Chemical Makeup and Conditions of the Skin

2 CE Hours

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Learning objectives

- Describe the basic anatomy and chemical composition of skin.
- List some common skin care mistakes.
- Explain the significance of material safety data sheets.
- Identify the role of the U.S. Food and Drug Administration.
- Associate common symptoms with conditions and diseases of skin.

Introduction to skin

In zootomy and dermatology, skin[1] is an organ of the integumentary system made up of multiple layers of epithelial tissues that guard underlying muscles and organs. As the interface with the surroundings, it plays the most important role in protecting against pathogens. Its other main functions are insulation and temperature regulation, sensation and vitamin D and B synthesis. Skin is considered one of the most important parts of the body.

Skin has pigmentation, or melanin, provided by melanocytes, which absorb some of the potentially dangerous ultraviolet radiation in sunlight. It also contains DNA repair enzymes which help to reverse UV damage, and people who lack the genes for these enzymes suffer high rates of skin cancer. One form predominantly produced by UV light, malignant melanoma, is particularly invasive, causing it to spread quickly, and can often be deadly. Human skin pigmentation varies among populations in a striking manner. This has sometimes led to the classification of people(s) on the basis of skin color.

Mammalian skin often contains hairs, which in sufficient density is called fur. The hair mainly serves to augment the insulation the skin provides, but can also serve as a secondary sexual characteristic or as camouflage. On some animals the skin is very hard and thick, and can be processed to create leather. Reptiles and fish have hard protective scales on their skin for protection, and birds have hard feathers, all made of tough β-keratins. Amphibian skin is not a strong barrier to passage of chemicals and is often subject to osmosis. A frog sitting in an anesthetic solution will quickly go to sleep.

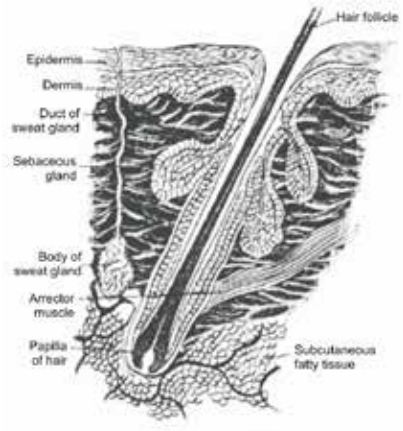
Damaged skin will try to heal by forming scar tissue, often giving rise to discoloration and depigmentation of the skin.

The skin is often known as "the largest organ of the human body." This applies to exterior surface, which covers the body and, appears to have the largest surface area of all the organs. Moreover, it applies to weight, as it weighs more than any single internal organ, accounting for about 15 percent of body weight. For the average adult human, the skin has a surface area of between 1.5-2.0 square meters, most of it is between 2-3 mm thick. The average square inch of skin holds 650 sweat glands, 20 blood vessels, 60,000 melanocytes, and more than a thousand nerve endings.

The use of natural or synthetic cosmetics to treat the appearance of the face and condition of the skin (such as pore control and black head cleansing) is common among many cultures.

Layers

Skin is composed of three primary layers: the epidermis, which provides waterproofing and serves as a barrier to infection; the dermis, which serves as a location for the appendages of skin; and the **hypodermis (subcutaneous adipose layer), which is called the basement membrane**.



Epidermis

The outermost epidermis consists of stratified squamous epithelium with an underlying connective tissue section, or dermis, and a hypodermis, or basement membrane. The epidermis contains no blood vessels, and cells in the deepest layers are nourished by diffusion from blood capillaries extending to the upper layers of the dermis. The main type of cells which make up the epidermis are keratinocytes, with melanocytes and Langerhans cells also present. The epidermis can be further subdivided into the following strata (beginning with the outermost layer): corneum, lucidum, granulosum, spinosum, basale. Cells are formed through mitosis at the basale layer. The

daughter cells, (see cell division) move up the strata changing shape and composition as they die due to isolation from their blood source. The cytoplasm is released and the protein keratin is inserted. They eventually reach the corneum and slough off (desquamation). This process is called keratinization and takes place within about 30 days. This keratinized layer of skin is responsible for keeping water in the body and keeping other harmful chemicals and pathogens out, making skin a natural barrier to infection.

Blood capillaries are found beneath the epidermis, and are linked to an arteriole and a venule. Arterial shunt vessels may bypass the network in ears, the nose and fingertips.

The dermis lies below the epidermis and contains a number of structures including blood vessels, nerves, hair follicles, smooth muscle, glands and lymphatic tissue. It consists of loose connective tissue otherwise called areolar connective tissue; collagen, elastin and reticular fibers are present. Erector muscles, or arrector pili muscles attached between the hair papilla and epidermis, can contract, resulting in the hair fiber pulled upright and consequentially the formation of goose bumps. Sebaceous glands are exocrine glands which produce sebum, a mixture of lipids and waxy substances: lubrication, water-proofing, softening and antibactericidal actions are among the many functions of sebum. Sweat glands open up via a duct onto the skin by a pore.

The dermis can be split into the papillary and reticular layers. The papillary layer is outermost and extends into the epidermis to supply it with nutrients. It is composed of loosely arranged fibers. Papillary ridges make up the lines of the hands and feet, producing individually unique fingerprints and footprints. The reticular layer is more dense and is continuous with the hypodermis. It contains the bulk of the structures (such as sweat glands). The reticular layer is composed of irregularly arranged fibers and resists stretching.

The hypodermis is not part of the skin, and lies below the dermis. Its purpose is to attach the skin to underlying bone and muscle as well as supplying it with blood vessels and nerves. It consists of loose connective tissue and elastin. The main cell types are fibroblasts, macrophages and adipocytes (the hypodermis contains 50 percent of body fat). Fat serves as padding and insulation for the body.

Types

Skin can be divided into thick and thin types. Thick skin is present on the soles of the feet and the palms of the hands. It has a larger stratum corneum with a higher keratin content. Thick skin does not grow hair; its purpose is to help grip. Thin skin is present on the bulk of the body and has a smaller stratum corneum and fewer papillae ridges. It has hair and is softer and more elastic. The characteristics of the skin, including sensory nerve density and the type of hair, vary with location on the body.

Functions

1. Protection: an anatomical barrier between the internal and external environment in bodily defense; Langerhans cells in the skin are part of the adaptive immune system.
2. Sensation: contains a variety of nerve endings that react to heat, cold, touch, pressure, vibration, and tissue injury; see somatosensory system and touch.
3. Heat regulation: the skin contains a blood supply far greater than its requirements which allows precise control of energy loss by radiation, convection and conduction. Dilated blood vessels increase perfusion and heat loss while constricted vessels greatly reduce cutaneous blood flow and conserve heat. Erector pili muscles are significant in animals.
4. Control of evaporation: the skin provides a relatively dry and impermeable barrier to fluid loss. Loss of this function contributes to the massive fluid loss in burns.
5. Aesthetics and communication: others see our skin and can assess our mood, physical state and attractiveness.
6. Storage and synthesis: acts as a storage centre for lipids and water, as well as a means of synthesis of vitamin D and B by action of UV on certain parts of the skin. This synthesis is linked to pigmentation, with darker skin producing more vitamin B than D, and vice versa.
7. Excretion: The concentration of urea is 1/130th that of urine. Excretion by sweating is at most a secondary function to temperature regulation.
8. Absorption: Oxygen, nitrogen and carbon dioxide can diffuse into the epidermis in small amounts, some animals using their skin for their sole respiration organ. In addition, medicine can be administered through the skin, by ointments or by means of adhesive patch, such as the nicotine patch or iontophoresis. The skin is an important site of transport in many other organisms.

Hygiene

The skin must be regularly cleaned. Unless enough care is taken, it will become cracked or inflamed. Unclean skin favors the development of pathogenic organisms. The constantly peeling off dead cells of the epidermis mix with the secretions of the sweat and sebaceous glands and the dust found on the skin to form a filthy layer on its surface. If not washed away, the dirt and dead skin slurry begins to decompose emitting a foul smell. Functions of the skin are disturbed when it is dirty and it becomes more easily damaged. The release of antibacterial compounds decreases. Dirty skin is more prone to develop infections. Cosmetics should be used carefully because these may cause allergic reactions. Each season requires suitable clothing in order to facilitate the evaporation of the sweat. Sunlight, water and air play an important role in keeping the skin healthy.

The skin supports its own ecosystems of microorganisms, including yeasts and bacteria, which cannot be removed by any amount of cleaning. In general, these organisms keep one another in check and are part of a healthy skin. When the balance is disturbed, e.g., by antibiotics which kill bacteria, there may be an overgrowth and infection by yeasts. The skin is continuous with the inner epithelial lining of the body at the orifices, each of which supports its own complement of flora.

Diseases of the skin[2]

Acne is the most common skin disorder seen by doctors. In fact, it will affect almost every one of us at some time in our lives. It can happen at any time, but teenagers are the ones who get it most often.

Acne can cause a great deal of embarrassment and anxiety. If it's really bad, it can cause people to become depressed, which can lead to withdrawing from friends and performing poorly at school or work.

Visible signs of acne

Comedones: An early acne blemish is caused by blocked pores, and at first the skin does not look red and inflamed. These early blemishes are called open comedones (blackspecks/blackheads) and closed comedones (whiteheads).

Papules and pustules: As these early spots get larger and inflamed, they become papules and pustules (pimples or zits).

Nodules: Very large and deep lumps can also develop in some people, these are called nodules and cysts (like boils), and can be painful.

Oily skin: The sebum production increases so that your skin looks and feels oily.

Hyperpigmentation: After the inflammation subsides, the skin can be discolored by brown acne stains (called hyperpigmentation) and damaged by scars. Acne scars are common and may occur even in mild acne.

Who gets acne?

Acne is the most common of all skin disorders. Almost everyone will have acne; most get mild cases, some are moderate and a few are severe. Teens aren't the only ones who get it. Acne has been diagnosed in young infants as well as in the elderly, but it is most often seen in teens and young adults with 85-100 percent of adolescents and up to 10 percent of young adults getting it.

Acne seems to affect the sexes somewhat differently. Before children reach puberty, acne is more commonly seen in girls. During puberty, acne affects boys and girls almost equally, but boys generally have more severe cases, and in adulthood, it tends to be seen more often in women.

Where does acne develop?

You can have acne on any part of your skin where sebaceous glands are found. These are the glands that produce oil for the skin. Most, but not all people get acne on their face, but the skin on the chest and back can also be affected. Acne can also be seen on the arms and thighs, but is less common.

When do people get acne?

Acne usually starts around the time you reach puberty, and usually will be mild. Often it will last for about 5 years, but can persist for as long as 10-20 years. About 25 percent of teens who have acne will still have it when they turn 25. The cause is not understood, but it's becoming more common for women who are in their 20s, 30s, and 40s to develop acne often for the first time. Temporary acne is often seen on the faces of newborns.

How does acne affect you?

Acne not only causes physical discomfort and damage, but it can also have a big emotional and social impact on your life. Acne (pimples or zits) can be tender and painful, and in extreme cases, the pimples can drain pus and blood, soiling pillowcases and clothing.

If you are feeling embarrassed and anxious about your appearance, this can be even more painful. Emotional effects can lead to mood changes, depression, social withdrawal and poor performance in school or at work. If acne is bad enough to leave scars, you may have to endure these emotional issues for years, because scarring is not readily correctable. While laser therapy and skin fillers certainly improve scars, it is best if you can prevent their formation in the first place.

What is atopic eczema?[3]

Eczema is a chronic recurring intensely itchy inflammation of the skin usually starting in early childhood. It is known as atopic eczema as well as atopic dermatitis.

Who is affected by eczema?

Eczema affects probably 10-15 percent of the population and is becoming more common for reasons that are not well understood. The frequency is variable throughout the world. Eczema is easily recognized by the dermatologist. Three quarters of the time, eczema presents itself in the first six months of life. The condition waxes and wanes over the years with frequent flare-ups. There are no specific tests available to confirm the diagnosis. The majority of cases have an increase in the serum Ig E level which is a sign of increased immunological activity.

What does the word eczema mean?

In Greek, eczema means to "boil over" and this refers to the weeping stage of acute eczema. Eczema, hay fever and asthma are grouped together in a complex known as atopy. The cause of eczema is not entirely understood. Genetic, immunological, as well as skin barrier defects, are important factors. External factors often influence the condition. The barrier function of the skin is less effective which allows more water loss from the skin. An increase in skin bacterial infections especially by staphylococcus aureus can be seen.

Psychological impact of eczema

The psychological impact of this disease is significant, especially feelings of embarrassment. Sleep disruption is common (80 percent) and 60 percent report the condition affecting their daily activities.

Diagnosis of eczema

Diagnosis of this condition, which has variable appearances, is dependent on a number of factors. The features or appearance in one person may be different from another. Skin in different locations in the same person may also have variable appearances which change according to the severity of eczema in that specific location.

SKIN INFECTIONS CAUSED BY FUNGI

Dermatophytes

Approximately 90 per cent of fungal skin infections are caused by dermatophytes, which are parasitic fungi affecting the skin, hair, or nails.

There are three groups of dermatophytes, called trichophyton (affects skin, hair and nails), microsporum (a type of fungus that causes ringworm epidemics in children) and epidermophyton (A fungal which grows on the outer layer of the skin and is the cause of tinea). These infections are mostly seen after puberty with the exception of tinea capitis, which is a fungal infection involving scalp hair, seen in children.

Dermatophytes also produce what is widely known as Ringworm, in which the fungi limit themselves to dead keratin, a protein found on the skin.

Fungi that have developed to live on animals can also infect us, and will usually cause much more inflammation and redness because our immune system sees them as a foreign invasion and goes into attack.

Other skin infections are caused by yeasts such as candida. Another known as malassezia furfur, or pityrisporum ovalae, is a type of fungus that causes brownish patches on the skin This particular yeast resides on skin that has a high (oily) sebum content such as the face, scalp and chest. It is responsible for dandruff of the scalp as well as a rash on the body called tinea versicolor. Candida can also settle in the moist folds of skin.

Psoriasis[4] is a common, chronic, non-contagious, reoccurring skin condition consisting of red, scaly, well defined, thickened areas of varying sizes. Any part of your skin on the body and on your nails can be affected. Arthritis may be associated with your psoriasis. The scalp, elbows, knees and lower back are commonly affected, but the face is usually not.

Key points:

1. Psoriasis is chronic and reoccurring.
2. It produces red, scaly, well-defined patches.
3. Psoriasis can affect any part of the skin on your body, particularly the scalp, elbows, knees and lower back.
4. It may include nail involvement and arthritis.

Who can get psoriasis?

Psoriasis affects approximately 2 percent of the population, and men and women in any age group can be affected. One type of psoriasis usually begins between the ages of 20 and 30 and runs in families, but the inheritance is variable. A gene called HLA-Cw6 has been linked. Approximately 30 percent of people with this condition also have a first-degree relative (that is parents, brothers, sisters and children) with psoriasis.

If you have an identical twin with psoriasis, the chance that you also have the condition is about 70 percent, while the risk for a twin who is not identical, is about 25 percent. The severity of psoriasis may vary between family members. For example, one member might have a very mild disease with only a couple of lesions, while another member might be covered with psoriasis. A second type typically begins around age 60 and does not run in families.

What causes psoriasis?

Psoriasis is an autoimmune condition involving the T-lymphocyte, a type of white blood cell.

Normally, the time between manufacturing and shedding skin cells is about 28 days. In psoriasis, the process is approximately 7 times faster; the outer cells are poorly formed and don't shed properly. They tend to pile up on the skin, producing the scale.

Rosacea[5] is a long lasting, non-scarring skin condition of the face that is often misdiagnosed as adult acne. It varies in severity and does not always worsen with time. Typically, you will experience inappropriate flushing that is not usually associated with sweating and/or persistent facial redness. It is common to have broken blood vessels (telangiectasias) on your cheeks. You may also experience bouts of inflammation that cause red papules (small bumps) or pustules. However, comedones (blackheads and whiteheads) are not part of rosacea.

About 50 percent of those with rosacea suffer eye involvement, including such conditions as conjunctivitis, blepharitis, dry gritty eyes, and recurrent sties. Nose enlargement (rhinophyma) is uncommon but mostly seen in men. It is only very rarely seen in women.

Key features:

1. Facial symptoms – burning and stinging.
2. Facial flushing, blushing evolving to persistent redness.
3. Inflammatory papules, pustules (pimples).
4. Cheeks are not warm.
5. Telangectasiae, (blood vessel lines).
6. Eye involvement.
7. Soft tissue hypertrophy or skin thickening (rhinophyma).

Who gets rosacea?

This condition is most commonly seen in those who have fair skin and is sometimes referred to as the "Curse of the Celts" or a "Peaches and Cream" complexion.

Where does rosacea occur on the skin?

You will usually see rosacea around the central area of your face. It may occasionally be isolated to one patch.

When does it usually start?

Onset usually occurs between 20-40 years of age.

How does rosacea affect us?

1. Rosacea can be very embarrassing; flushing can be a source of social discomfort.
2. Many may feel that they are perceived as heavy drinkers.
3. Eyes can be gritty and uncomfortable.
4. Older men are frequently ashamed if their nose becomes bigger and knobbly.

Your biggest skin-care mistakes – solved![6]

From over-exfoliating to over-moisturizing, top dermatologists share women's leading complexion blunders and offer easy advice on setting any beauty routine right.

Having perfect skin is at the top of just about every woman's wish list. But despite all the knowledge we've gleaned over the years from magazines, friends, facialists and dermatologists, we still don't seem entirely sure how to achieve that flawless complexion. In fact, even the skin-savviest among us are prone to making occasional mistakes that can wreak havoc on our complexions – out of laziness, overzealousness or just plain misinformation. To the rescue: Top dermatologists share the worst offenses of their patients and show you how to get your routine back on track.

Mistake No. 1 – Trying to scrub away acne.
Acne is not a hygiene problem; it's a hormonal issue. Excessively cleaning your face won't get rid of acne. Instead of attempting to scrub your pimple-prone skin into submission, wash it gently with a foaming face wash that's designed to lift off dirt without irritating skin. And if you do feel compelled to enlist a scrub, use it no more than once a week, choosing a product that has even-sized, round beads, not rough particles. Rough grains can irritate the skin to the point where it starts to overproduce oil.

Mistake No. 2 – Putting on sunscreen once and assuming you're protected.
The big mistake women make is trusting the sunscreen label that reads 'all day protection.' The truth is that no sunscreen lasts more than four hours; you're kidding yourself if you think you can put it on once and forget about it. Regular sunscreen use is even more important if you are treating your face with Retin-A or alpha- or beta-hydroxy acids, or getting peels or microdermabrasion – all of which can leave skin more sensitive to the sun's ultraviolet rays. The solution is not only using sunscreen more often, but applying more sunscreen. The label may promise SPF 30, but spreading just a thin coat over your skin will give you only a fraction of that protection.

Mistake No. 3 – Falling for the ingredient du jour.
Green tea, licorice extract, betahydroxy acids – for every new product, you'll find someone for whom it's the miracle that finally fixed their every skin flaw. But that doesn't necessarily mean it will have the same effect on you. That means observing your skin - paying attention to how it feels, how it looks and how the weather conditions where you live (whether the air is dry or humid) affect it.

Mistake No. 4 – Not reading labels carefully.
Reading the fine print on products is essential, particularly if you have oily, blemish-prone skin or suffer from rosacea or topical allergies. Look for moisturizers, sunscreens and foundations that are clearly marked "oil-free" or "noncomedogenic." The same rule holds true for those with dry skin; you need oil- so you don't want to invest in a product meant for acne-prone skin.

Mistake No. 5 – Ignoring skin from the neck down.
Alligator-skin arms and legs are undoubtedly unattractive, but there's more than a purely aesthetic reason for taking care of your body skin. The skin is a barrier designed to keep out bacteria. When skin gets excessively dry and itchy, scratching can introduce infection. The best defense is adequate moisture. Fresh out of the shower every day, apply a layer of moisturizer on still-damp skin to seal in water.

Mistake No. 6 – Picking!
It's the dirty little secret so many of us share: the inability to leave our skin alone. This is the worst skin-care offense of them all, and yet we can't stop popping, squeezing and picking. It's a very difficult habit to break, but you need to figure out the times and places where you tend to pick at your skin the most and break that ritual. Maybe it means tossing out your magnifying mirror or putting a lower-wattage bulb in the bathroom light fixture. Or maybe you just need to remind yourself that by delving mere millimeters into the skin, you can cause a mark that will stay on your face for at least two weeks (or, at worst, result in a scar) – as opposed to leaving a pimple untouched so that it will vanish on its own within about a week.

Mistake No. 7 – Assuming that more is better.
More is better may apply to things like using sunscreen and eating vegetables, but when it comes to caring for your skin, it's usually true that less is more. Chances are that if the product label reads "once a day," you're going to cause problems by using it more frequently. In fact, you can worsen your skin's condition by causing extra irritation.

The same holds true for trying too many products at once. Just because Retin-A and hydroxy acids can be beneficial for the skin doesn't mean you should start slathering them on several times a day – or even every day. Not only do you need to build up your usage of such ingredients gradually, but you should also never try more than one new product at a time.

Seven things you are doing right

1. You're drinking lots of water. Drinking at least eight 8-ounce glasses of water each day will keep skin hydrated and healthy.
2. You stopped using soap to wash your face. Unlike most soaps, cleansers are formulated to not strip the skin of essential oils.
3. You're washing morning and night. Cleansing in the morning gives your skin a fresh start, and at night it clears away pore-clogging dirt, oil and makeup.
4. You started using a moisturizer. Every skin type benefits from a moisturizer.
5. You bought your first eye cream. It's never too early to combat the signs of aging in the thin, sensitive eye area.
6. You're slowing down the aging process. There are things you can do to diminish wrinkles, namely applying sun protection and investing in a good anti-aging cream.
7. You're applying makeup with sunscreen. While SPF-laden cosmetics don't give total sun protection, foundations, powders and lipsticks with SPF are a great start.

Material safety data sheets (MSDS)

Hazardous substances are used in this industry on a regular basis and the licensee is responsible for knowing and obeying the laws of all regulatory agencies they may encounter in their careers. The material safety data sheet (MSDS) is the primary source of information describing the hazardous properties of each chemical product used in the profession. It contains information on potential health hazards, proper handling of the chemicals and disposal methods, as well as, emergency first-aid procedures. The MSDS is the tool that will help hair, skin, and nail care professionals work safely in their environment.

The Federal OSHA hazard communication standard requires that schools and salons develop and maintain a list of hazardous chemicals present in the work place. Schools and anyone employing cosmetology licensees are required by law to collect and maintain a file on MSDS for the chemicals used in the establishment.

Manufacturers and distributors of products are, by law, charged with providing an MSDS sheet for each of their products free of charge. Schools are responsible under the Hazard Communication Standard to train and familiarize both their staff and students about hazardous chemicals present in their facilities. An MSDS should be requested each time products containing hazardous substances are purchased or acquired. These files should be updated regularly. MSDS can be requested directly from the manufacturer or distributor of these products.

The MSDS should be reviewed in order to find out all necessary health and safety information about the product before using it. This will help individuals make educated decisions about the products they use in their profession for their own personal safety, as well as the health and safety of their clients.

Regardless of your current health, it's important to know the ingredients in your personal care items. Skin care products can contain ingredients which are associated with some risk, so read ingredient labels carefully. Because labels are often difficult to decipher and not all ingredients are necessarily disclosed, finding safer personal care products can be a challenge. Remember it is also the amount, not just the presence, of an ingredient that determines risk.

Women with skin disorders should not assume skin care products are safe. Trying a different type skin care product may actually aggravate existing skin disorders.

The role of the FDA

When consumers notify the FDA of problems with personal care products, the agency evaluates evidence on a case-by-case basis and determines if follow-up is needed. The FDA looks for patterns of complaints or unusual or severe reactions. The agency may conduct an investigation, and if the evidence supports regulatory action, the FDA may request removal of an item from the market.

One example is the possible hazards associated with use of chemical skin peeling products.[7] The FDA conducted an investigation to determine the seriousness of injuries reported to be associated with such products and the extent to which they occur.

FDA issued the warning after it received reports of several injuries caused by skin peelers including four reports of skin burns from using a product called PeelAway. The agency said there may be other unreported injuries from PeelAway, as well as from other skin peeling products. The products in question contain ingredients that purportedly remove wrinkles, blemishes, blotches and acne scars. They are often promoted with claims that they can restore youthful-looking skin.

FDA said such products can penetrate the skin too deeply, causing severe skin damage. In several cases, persons have been hospitalized for severe burns, swelling and pain. In one case, a California woman suffered seizure, shock and second degree burns after a mixture of skin peel chemicals was applied to her legs by a beautician. The case was under review by California state health officials.

Skin peeling products vary considerably as to their ingredients and strength. Also, skin reactions to the chemicals used in the products vary among individuals. Skin peeling products typically contain combinations and concentrations of several different acids such as resorcinol, phenol, lactic acid, trichloroacetic acid, salicylic acid, and glycolic acid and other alpha hydroxy acids.

They are ordinarily applied to the skin for a short time each day, usually for six to 12 days. The skin initially reddens, as with a sunburn, then darkens and finally peels away revealing what manufacturers claim will be "new skin." Treatments may be painful and leave permanent scars.

Skin peeling procedures used to be carried out only by plastic surgeons and dermatologists. However, they are now being done by a variety of non-medical professionals such as cosmetologists and beauticians, some using newly marketed preparations. Several of the products can be purchased through the mail. Many have inadequate instructions; none have been approved by FDA as being safe and effective.

In the course of conducting its investigation, FDA reviewed all products marketed with skin peeling claims. The FDA worked with state attorneys general who are also taking measures to stop the sale and use of hazardous skin peeling products.

In a warning letter sent to PeelAway manufacturer Global Esthetics of Seattle, Wash., May 14, 1992 FDA, said that it considers PeelAway to be a new drug that cannot be legally marketed without FDA approval, and that the product is misbranded and presents a significant health hazard.

The actions announced were not directed at facial mask-type products intended for one-time or occasional use to cleanse the skin.

Tattoos and permanent makeup[8]

FDA considers the inks used in intradermal tattoos, including permanent makeup, to be cosmetics and considers the pigments used in the inks to be color additives requiring premarket approval under the Federal Food, Drug, and Cosmetic Act. However, because of other public health priorities and a previous lack of evidence of safety concerns, FDA has not traditionally regulated tattoo inks or the pigments used in them. The actual practice of tattooing is regulated by local jurisdictions. FDA is aware of more than 150 reports of adverse reactions in consumers to certain permanent make-up ink shades, and it is possible that the actual number of women affected was greater. In addition, concerns raised by the scientific community regarding the pigments used in these inks have prompted FDA to investigate the safe use of tattoo inks. FDA continues to evaluate the extent and severity of adverse events associated with tattooing and is conducting research on inks. As new information is assessed, the agency will consider whether additional actions are necessary to protect public health.

In addition to the reported adverse reactions, areas of concern include tattoo removal, infections that result from tattooing and the increasing variety of pigments and diluents being used in tattooing. More than 50 different pigments and shades are in use, and the list continues to grow. Although a number of color additives are approved for use in cosmetics, none is approved for injection into the skin. Using an unapproved color additive in a tattoo ink makes the ink adulterated. Many pigments used in tattoo inks are not approved for skin contact at

all. Some are industrial grade colors that are suitable for printers' ink or automobile paint.

Nevertheless, many individuals choose to undergo tattooing in its various forms. For some, it is an aesthetic choice or an initiation rite. Some choose permanent makeup as a time saver or because they have physical difficulty applying regular, temporary makeup. For others, tattooing is an adjunct to reconstructive surgery, particularly of the face or breast, to simulate natural pigmentation. People who have lost their eyebrows due to alopecia (a form of hair loss) may choose to have "eyebrows" tattooed on, while people with vitiligo (a lack of pigmentation in areas of the skin) may try tattooing to help camouflage the condition.

Whatever their reason, consumers should be aware of the risks involved in order to make an informed decision.

What risks are involved in tattooing?

The following are the primary complications that can result from tattooing:

1. **Infection**. Unsterile tattooing equipment and needles can transmit infectious diseases, such as hepatitis and skin infections caused by Staphylococcus aureus ("staph") bacteria. Tattoos received at facilities not regulated by your state or at facilities that use unsterile equipment (or re-use ink) may prevent you from being accepted as a blood or plasma donor for twelve months.
2. **Removal problems**. Despite advances in laser technology, removing a tattoo is a painstaking process, usually involving several treatments and considerable expense. Complete removal without scarring may be impossible.
3. **Allergic reactions**. Although FDA has received reports of numerous adverse reactions associated with certain shades of ink in permanent makeup, marketed by a particular manufacturer, reports of allergic reactions to tattoo pigments have been rare. However, when they happen they may be particularly troublesome because the pigments can be hard to remove. Occasionally, people may develop an allergic reaction to tattoos they have had for years.
4. **Granulomas**. These are nodules that may form around material that the body perceives as foreign, such as particles of tattoo pigment.
5. **Keloid formation**. If you are prone to developing keloids – scars that grow beyond normal boundaries – you are at risk of keloid formation from a tattoo. Keloids may form any time you injure or traumatize your skin. Micropigmentation: State of the Art, a book written by Charles Zwerling, M.D., Annette Walker, R.N., and Norman Goldstein, M.D., states that keloids occur more frequently as a consequence of tattoo removal.
6. **MRI complications**. There have been reports of people with tattoos or permanent makeup who experienced swelling or burning in the affected areas when they underwent magnetic resonance imaging (MRI). This seems to occur only rarely and apparently without lasting effects.

There also have been reports of tattoo pigments interfering with the quality of the image. This seems to occur mainly when a person with permanent eyeliner undergoes MRI of the eyes. Mascara may produce a similar effect. The difference is that mascara is easily removable. The cause of these complications is uncertain. Some have theorized that they result from an interaction with the metallic components of some pigments.

However, the risks of avoiding an MRI when your doctor has recommended one are likely to be much greater than the risks of complications from an interaction between the MRI and tattoo or permanent makeup. Instead of avoiding an MRI, individuals who have tattoos or permanent makeup should inform the radiologist or esthetician of this fact in order to take appropriate precautions and avoid complications.

A common problem: Dissatisfaction

A common problem that may develop with tattoos is the desire to remove them. Removing tattoos and permanent makeup can be very difficult.

Although tattoos may be satisfactory at first, they sometimes fade. Also, if the tattooist injects the pigments too deeply into the skin, the pigments may migrate beyond the original sites, resulting in a blurred appearance. Another cause of dissatisfaction is that the human body changes over time, and styles change with the season. The permanent makeup that may have looked flattering when first injected may later clash with changing skin tones and facial or body contours. People who plan to have facial cosmetic surgery are advised that the appearance of their permanent makeup may become distorted. The tattoo that seemed stylish at first may become dated and embarrassing. And changing tattoos or permanent makeup is not as easy as changing your mind.

Consult your health care provider about the best removal techniques for you.

What about temporary tattoos?

Temporary tattoos, such as those applied to the skin with a moistened wad of cotton, fade several days after application. Most contain color additives approved for cosmetic use on the skin. However, the agency has issued an import alert for certain foreign-made temporary tattoos.

The temporary tattoos subject to the import alert are not allowed into the United States because they don't carry the FDA-mandated ingredient labels or they contain colors not permitted by FDA for use in cosmetics applied to the skin. FDA has received reports of allergic reactions to temporary tattoos.

In a similar action, FDA has issued an import alert for henna intended for use on the skin. Henna is approved only for use as a hair dye, not for direct application to the skin. Also, henna typically produces a reddish brown tint, raising questions about what ingredients are added to produce the varieties of colors labeled as "henna," such as "black henna" and "blue henna." FDA has also received reports of allergic reactions to products applied to the skin that contain henna.

SAFER SUNNING IN SEVEN STEPS[9]

Dangers when outside in the sun

Harmful rays from the sun, sunlamps and tanning beds may cause:

1. Skin cancer, which can be deadly.
2. Eye problems.
3. Weakened ability to fight disease.
4. Unsightly skin spots.
5. Wrinkles and "leathery" skin.

Take extra care

Be sure to follow the seven steps to safer sunning, especially if you answer yes to any of these questions:

1. Do you have pale white skin?
2. Do you have blonde, red or light brown hair?
3. Were you ever treated for skin cancer?
4. Has a family member ever had skin cancer?
5. Do you have an illness? If so, ask your doctor about extra care.
6. Do you take medicines? If so, ask your doctor about extra care.
7. Give babies and children extra care in the sun.

Protect yourself with the seven steps to safer sunning

1. **Stay in the shade**. Avoid the sun from 10 am to 4 pm. This is when sun rays are strongest. Don't be fooled by cloudy skies. Harmful rays pass through clouds.
2. **Use sunscreen products on your skin**. Many suntan products have sunscreens to protect your skin from the sun.

   Products with sunscreens have an "SPF" number on the label. SPF stands for sun protection factor. A higher number means it protects longer. Buy products with an SPF number of 15 or more. Buy products whose label also says: "broad spectrum," meaning it protects against the two types of harmful sun rays, and "water resistant," meaning it stays on your skin longer, even if you get wet or sweat a lot.

   Tips for using sunscreen products:
   - Put a sunscreen of at least SPF 15 on your skin 15 to 30 minutes before going outside.
   - Rub the sunscreen evenly on all uncovered skin. Be sure to put it on your eyelids, lips, nose, ears, neck, hands and feet.
   - If you do not have much hair, put it on the top of your head.
   - Do not get a sunscreen in your eyes. It can sting.
   - Once in a while, put on more sunscreen while you're in the sun. Read the label to see how often to put it on.
   - Do not use a sunscreen on babies under 6 months old.
   - On children older than 6 months, use a sunscreen every time they go out.
3. **Wear a hat**. A hat with a wide brim helps shade the neck, ears, eyes, and head.
4. **Wear sunglasses**. Buy only sunglasses with a label saying the glasses block 99 to 100 percent of the sun's rays. If there is no label, do not buy the glasses.
5. **Coverup**. Wear loose, lightweight, long-sleeved shirts and long pants or long skirts when in the sun.
6. **Avoid artificial tanning methods**. This includes sunlamps and tanning beds, as well as tanning pills and tanning makeup.

   Tanning pills have a color additive that turns your skin orange after you take them. The FDA has OK'd this color additive for coloring foods but not for tanning the skin. The large amount of color additive in tanning pills may be harmful.

   Tanning makeup is put on the skin to make it look tan. Sometimes the color can be washed off with soap and water. Other times, it wears off after a few days. These products are not sunscreen lotions and will not protect your skin from the sun.
7. **Check your skin regularly for signs of skin cancer**. Look for changes in the size, shape, color or feel of birthmarks, moles and spots. If you find any changes or find sores that are not healing, see your doctor.

   Look at the back of your neck and scalp with the help of a hand mirror.

   Look at your body – front, back and sides – in the mirror.

   Bend your elbows and look at the undersides of your arms.

   Look at the backs of your legs and feet.

   Check parts that are hard to see – like your back – with a hand mirror.

Botox: Background[10]

Botox®, manufactured by Allergan Inc., belongs to a class of drugs called botulinum toxins, which derive from the bacterium Clostridium botulinum. Strange as it sounds, this is actually a very similar source of many common medicines, such as penicillin and other antibiotics, which derive from mold.

Although there are seven different types of botulinum toxins (A, B, C1, D, E, F, and G), most of the research conducted to date has focused on type – called BTX-A, manufactured as Botox®.

The bacterium produces a protein that blocks the release of acetylcholine, which normally transmits messages from the nerves to the muscles to make them contract and move. Once transmission has been blocked, muscles relax, providing relief to patients with overactive muscles, reducing spasms and pain. The effect is completely reversible and generally lasts for a few months in most clinical uses.

Botox: Approved applications

Frown lines

The "Botox® buzz" began with the discovery that the toxin somehow inhibited the ability to frown when injected between the eyebrows; now, Botox® has been used for cosmetic purposes for over 10 years and is the only BTX approved for cosmetic use in North America.

Two large clinical trials of 405 patients demonstrated that Botox® safely and effectively diminished frown lines (glabellar rhytides) for up to 4 months without any serious adverse effects (Carruthers 2002; Carruthers 2003).

Over 80 percent of study participants reported an improvement in their frown lines a week after injection; after 30 days, patients rated their glabellar lines much improved or non-existent. Improvements were still reported up to 4 months later.

Eye and facial spasms

The term blepharospasm can be applied to any abnormal uncontrolled muscle contraction around the eyes, from blinking or eyelid tics, to twitches and the inability to keep the eyes open for significant periods of time.

Long-term studies have shown that up to 90 percent of patients with blepharospasm obtain almost complete relief lasting 3 to 4 months after Botox® injections (Carruthers 1985; Carruthers 1987; Scott 1985; Tsoy 1985; Dutton 1986; Dutton 1994; Poungvarin 1997).

Hemifacial spasm is a disorder characterized by frequent involuntary contractions of the muscles on one side of the face. Hemifacial spasm is treated primarily with Botox® injections, with up to 95 percent of people with involuntary facial spasms and tics reporting improvement

after treatment (Wang 1998). There is evidence that repeated injections over a longer period of time may increase the benefit (Jankovic 1993).

Wry neck

Botox® has been used since 1985 in the treatment of cervical dystonia (also known as spasmodic torticollis or wry neck), which is characterized by neck muscles contracting involuntarily, causing abnormal movements of the head and neck that may be sustained or jerky. Spasms in the muscles or pinched nerves in the neck can result in considerable pain and discomfort.

Botox® injections directly into the affected neck muscles are the primary and most effective form of treatment for cervical dystonia, reducing the amount of uncontrollable movement and relieving the associated pain in about 70 percent of patients (Jankovic 1990; Velickovic 2001).

Hyperhidrosis

Hyperhidrosis is a chronic disorder of excessive sweating that can affect any body part, including the underarms, the palms, the soles of the feet, and the face.

By blocking the release of acetylcholine, which activates the sweat glands, Botox® injections can relieve excessive sweating, a life-altering procedure for those suffering from the embarrassing ailment, and were approved for use under the arm in September 2001.

Previous treatments for excessive underarm perspiration — which is known as axillary hyperhidrosis — were often ineffective and short-acting, or were associated with significant risks. Studies have shown that 80 to 95 percent of patients respond to one treatment session (Naumann 2001; Lowe 2003; Naumann 2003). Along with a decrease in perspiration, injections can improve quality of life (Campanati 2003) and decrease body odour (Heckmann 2003) for up to 7 months (Naumann 2003). A long-term study has shown that side effects are minimal, and repeated injections over 16 months are safe and efficacious, with 50 percent or greater reduction in sweating seen in 96 percent of patients after the first treatment (Naumann 2003).

EMERGING USES OF BOTOX

Expanding cosmetic applications

Although Botox® has been officially approved only for use in the treatment of frown lines, many physicians have used it for a number of other cosmetic areas for years. It has been found effective in smoothing out horizontal lines in the forehead, crow's feet, mouth frown, dimpled chins, and lines on the neck (Carruthers A 2001). Botox® is now being used in more artistic manners, to lift the brow and shape eyebrows (Huang 2000; Carruthers A 2001; Fagien 2001), widen the eyes to produce a more rounded look (Carruthers J 2001; Flynn 2001), shape the jaw and sides of the face (Park 2003), and to balance asymmetrical features (due to injury or surgery). In addition, studies have found that the addition of Botox® to traditional cosmetic surgery or other procedures (such as laser resurfacing) enhances the result (Fagien 2001).

Botox: Side Effects and Safety

As with any medication, potential side effects of Botox® do exist and vary according to injection site, dose, frequency of injections, and the amount of physician expertise. Most side effects – such as pain, tenderness, or bruising at the injection site – are temporary and occur within a few days after treatment. The most common side effects of injections around the eyes and in the face include temporary bruising, eyelid drooping (ptosis), dry eyes, and double vision (diplopia) (Hsiung 2002; Tan 2002), and facial droop can occur with injections into the cheek. It is generally agreed that in the hands of experienced physicians, these side effects are considered rare.

The most common side effects in patients receiving Botox® for cervical dystonia are difficulty swallowing (dysphagia), upper respiratory infection, neck pain, and headache. Potential complications when using Botox® in the face and neck occur when too much toxin is injected or when the right amount is injected into the wrong muscle. Inaccurate injections in the forehead or around the eyes can cause drooping lids; too much injected in the neck can cause muscle weakness and difficulty swallowing. In general, when used at recommended doses by skilled physicians, Botox® is safe and is not known to cause any long-term side effects.

What long-term clinical data exist show a medication with a good record of safety. In a study of 65 patients who received repeated injections for 10 years, side effects were all temporary and mild and decreased after repeated injections (Defazio 2002). Examination of the eye muscles after Botox® has shown that repeated injections do not cause irreversible muscle atrophy (wasting) or any other degenerative changes (Borodic 1992), and muscle function after injection reverts to normal (de Paiva 1999). A large study of 235 patients who received Botox® injections for cervical dystonia, hemifacial spasm, and blepharospasm showed a 75 percent benefit from treatment for up to 10 years. Although side effects occurred in 27 percent of study participants at any one time, only 1.3 percent stopped receiving injections because of intolerable adverse effects (Hsiung 2002).

What does this tell you?

Botox® injections have not been shown to permanently change your muscles or cause any long-term problems. The side effects of Botox® injections are usually exactly what the therapy is supposed to cause: muscle weakness. It's crucial to inject into the right muscle with the appropriate dose. Finding an experienced physician is of utmost importance, as many complications are the result of misplaced injections or too-large doses.

Important note – Licensed cosmetologists and estheticians are prohibited from performing Botox treatments. Botox treatments may only be performed by a licensed physician.

CHEMICAL MAKEUP AND CONDITIONS OF THE SKIN

Final Examination Questions

Choose the best answer for the following questions 1 through 10 and mark your answers online at **Cosmetology.EliteCME.com**.

1. The outermost layer of the skin is called the hypodermis.

   ○ True ○ False

2. Unclean skin favors the development of pathogenic organism.

   ○ True ○ False

3. Atopic eczema is the most common of all skin disorders.

   ○ True ○ False

4. Approximately 90 percent of fungal skin infections are caused by dermophytes, which are parasitic fungi affecting the skin, hair, or nails.

   ○ True ○ False

5. Acne is not a hormonal problem; it is a hygienic issue.

   ○ True ○ False

6. Removing tattoos is a fairly easy process.

   ○ True ○ False

7. Some side effects of Botox can be temporary bruising, dry eyes, and double vision.

   ○ True ○ False

8. Schools and anyone employing cosmetology licensees are required by law to collect and maintain a file on MSDS for the chemicals used in the establishment.

   ○ True ○ False

9. If you are a healthy person, it is not really important to know the ingredients in your personal care items.

   ○ True ○ False

10. The Federal Drug Administration looks for patterns of complaints or unusual or severe reactions caused by personal care products.

    ○ True ○ False

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