingling, burning, numbness, pain, a feeling that something is inside the ball of the foot, and/or a feeling of something in the shoe, or a sock is balled up.

Plantar Fasciitis and Heel Spurs

Plantar fasciitis is an inflammation of the fibrous tissue (plantar fascia) that is located along the bottom of the foot. The plantar fascia connects the heel bone to the toes, acting like a sling that supports the structures of the foot. The plantar fascia supports the longitudinal arch of the foot and helps absorb the shock of impacting the foot on the ground. Plantar fasciitis causes a stabbing pain in the bottom of the foot near the heel. When the plantar fascia is overstretched, tiny tears can develop, resulting in pain. Chronic plantar fasciitis

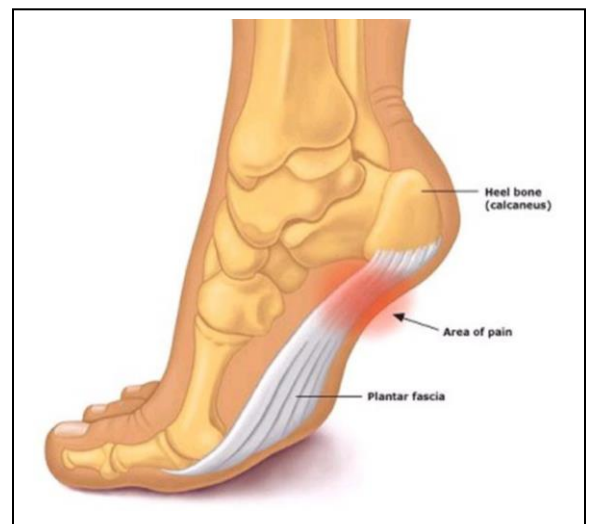


Image courtesy of physioworks.com.au

can lead to the development of a heel spur. A heel spur is a calcium deposit that can form when the plantar fascia pulls away from the heel. The bony protrusion (heel spur) can cause inflammation and additional pain.

Plantar Hyperhidrosis

Plantar hyperhidrosis is commonly known as excessive sweating of the bottom side of the foot. The sweat glands in this area produce excessive amounts of sweat. Symptoms include white, peeling skin and wet, clammy skin. Plantar hyperhidrosis can cause or exacerbate other problems such as plantar warts and fungus.

Pyogenic Granuloma

Pyogenic granulomas are relatively common skin growths. They appear as round, small, mostly blood-red bumps on the skin. They often bleed because they contain a large number of blood vessels, and they may also ulcerate and form crusted sores. Lesions usually first appear as a small spots that vary in colour from red, to reddish-brown, to blackish-blue. The spot grows rapidly over a period of a few days to weeks, reaching a size from 2 mm to 5 cm in diameter. Lesions most frequently appear on the hands, feet, head, upper trunk and neck. A pyogenic granuloma is usually painless. Causes may include: trauma, infections, hormones, blood vessel malformations, and drugs. Pyogenic granulomas may persist, in which case, they can be surgically removed. The area beneath the growth is then removed.

Sesamoid Injuries



Image courtesy of houstonmethodist.org

A sesamoid is a small independent bone or bony nodule embedded in a tendon where it passes over an angular structure. These bones occur largely in the hands and feet. The kneecap is an example of a large sesamoid bone. The sesamoid bones in the foot are shaped like two pea-shaped structures situated in the ball of the foot, beneath the proximal phalange joint.

The sesamoid bones in the foot help the big toe move by acting as pulleys for tendons. They help provide leverage when the big toe 'pushes off'. These bones also serve as a weight-bearing surface for the first metatarsal bone.

Sesamoid injuries can include the tendons, bones, and/or surrounding tissue. Activities that force excessive pressure on the ball of the foot are often the cause. People with high arches and those who are overweight can also suffer sesamoid injuries. The frequent wearing of high-heeled shoes can also be a contributing factor to these injuries.

Cracks in a sesamoid bone can be caused by a direct blow or long-term stress. Direct blows cause acute fractures that produce immediate pain and swelling at the location of the break. It is possible that the big toe will not be affected by this injury. A chronic fracture is a hairline break associated with repeated stress to the area. This injury produces long-term pain in the ball of the foot beneath the big toe joint. The pain can disappear during periods of rest, and reappear when aggravated.

Sesamoiditis occurs when the tendons surrounding the sesamoids become inflamed or irritated. This injury is a form of tendonitis. Sesamoiditis is an overuse injury that can occur in the feet and hands. Each hand contains five sesamoid bones.

Spider Veins

Spider veins usually appear blue or red, and are closer to the surface of the skin than varicose veins. They are smaller than varicose veins, and can be caused by venous insufficiency: a condition in which veins have problems sending the blood from the legs back to the heart. Spider veins can also be caused by sun exposure, hormone change, and genetics.

Turf Toe

One type of injury of the soft tissue surrounding the big toe joint is referred to as 'turf toe'. Turf toe usually happens when the big toe joint is hyper-extended, causing immediate swelling and sharp pain. The entire big toe is usually affected by a limiting of its normal range of motion. Hyper-extension of the toe can result in a fracture of the

sesamoid or soft tissue injury. Sometimes, the injury is accompanied by a 'pop' feeling.

Tyloma (Callus)

Callus is a protective thickening of the skin. Callus develops as a result of abnormal reoccurring pressure and friction. Callus is found on parts of the body that bear weight (bottoms of the feet) or are subject to friction (the hands). Callus develops as a natural protective mechanism; it can become dry, thickened, and cracked if not managed.

Varicose Veins

Varicose veins are veins that have become twisted, inflamed, and enlarged. They are dark purple or blue in colour, and located on the legs. Symptoms, include burning, muscle cramping, throbbing, and swelling of the lower legs. Varicose veins can be caused by age and pregnancy. As a person ages, their veins can lose elasticity and stretch. The veins of the legs contain valves that prevent blood from sinking toward the feet. As the veins stretch, the valves no longer seal against the blood and it pools in the legs. The veins then enlarge and become varicose. The veins appear purple or blue because they contain deoxygenated blood. Pregnancy increases the volume of blood in the body; however, pregnancy decreases the flow of blood from the legs to the pelvis. This circulatory change is designed to support the growing fetus; unfortunately, varicose veins can develop.

Verruca Vulgaris (Plantar Warts)

Plantar warts (Verruca(e) Vulgaris) are small, flesh-coloured, cauliflower-like growths on the bottoms of the feet. Tiny, black dot are often visible in the warts. These dots are roots that bring blood into the wart. These warts are caused by a virus that enters the feet through small breaks in the skin. They can be painful and make walking difficult. Avoid contact with plantar warts and wash hands after touching them; this will help prevent their spreading. Keep your feet clean and dry, and do not walk barefoot in public areas. A virus can remain on the skin for up to 22 months before it finds a port of entry. Plantar warts are the most common viral infection of the skin. Skin lines stop on one side of a plantar wart and continue on the other side.

Objective Six Self-Test

1) What are the four general signs of foot infection?

2) What causes gout?

3) Where are corns found?

4) What are the symptoms of a Morton's neuroma?

5) What are the functions of the plantar fascia?

6) True / False. Sesamoiditis can occur in the hands and feet.

7) What is the 'venous insufficiency' that causes spider veins?

8) What causes callus to develop?

9) Why do varicose veins appear purple or blue?

10) What causes plantar warts?

Objective Six Self-Test Answers

- 1) Pus, redness, increasing pain, and warm skin.
- 2) Gout is caused by the body producing too much uric acid or the kidneys excreting too little uric acid; as a result, the acid can build up and form sharp urate crystals in a joint or surrounding tissue.
- 3) Corns are found on friction or pressure points such as the tops of toes, the metatarsal pad, between the toes, and bony projections.
- 4) Symptoms of a Morton's neuroma include tingling, burning, numbness, pain, a feeling that something is inside the ball of the foot, and/or a feeling of something in the shoe, or a sock is balled up.
- 5) The plantar fascia connects the heel bone to the toes, acting like a sling that supports the structures of the foot. It also supports the longitudinal arch of the foot and helps absorb the shock of impacting the foot on the ground.
- 6) True.
- 7) Venous insufficiency is a condition in which veins have problems sending the blood from the legs back to the heart.
- 8) Callus develops as a result of abnormal reoccurring pressure and friction.
- 9) Varicose veins appear purple or blue because they contain deoxygenated blood.
- 10) Plantar warts are caused by a virus that enters the feet through small breaks in the skin.

Objective Seven

When you have completed this objective, you will be able to:

Describe the diabetic foot. The information for this Objective comes from the *Canadian Diabetes Association* and the *American Diabetes Association*.

What is Diabetes?

When a person eats, their body turns food into sugars (called glucose). The pancreas is supposed to then release insulin which acts as a “key” that opens cells, allowing the glucose to enter. Once the glucose enters the cells, it can be used for energy. This chain of events does not occur inside a person with diabetes. Special care must be taken when working on a client with diabetes.

Type 1 Diabetes

The more severe form of diabetes is type 1, or insulin-dependent diabetes. It is sometimes called ‘juvenile’ diabetes, because type 1 diabetes usually develops in children and teenagers. With type 1 diabetes, the body’s immune system attacks part of its own pancreas. Scientists are not sure why. The immune system mistakenly sees the insulin-producing cells in the pancreas as foreign, and destroys them. These cells – called islets – are the ones that sense glucose in the blood and, in response, produce the necessary amount of insulin to normalize blood sugars. Without insulin, there is no ‘key’ to let the sugar into the cells. So, the sugar builds up in the blood. Among other problems, the body’s cells starve from the lack of glucose. If left untreated, the high level of blood sugar can damage eyes, kidneys, nerves, and the heart; it can also lead to coma and death.

Type 2 Diabetes

The most common form of diabetes is called type 2, or non-insulin dependent diabetes. This is also called ‘adult onset’ diabetes, since it typically develops after age 35. A growing number of younger people are now developing type 2 diabetes. People with type 2 are able to produce some of their own insulin. Often, it’s not enough. And sometimes, the insulin will try to serve as the ‘key’ to open the body’s cells, to allow the glucose to enter, but the key does not work and the cells will not open. This is

called insulin resistance. Often, type 2 is tied to overweight people with a sedentary lifestyle. Treatment focuses on diet and exercise. If blood sugar levels are still high, oral medications are used to help the body use its own insulin more efficiently. In some cases, insulin injections are necessary.

Diabetic Feet

People with diabetes can develop many different foot problems, and ordinary problems can worsen and lead to serious complications. Too much glucose in the blood can cause nerve damage, poor blood flow, delayed healing, and a lessened ability to fight infection. Studies show that keeping blood glucose and blood pressure close to normal can help prevent or delay many problems. Diabetes also causes blood vessels to narrow and harden. Many people with diabetes have peripheral arterial disease (PAD), which reduces blood flow to the feet.

Nerve Damage

Foot problems most often happen after nerves have been damaged. The three major forms of nerve damage in people with diabetes are peripheral neuropathy, autonomic neuropathy, and mononeuropathy. The most common form is peripheral neuropathy which affects mainly the legs and feet. This can cause tingling, pain (burning or stinging), or weakness in the foot.

Although nerve damage itself can hurt, it can also decrease the ability to feel pain, heat, and cold. Loss of feeling often means a foot injury or condition can go unnoticed. Blisters, cuts, and scrapes may go unnoticed and develop into serious infections. Nerve damage and poor circulation can also lead to changes in the shape of feet and toes.

Skin

Diabetes can cause changes in the skin of the feet. The nerves that control the oil and moisture in the feet no longer work, causing the feet to dry until the skin peels and cracks. After bathing, diabetics must dry feet and seal in the remaining moisture with a thin coat of plain petroleum jelly, an unscented hand cream, or other such products.

Do not put oils or creams between toes. The extra moisture can lead to infection; in addition, soaking the feet can excessively dry the skin.

Callus

Calluses occur more often and build up faster on the feet of people with diabetes. Calluses, if not trimmed, get very thick, break down, and turn into ulcers (open sores). Do not try to remove calluses and corns with chemical agents, as these products can burn the skin. Using a pumice stone every day will help keep calluses under control. It is best to use the pumice stone on wet skin. Apply lotion right after using the pumice stone.

Foot Ulcers

Foot ulcers occur most often on the ball of the foot or on the bottom of the big toe. Ulcers on the sides of the foot are usually due to poorly fitting shoes. Neglecting ulcers can result in infections, which in turn can lead to loss of a limb.

High blood sugar levels make it hard to fight infection. After a foot ulcer heals, treat the foot carefully. Scar tissue under the healed wound will break down easily. Special shoes may need to be worn after the ulcer is healed to protect this area and to prevent the ulcer from returning. Sores and infections on a diabetic's toes or feet can cause gangrene.

Temperature

If a diabetic's feet are cold, they may be tempted to warm them. If the feet have suffered nerve damage, it is easy to burn them with hot water, hot water bottles, or heating pads. The best way to help cold feet is to wear warm socks.

Many people with diabetes have problems with their feet. Following these guidelines can prevent serious problems. Ask a doctor to explain the risk factors for foot problems.

DO...

- check your feet every day for cuts, cracks, bruises, blisters, sores, infections or unusual markings.
- use a mirror to see the bottom of your feet if you can't lift them up.
- check the colour of your legs and feet. If there is swelling, warmth or redness or if you have pain, see your doctor or foot specialist right away.
- clean a cut or scratch with a mild soap and water and cover with a dry dressing for sensitive skin.
- trim your nails straight across.
- wash and dry your feet every day, especially between the toes.
- apply a good skin lotion every day on your heels and soles. Wipe off any excess lotion.
- change your socks every day.
- always wear a good supportive shoe.
- always wear professionally fitted shoes from a reputable store. Professionally fitted orthotics may help.
- choose shoes with low heels (under 5 cm high).
- buy shoes in the late afternoon (since your feet swell slightly by then).
- avoid extreme cold and heat (including the sun).
- exercise regularly.
- see a foot care specialist if you need advice or treatment.

DON'T...

- cut your own corns or calluses.
- treat your own in-growing toenails or slivers with a razor or scissors. See your doctor or foot care specialist.
- use over-the-counter medications to treat corns and warts. They are dangerous for people with diabetes.
- apply heat to your feet with a hot water bottle or electric blanket. You could burn your feet without realizing it.
- soak your feet.
- take very hot baths.
- use lotion between your toes.
- walk barefoot inside or outside.
- wear tight socks, garters or elastics, or knee highs.
- wear over-the-counter insoles – they can cause blisters if they are not right for your feet.
- sit for long periods of time.
- smoke.

Objective Seven Self-Test

1) Describe the biological circumstances that create diabetes:

2) Which type of diabetes can be managed with exercise and diet?

3) List five problems associated with the diabetic foot that may be unique to a diabetic, or worse to a diabetic:

4) How can nerve damage cause additional conditions?

5) How does diabetes cause changes to the skin of the foot?

6) True / False. Neglecting an ulcer could result in amputation of the foot.

7) What is the safest way to keep a diabetic's feet warm?

Objective Seven Self-Test Answers

- 1) Diabetes occurs when the pancreas does not release insulin, and blood sugars are prevented from entering the cells.
- 2) Type 2.
- 3) Any of the following: nerve damage, poor blood flow (caused by narrowed, hardened veins), delayed healing, a lessened ability to fight infection, nerve damage, excessive callus, PAD, and ulcers
- 4) Nerve damage can decrease the ability to feel pain, heat, cold, and moisture. A diabetic with nerve damage may not be aware of these conditions, and suffer from cuts, infections, frost bite, burning, athletes foot, ect.
- 5) The nerves that control the oil and moisture in the feet no longer work, causing the feet to dry until the skin peels and cracks.
- 6) True.
- 7) Wear warm socks made from natural fibre such as wool or cotton.

Objective Eight

When you have completed this objective, you will be able to:

Describe hand conditions.

Ligaments

Ligaments are strong bands of fibrous tissue (collagen) that connect bones or hold organs in place. They are similar to tendons, but different. A ligament is a fibrous connective tissue which attaches bone to bone, and usually performs the function of holding structures together and keeping them stable. In contrast, a tendon is a fibrous connective tissue which attaches bones to muscles or muscles to structures like the eyeball. Ligaments hold things together, while tendons move things. A single hand contains about 123 named ligaments.

Basal Joint Arthritis

The basal joint is located at the base of the thumb, and it makes the movements of the thumb possible. Basal joint arthritis causes pain at the base of the thumb, particularly during pinching or gripping. It can cause a loss of power during pinching.

Osteoarthritis

Osteoarthritis is a deterioration of the moving parts of the joints. In the hand, osteoarthritis it often affects the small joints of the fingers and the basal joint. The large joints of the hand often remain unaffected. Osteoarthritis is also referred to as degenerative arthritis or degenerative joint disease. The cause of osteoarthritis is not precisely known; it is possibly due to deterioration of the cartilage covering the ends of the bones. Osteoarthritis can occur in families, and can also develop after an injury. Scientific evidence suggests that chondroitin / glucosamine can alleviate osteoarthritis.

Rheumatoid Arthritis

Rheumatoid arthritis is a medical condition. The immune system attacks and damages parts of the body. Inflammation or irritation is caused in the moving parts of the body, including joints and tendons. Swelling, weakness, and pain may occur. The shape and alignment of joints may alter over time. The causes for developing rheumatoid

arthritis are not known. It commonly affects the big knuckles of the fingers and the wrist bone on the side of the small finger.

Tendon Injuries

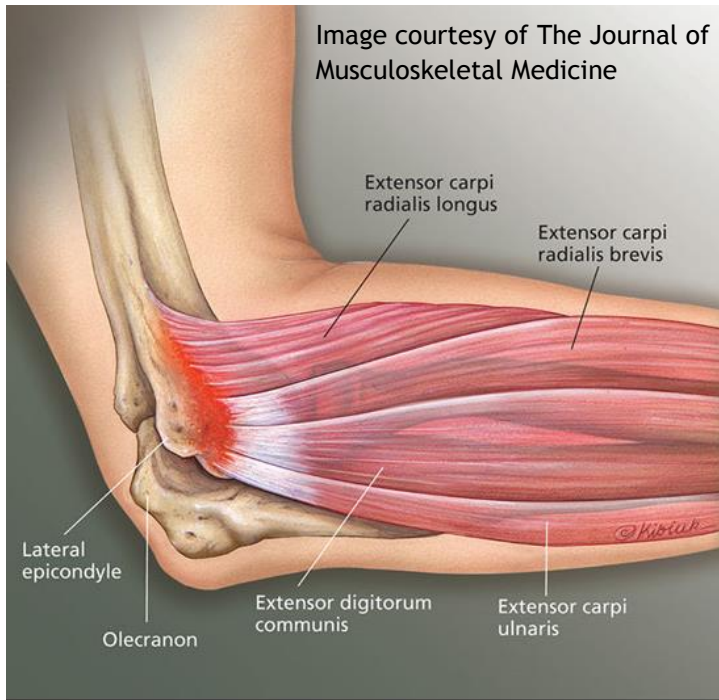
Tendons are flexible, smooth, and strong string-like structures that help make limbs and digits move. They attach to bones at one end and muscles at the other. When a muscle contracts, it pulls the tendon, which in turn moves the bone. The muscles of the forearm attach to tendons which attach to the bones of the hand and fingers. The tendons which straighten the fingers are called 'extensor tendons' and the tendons which curl the fingers are called 'tensor tendons.' Tendon injury can cause finger stiffness and reduced movement. On the underside of each finger joint, the flexor tendons are located just under a layer of skin. At this point, the tendons are susceptible to lacerations. Lacerations of the tendons can cause permanent damage and surgery may be required. Tendons may tear or be torn off the bone by a sudden pull against a strong grip.

Tendonitis

Tendonitis is a swelling around tendons and joints that is caused by the collecting of fluid in the area. Strenuous or repeated activities can cause and/or aggravate tendonitis. Irritated flexor tendons can become painful, stiff, and swollen. Fingers may catch, click, or lock in position if the swollen tendons cannot properly move. Flexor tendons pass through a cylinder called the tendon sheath at the joint in the palm at the base of the finger. Inflammation and irritation is often the worst at this location.

DeQuervain's Tenosynovitis

DeQuervain's tenosynovitis is a painful condition that affects the tendons located on the thumb side of the wrist. These tendons move the thumb sideways away from the palm. It causes pain when turning the wrist, grasping, and making a fist. The exact cause is not known. DeQuervain's tenosynovitis can occur after unusual, repeated activity involving lifting or side to side motion of the wrist. Symptoms include pain near the base of the thumb, difficulty moving the thumb and wrist when grasping or pinching, swelling near the base of the thumb, and a 'sticking' sensation in the thumb during its movement.



Tennis Elbow

Tennis elbow (also known as golfers elbow) is a type of tendonitis that causes pain on the outer side of the elbow and forearm. The overuse of the muscles of the forearm will cause inflammation of the tendons that connect the muscles of the lower arm to the bone. Repetitive gripping activities, especially if they involve the thumb and first two fingers can cause tennis elbow. Gripping and lifting with the hand in certain positions can aggravate the pain. In addition to pain, swelling

on the side of the elbow may also occur. The tendon may heal slowly over the course of several months or not be able to heal. If a person has tennis elbow, avoid lifting with palms down and elbows straight. A splint or brace can be used to support the wrist.

Boutonniere Finger

The boutonniere deformity refers to a finger or toe in which the joint nearest the knuckle is permanently bent toward the palm, while the farthest joint is bent up. It can be caused by genetics, inflammatory disorders such as rheumatoid arthritis, or injury.

Mallet Finger

Mallet finger is a deformity of the fingertip or thumb in which the end joint of the finger or thumb falls down and will not lift itself. It is caused when the extensor tendon that straightens the finger is damaged. An object can strike the tip of the finger or thumb and forcibly bend it. The blow can tear the extensor tendon and even pull away a piece of bone along with it. The tip of the finger or thumb no longer straightens.

Ski Pole Thumb

Ski pole thumb is also known as 'gamekeeper's thumb.' It occurs when the thumb is pushed sideways away from the index finger. The ulnar collateral ligament may tear or detach from its connection to the bones. In the short term, the thumb joint loses its stability and the thumb loses its strength; in the long term, the side to side movement of the thumb may become floppy. Symptoms include pain and swelling in the area, a weakened grasp, and eventually, the possibility of arthritis.

Objective Eight Self-Test

1) What are the functions of ligaments?

2) Which joints in the hand are mostly affected by osteoarthritis?

3) Identify three symptoms of rheumatoid arthritis:

4) What is the difference between an extensor tendon and a flexor tendon?

5) What is the cause of tendonitis?

6) What is tennis elbow and where does it occur?

7) What causes ski pole thumb?

Objective Eight Self-Test Answers

- 1) Ligaments hold organs in place and attach bone to bone. They hold structures together and keep them stable.
- 2) Osteoarthritis usually affects the small joints of the fingers and the basal joint.
- 3) Any three of the following: inflammation or irritation in the moving parts of the body, including joints and tendons, swelling, weakness, and pain may occur. The shape and alignment of joints may alter over time.
- 4) Tensor tendons curl joints, while extensor tendons straighten them.
- 5) Strenuous or repeated activities.
- 6) Tennis elbow is a type of tendonitis that occurs on the outer side of the elbow and forearm.
- 7) Ski pole thumb is caused when the ulnar collateral ligament tears or detaches from its connection to the bones.

Objective Nine

When you have completed this objective, you will be able to:

Describe carpal tunnel syndrome. The information for this section comes from the Canadian Centre of Occupational Health and Safety.

What is Carpal Tunnel Syndrome?

Carpal tunnel syndrome is a condition affecting the hand and wrist. The carpal tunnel is a space in the wrist surrounded by wrist bones and by a rigid ligament that links the bones together.

The flexing tendons of the fingers and thumb and the median nerve pass through this small tunnel. The tendons help the fingers curl, while the median nerve carries signals from the brain to control the actions of the fingers and hand. The median nerve also carries information about temperature, pain, and touch from the hand to the brain, and controls the sweating of the hand.

The thumb, index, middle and ring fingers are under the control of the median nerve.

The tendons of the fingers surround the median nerve in the carpal tunnel. Swelling of the tendons reduces the space in the tunnel and squeezes the median nerve which is softer than the tendons. Pressure on this nerve can injure it. Such injury results in sensations of numbness, tingling, pain, and clumsiness of the hand. **This combination of symptoms is called *carpal tunnel syndrome*.** People with carpal tunnel syndrome experience difficulty in performing tasks such as unscrewing bottle tops, fastening buttons, or turning keys.



Image courtesy of Alison Glodowski

Developing Carpal Tunnel Syndrome

Bending the wrist or moving the fingers is achieved when muscles pull the tendons. The tendons of the hand are encased in sheaths, or sleeves through which the tendons slide. The inner wall of the sheaths contains cells that produce a slippery fluid to lubricate the tendons. Lubrication is essential for the normal and smooth functioning of the tendons. With repetitive or excessive movement of the hand, the lubrication system may malfunction. It may not produce enough fluid or it may produce a fluid with poor lubricating qualities. Failure of the lubricating system creates friction between the tendon and its sheath causing inflammation and swelling of the tendon area. In turn, the swelling squeezes the median nerve in the wrist or carpal tunnel. Repeated episodes of inflammation cause fibrous tissue to form. The fibrous tissue thickens the tendon sheath, and hinders tendon movement.

Occupational Factors of Carpal Tunnel Syndrome

The National Institute of Neurological Disorders and Stroke (USA) indicates that carpal tunnel syndrome is "often the result of a combination of factors that increase pressure on the median nerve and tendons in the carpal tunnel, rather than a problem with the nerve itself". Carpal tunnel syndrome has been associated with certain tasks including:

- Repetitive hand motions.
- Awkward hand positions.
- Strong gripping.
- Mechanical stress on the palm.
- Vibration.

Estheticians, cashiers, hairdressers, knitters, and sewers are examples of people whose work-related tasks involve the repetitive wrist movements associated with carpal tunnel syndrome. Bakers who flex or extend the wrist while kneading dough, and people who flex the fingers and wrist in tasks such as milking cows, using a spray paint gun, and hand-weeding are other examples. Excessive use of vibrating hand tools may also be related to carpal tunnel syndrome.

Some studies show that psychosocial factors (such as stress) can contribute to the development of carpal tunnel syndrome.

Non-occupational Factors of Carpal Tunnel Syndrome

Carpal tunnel syndrome is associated with several diseases and situations such as:

- Arthritis.
- Diabetes.
- Gout.
- Amyloidosis (infiltration of the liver, kidneys, spleen with a starch-like substance).
- Hypothyroidism (underactive thyroid gland).
- Tumours of tendon sheaths.
- Wrist fractures and dislocations.
- Wrist cysts.
- Pregnancy.
- Use of oral contraceptives.
- Menopause.

All these diseases and situations increase the volume of the contents of the carpal tunnel, resulting in compression of the median nerve. Some individual factors, such as the size and shape of the wrist and the shape of the median nerve, may contribute to the development of carpal tunnel syndrome.

Symptoms of Carpal Tunnel Syndrome

The typical symptoms of carpal tunnel syndrome are tingling of the thumb, index, middle, and ring fingers, and night pain. The pain awakens the sufferer, but is often relieved by shaking, hanging, or massaging the hand. Pain may involve not only the hand, but also the arm and the shoulder. Numbness and loss of manual dexterity occur in more advanced cases. Weakness of the hand also occurs, causing difficulty with pinch and grasp. The person may drop objects or be unable to use keys or count change with the affected hand. The skin may dry because of reduced sweating.

People who suspect carpal tunnel syndrome often consult a doctor. The evaluation of occupational carpal tunnel syndrome includes identifying workplace risks. Evaluation begins with a discussion of the person's employment and requires a detailed description of all the processes involved in a typical day's work. It also requires consideration of the frequency, intensity, duration and regularity of each task

performed at work. Diagnosis of carpal tunnel syndrome is confirmed by performing certain tests to detect damage to the median nerve.

Tinel's test - The physician taps the median nerve at the wrist. A tingling response in one or more fingers indicates damage to the median nerve.

Phalen's test - The patient puts the backs of the hands together and bends the wrists for one minute. Tingling of the fingers indicates damage to the median nerve.

Electromyography - Electrodes are placed on the forearm and electrical current is passed through the patient. Measurements on how fast and how well the median nerve transmits messages to muscles indicate if there is damage to this nerve.

Treatment of Carpal Tunnel Syndrome

When symptoms of carpal tunnel syndrome are mild or likely to be temporary, treatment includes rest, anti-inflammatory drugs, cold packs, or a splint. Even if a patient wears a splint that has been prescribed, he or she should avoid the activities that caused or aggravated the injury. Where this is not possible, patients should wear the splint after work and particularly during sleeping hours. Specific exercises supervised by a physical or occupational therapist and yoga can be beneficial. Surgery may be necessary if the symptoms are severe and if the other measures do not provide any relief. Surgery should not be the first choice for treatment. Even after surgery, a number of patients may still have some problems.

Preventing Carpal Tunnel Syndrome

Prevention of carpal tunnel syndrome may involve redesigning work stations, tools, or the job, and educating workers. Proper work station design reduces awkward wrist positions and minimizes the stressful effects of repetitive motions. Awkward positions can originate from unsuitable work station designs that do not take into account the size and proportions of the human body. Work stations should be adjustable and should accommodate a vast majority of people who work in that area. Redesigning work methods is important to reduce awkward wrist flexion.

Redesigning tools is also important. One study in a poultry processing plant found that workers who used standard knives were prone to carpal tunnel syndrome. When the workers started using knives with a bent handle, they no longer needed to bend

their wrists while cutting the meat. This change significantly reduced the occurrence of carpal tunnel syndrome.

Job design includes the following:

- Analysis of the sequence of the tasks to allow changes in body position.
- Work-rest schedule to relieve muscles from mechanical stress.
- Work breaks to avoid monotonous and repetitive patterns of work.
- Rotation of tasks to move workers from one job to another.

Worker training should aim to reduce the number and types of awkward wrist postures and the number of repetitive motions. Informing workers about the risk factors that can contribute to carpal tunnel syndrome is important. To limit the effects of a physically stressful job, employers should work closely with employees. This is achieved by implementing worker training and job rotation, and by matching employees to job assignments.

Objective Nine Self-Test

1) In biological terms, what causes carpal tunnel syndrome?

2) What happens when the tendon lubrication system fails?

3) Which five tasks can cause carpal tunnel syndrome?

4) What is considered during the evaluation of a workplace which may pose a risk for carpal tunnel syndrome?

5) What can be done to treat a mild case of carpal tunnel syndrome?

6) List three things that can be done to prevent carpal tunnel syndrome in the workplace:

Objective Nine Self-Test Answers

- 1) Along with the median nerve, the flexing tendons of the fingers and thumb pass through the carpal tunnel. When the tendons swell, the space in the tunnel is reduced and the median nerve gets pinched.
- 2) Failure of the lubricating system creates friction between the tendon and its sheath causing inflammation and swelling of the tendon area.
- 3) Repetitive hand motions, awkward hand positions, strong gripping, mechanical stress on the palm, and vibration.
- 4) An evaluation considers: a description of all the processes involved in a typical day's work, and the frequency, intensity, duration and regularity of each task performed at work.
- 5) Treatment can include: rest, anti-inflammatory drugs, cold packs, and the wearing of a splint, even at night.
- 6) Any of the following: redesigning work stations, tools, or the job, educating workers, reducing awkward wrist positions, work methods, and repetitive motions, analyzing the sequence of the tasks to allow changes in body position, developing a work-rest schedule to relieve muscles from mechanical stress, taking work breaks to avoid monotonous and repetitive patterns of work, and rotating tasks to move workers from one job to another.

Objective Ten

When you have completed this objective, you will be able to:

Describe contraindications that may restrict or prevent a service.

A contraindication may restrict or prevent a service for many reasons. If a client has a fractured bone in their foot, the administering of a foot massage may cause injury. In this case, the service is prevented; however, it may be possible to work on and add enhancements to their toenails. In this case, the service might be restricted or adapted. Check with the AHJ and your employer to determine which contraindications either restrict or prevent services. Never diagnose a contraindication. If a client appears to have a contraindication, refer them to a physician.

Contraindications That Restrict a Manicure or Pedicure

Common warts	Onychauxis
Beau's lines and grooves	Onychocryptosis
Bitten nails	Onycholysis (depending on severity)
Bruising of the skin	Onychomalacia
Bunions	Onychorrhexis
Cyanosis	Pincer nails
Fissures	Plantar warts
Flaking nails	Plicated nails
Fractures or broken bones	Psoriasis
Hammer toe	Pterygium
Hangnails	Scleronychia
Hematoma	Splinter hemorrhages
Involuted toenail	Yellow nail syndrome (uninfected)
Koilonychia	
Leukonychia	
Melanonychia	

Contraindications That Prevent a Manicure or Pedicure

In general, contraindications that prevent a service are those that involve contact with open flesh, or contact with highly communicable fungi and/or bacteria. A contraindication may be listed above as being 'restricted from service', but if it is accompanied by an infection, it becomes 'prevented from service.' Depending on an esthetician's scope of practice, they may work on a client who has one of the contraindications listed below.

Bruised nail bed	Onychomycosis
Candida	Paronychia
Dermatophytes	Pseudomonas
Mold	Psoriasis of the Nail
Onychia	Ring worm
Onycholysis	Tinea Unguium
Onychomadesis	Yeasts

Objective Ten Self-Test

1) With whom should an apprentice consult to determine which contraindications restrict services, and which contraindications prevent services?

2) Complete the table below for contraindications that may restrict a manicure or pedicure.

	Onychauxis
Beau's lines and grooves	
	Onychomalacia
Bunions	
	Pincer nails
Fissures	
Flaking nails	Plicatured nails
	Pterygium
Hangnails	
	Splinter hemorrhages
Koilonychia	
Leukonychia	

3) In general, what types of contraindications prevent a service?

4) Complete the table below for contraindications that may prevent a manicure or pedicure.

	Onychomycosis
Candida	
Dermatophytes	
	Psoriasis of the Nail
Onychia	
	Tinea Unguium

Objective Ten Self-Test Answers

- 1) The AHJ and the salon owner.
- 2) See table on page 71.
- 3) Contraindications that involve contact with open flesh, or contact with highly communicable fungi and/or bacteria.
- 4) See table on page 72.

Objective Eleven

When you have completed this objective, you will be able to:

Demonstrate analyzing conditions, disorders, and diseases of the hands and feet.

Laboratory Exercise

Purpose: to analyze conditions, disorders, and diseases of the hands and feet.

Materials:

Procedure: With a partner, analyze each other's hands and feet. Identify any contraindications that may restrict or prevent a service.

Instructor verification: _____

Module Summary Self-Test

1) Is the nail plate one solid piece? Explain.

2) What can result if the lunula is damaged?

3) What terms are used to describe a nail plate that whose arch is sharper than normal?

4) How much does the average nail plate grow in the normal adult per month.

5) Why are toenail plates thicker than fingernail plates?

6) What can result from damage to the matrix?

7) What are the two main sources of nail disorders?

8) What are beaus lines?

9) Why should a client with melanonychia be immediately referred to a physician?

10) What is onychomycosis?

11) What is a term used to describe any disease or deformity of the nails?

12) What is onychia, and what is a common cause?

13) What two factors make the Achilles tendon susceptible to injury?

14) How should small and large blisters be covered?

15) In relation to the ankle, which additional problem can be caused by flat foot?

16) What is the role of insulin in the body?

17) What is the most common form of nerve damage in the feet of a diabetic, and what are its symptoms?

18) How should a diabetic trim their toenails?

19) How does rheumatoid arthritis develop?

20) Which condition causes: painful along the tendons located on the thumb side of the wrist, and pain when turning the wrist, grasping, and making a fist.

21) What does mallet finger look like?

22) If a person is suffering from carpal tunnel syndrome, how is their grip affected?

23) How is a Phalen's test performed?

24) True / False. Arthritis is not a non-occupational factor of carpal tunnel syndrome.

25) What should be done if a client appears to have a contraindication?

26) True / False. Psoriasis of the nail is a contraindication that restricts a service.

27) True / False. Bunions are a contraindication that restricts a service.

Module Summary Self-Test Answers

- 1) No. The nail plate is constructed of approximately 100 layers of nail cells.
- 2) Permanent deformity to the nail plate an result from lunula damage.
- 3) High-arched or circumflex.
- 4) About 2.5 mm to 3 mm per month.
- 5) The matrix of a toenail plate is longer.
- 6) Nail plates can develop thinner or with grooves.
- 7) A breakdown of the normal way a nail forms, and circumstantial factors such as stress and diet.
- 8) Beaus lines are visible depressions running across the width of the natural nail plate.
- 9) Melanonychia can indicate melanoma.
- 10) Onychomycosis is a fungal infection between the nail plate and the nail bed.
- 11) Onychosis.
- 12) Onychia is an inflammation of the nail matrix commonly caused by unsanitary implements.
- 13) Limited blood supply to the tendon and high tensions placed on it.
- 14) Cover small blisters with a bandage, and large ones with a gauze pad held by adhesive.

- 15) The ankle often pronates (rolls inward).
- 16) Insulin opens cells, allowing the glucose to enter and be consumed by the cells.
- 17) The most common form is peripheral neuropathy which causes tingling, pain (burning or stinging), or weakness in the foot.
- 18) Straight across.
- 19) The immune system attacks and damages parts of the body.
- 20) DeQuervain's tenosynovitis.
- 21) The end joint of the finger or thumb falls down and will not lift itself.
- 22) The grip is weakened, causing difficulty with pinching and grasping.
- 23) The patient puts the backs of the hands together and bends the wrists for one minute. Tingling of the fingers indicates damage to the median nerve.
- 24) False.
- 25) The client should be referred to a physician.
- 26) False.
- 27) True.

