Head Lice: Perfectly Adapted Human Predators

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PROLOGUE
Lice and their treatment are presented to students in the third professional year as a portion of a four-hour required course in Nonprescription Products and Devices. Taught three times yearly, the course uses the textbook Nonprescription Product Therapeutics.

The section on head lice occupies approximately 90 minutes, and is supplemented by several learning interventions. Students view slides supplied by the Centers for Disease Control illustrating head lice, nits and nymphs. The instructor also passes dead head lice around the classroom to facilitate the student’s recognition of the pest in regard to size and color. Finally, as students enter class, they are asked to look into a microscope set to 10X with a slide of nits attached to a hair. When available, the instructor prefers to use viable nits to allow visualization of the nymph’s heartbeat. Occasionally, students may witness the emergence of the nymph from the egg case.

INTRODUCTION
The fear of being preyed upon is nearly universal in human beings. Various phobias exist to such intentional or accidental predators as sharks, spider, snakes, scorpions, tigers and bears. In this section of the dermatology lectures we explore just such a predator, a parasite which must obtain regular meals of human blood to exist.

Stories of obligate human parasites are decades old, with the most well-known being the vampire mythos. Dracula was written to be a horrifying story, but at least after he drank the victim’s blood, he flew out the window. We are now covering the head louse, another blood-sucking human predator, but there is an important difference: head lice do not willfully leave the host. These creatures have a perfect existence, eating and defecating on your head, meeting members of the opposite sex, copulating, and laying eggs on your hair. They are referred to by some as “mechanized dandruff.”

This is not a glamorous topic. In other therapeutics courses you are able to cover the more compelling human conditions, such as diabetes mellitus, renal failure, and hepatic encephalopathy. Throughout this nonprescription products course we have studied the “minor” medical conditions which many clinicians simply do not have sufficient time to cover (e.g., hemorrhoids, gingivitis, motion sickness, and dandruff). However, for the sufferer they are obviously important, as sales of products marketed to treat them continue to grow. Some of these conditions are also extremely embarrassing. For this reason, the pharmacist must exercise great tact when counseling patients who require assistance.

THE HEAD LOUSE

General Information. There are three types of human lice, each perfectly evolved for its ecological niche. The most common is the head louse, Pediculus humanus, var. capitis. The second most common type, the crab louse (Phthirus pubis) is placed into a separate genus(1). The least common type of human louse in the U.S. is the body louse, Pediculus humanus, var. humanus or corporis (both terms have been used), which is very similar to the head louse, differing mainly in its living

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preferences and some minor anatomic features. Whereas the head louse lives on the head and lays its eggs on the hair shaft, the body louse lays its eggs in clothing that is worn for many days without being washed, while obtaining blood meals from the person wearing the clothing. Unless specifically mentioned, all of the remaining comments will refer to the most common type of human louse, the head louse.

Paleontologists have yet to locate fossilized head lice, but there is a rich historical lore surrounding lice, nonetheless. Archeologists are quite familiar with lice, having excavated mummies with lice, ancient combs with nits, and records indicating that Egyptian priests shaved the heads to treat head lice(2). Examination of ancient lice reveals that they are identical to the present-day predators.

Head lice belong to the order Phthiraptera, and to the group Anoplura. These insects have no wings, nor can they jump. The pharmacist counseling a patient with head lice does not have to fear that the lice will fly over or jump onto the pharmacist like a grasshopper. Their method of movement relies on six legs, each of which terminates in a claw that is easily able to grasp human hair. Using claws alone, lice can crawl through hair at an astounding 12 inches per minute, no mean feat for an insect that is only 2-4 millimeters in length(2).

The head louse found on humans is a human parasite only, and cannot be contracted from the family dog, cat, or any other animal. While other mammals and birds do indeed have lice, they are species-specific, so much so that they are placed in different groups, families, or genera(3).

The Life Cycle. The female head louse lives for about 17-22 days, laying about 10 eggs daily, so she could potentially infest the human with approximately 200 eggs, assuming she locates a sexually mature male whenever fertilization is required(1). She lays eggs (known as nits) on the hair shaft itself, in the closest proximity possible to the scalp in most cases, at the skin-hair shaft junction. She attaches the egg to the hair with an extremely strong cement that allows the nit to remain tightly affixed despite regular combing and washing. Each oval egg is composed of a waxy material that protects the maturing larva, with a perforated top to allow respiration. The larva normally matures to its birth time in 6-9 days, using the body heat radiating from the host’s scalp as an incubator(4). When it is ready to exit the egg case, the immature insect begins to swallow air, expelling it rectally. This forms an expanding bubble which pushes the insect through the top of the egg to the outside. This insect truly flattulates its way to life. Following its birth, the nymph must obtain a blood meal from the host within 24 hours or it will not survive. After birth, the nymph matures sexually in 7-10 days, meets a louse of the opposite sex and begins the life cycle anew.

EPIDEMIOLOGY OF HEAD LOUSE INFESTATION
In order to delineate the population groups most likely to contract head lice infestation, we need to first look at the methods by which they are transmitted to patients. A primary method of transmission is host-to-host, usually direct head-to-head contact. For instance, suppose an uninfested child is sleeping with an infested child (such as a sibling or a friend) during a sleepover. If the hair of the infested child contacts the hair of the uninfested child, the lice have a handy hair bridge that is approximately body temperature to facilitate colonization of the unsuspecting new victim.

The mode of transmission is often less direct. Perhaps children’s coats are kept in a pile or on adjacent hooks at school or daycare. Lice on the infested child’s coat can crawl onto another coat. Then, they will enter the new child’s scalp when the coat is worn. Similar comitie-to-person spread is seen when items are shared by successive individuals, such as baseball helmets, computer headphones, or portable CD player headphones. Wearing another person’s hats, scarves, or using their combs, brushes or other grooming aids may facilitate spread. When the mode of transmission is one of these less direct avenues, it is usually from contacting an item that has very recently contacted the host’s head. By contrast, lice are seldom contracted through direct contact with parts of the environment which are not in intimate contact with a head (e.g., tables, couches, chairs, rugs). Lice do not mount expeditions, striking off to find new heads. Instead, since they are obligate human parasites, they have evolved with the instinct to stay on the human at all costs. Thus, the perception of one’s entire house being contaminated is mistaken. With the above transmission methods in mind, those most likely to become infested with head lice are patients with a family member or close friend who is infested(4).

Age. The average person thinks of head lice as a problem of childhood, and this is usually true, in that the most common age infested is 6-11. These children are more likely to engage in activities that allow prolonged head-to-head contact, such as taking nap breaks during school. Of course, once a family has an infested member, age is no longer a consideration since families tend to have close contact with each other regardless of age.

Gender. Females of all ages are more prone to contract head lice than males. Young girls often enjoy close-contact play, such as “dress-up” and grooming each other and themselves. Boys, on the other hand, are sociologically more inclined to play games that do not involve close contact with other boys (chase games, hiding games, war simulation). Even within the family, the mother is more likely to provide reassurance and nurturing that may involve sustained hugging.

Race. All hair is not alike. The hair of Caucasians, Orientals, and native Americans is round in cross section, whereas those of African descent have hair that is oval in cross-section. The lice that predominate in the U.S. are thought to have arrived with the early Caucasian settlers. Having evolved with their hosts, they are only able to grasp the rounded hair with their claws(1). They cannot easily grip the oval hair shaft. For this reason, Black children are rarely infested in the U.S., although every other group is at high risk. Conversely, African lice are evolved to grip the oval hair, so those with rounded hair shafts are largely protected from infestation with the native lice found in Africa, and African natives are at high risk in their home country.

CONFIRMATION OF HEAD LOUSE INFESTATION
When a patient suspects head lice, what can the pharmacist do to help confirm their presence? The most obvious thing is to inspect the heads. The technique of checking heads is not difficult, once the pharmacist is properly trained. I use it in my practice and also in the mass screening programs which I have conducted.

Confirmation via Combing. I have heard students and other professionals speak about seeing heads that are so heavily infested that the hair is literally crawling with lice, even to the
extent that the hair seems to move. However, these patients are the exception. Rather, the pharmacist or other examiner must conduct a painstaking search to confirm an infestation.

The pharmacist should expect to find few live lice during an exam, perhaps no more than 5-10. United States lice are tan in color, matching the background Caucasian skin (lice found in Africa are darker, matching the predominant skin color of its native residents). American lice can be compared to a sesame seed in size and color, except your typical sesame seed is not capable of locomotion. Head lice have receptors on their body which sense movement of adjacent hairs. When the pharmacist parts the hair, they scramble to safety in the nearest dense bundle of hair, making them hard to see and even more difficult to capture.

When checking the head, there are several specific steps that should be followed:

- Wear disposable gloves;
- Find a location with good light, preferably direct sunlight. This may require seating both the patient and examiner outdoors on a patio or the pharmacy’s back porch. If this is not available, a strong lamp may be sufficient;
- If the examiner is far-sighted, has poor vision or any other visual detail abnormality (e.g., amblyopia), a magnifying glass may be necessary;
- Remove tangles from the hair with a comb or hairbrush;
- Divide the hair into sections, examining each section individually and fastening it away from non-examined hair when it is inspected;
- Grasp a one-inch section of hair and use a lice comb to comb each hair section carefully and slowly from the scalp outward to the end of the hair. Lice combs traditionally sold for lice detection/removal are made of a one-piece plastic or metal construction that hinders their efficiency greatly. However, a recently introduced lice comb is rapidly becoming the standard for lice detection and removal. Known as the LiceMeister, it is made by embedding 32 stainless steel teeth in a rigid plastic handle. The teeth are long and tapered, and are set so close that combing removes virtually all lice, both adults and nymphs, and virtually all nits. Thus, this innovative device can both screen for the presence of lice and remove them to halt an infestation(5).
- Dip the LiceMeister into a cup of water after each hair section is combed. If debris (e.g., nits) builds up between the teeth of the comb, use a toothbrush or dental floss to clean between them.
- Continue combing each section of hair until all is thoroughly combed.
- If the exam is negative, caution the parent or caregiver to screen each day, as long as lice infestation is still possible or suspected.

Simple Visual Confirmation. If the LiceMeister is not available, the pharmacist may still be able to detect head louse infestation, although it is more difficult to inspect all of the hair. In this case, the pharmacist should still use gloves, strong light and a magnifying glass if necessary. The hair may be parted with wooden paddles and inspected carefully. The efficiency of this method is far lower than with combing.

When simple visual confirmation is sought, the pharmacist should look for live lice, but also the oval-shaped nits attached to the hair shaft. It is almost impossible to tell visually which nits are still incubating eggs and which are hatched, but there are several clues. Nits most likely to be viable are those closest to the scalp. Hair grows about 0.35 mm daily, so a nit which is located as far as 1 inch from the scalp was probably laid as long as 2.6 or more months ago. If this nit is not empty, it is not viable in most cases, since its probable residence time on the head exceeds the incubation period. As lice themselves depend on frequent blood meals, they are most often found next to the scalp, and this is where laid eggs have the best chance of hatching since it is in closest proximity to human body heat. However, there are exceptions. In some way, a gravid female louse’s behavior changes when she is in a warm climate, where the ambient air is close to human body heat, or exceeds it. In these cases, she may lay an egg anywhere along the human hair shaft, since outside temperatures facilitate hatching. So it is not enough to examine distance from the hair to determine viability of a nit. One must also take the temperature of the ambient air into account. On a cold Minnesota day, a nit located two inches from the scalp would probably not be viable, but on a warm Texas summer day, it might well be viable.

The appearance of the nit is also a clue to its viability. A nit which still contains a viable or dead unhatched louse appears darker and translucent, whereas an empty egg case appears whiter, more dull, and more opaque. Since these judgments are difficult at best with the naked eye, I confirm them with a microscope when feasible. I ask the patient if I may examine strands of hair with nits in situ and remove several for later inspection, also taking a home or work phone number from the patient. After a microscopic examination, I can call the patient to provide instructions the following day. This final step continues the requirements for providing pharmaceutical care for head lice, by helping ensure that the patient is properly treated.

Differentiate Pseudonits. When looking for nits, the pharmacist must be alert to pseudonits which resemble nits but which are not signs of louse infestation. A pseudonit is any object found in the hair which can cause diagnostic confusion. This wide range of residue can include dandruff scales, dirt or small plant matter blown into the hair, or flakes from hair spray or hair grooming aids. Generally, if the matter can be easily flicked from the hair with the finger, it is not a nit, since the glue used by the mother louse to cement nits holds them tightly. An exception is an object known as the desquamated epithelial cell plug, which is ejected from a hair under certain conditions. It encircles the hair, and cannot be easily removed. Again, a microscope will differentiate these nonviable objects from nits.

Look for Lice Feces. Lice feces are dark in color. They may fall into the inner collar of a shirt or blouse, where they become lodged in the clothing. As the person turns the head from side-to-side, body moisture spreads the feces along the inner collar. The pharmacist may note these black streaks as an indicator of louse infestation.

Ask About Additional Symptoms. The patient affected with lice may scratch vigorously to remove them. The pharmacist may notice open sores on the head where the fingernails have penetrated the skin. If they become secondarily infected with staph and/or strep, they are said to have undergone “impetiginization.” These lesions may be more or less parallel in arrangement, caused by simultaneous penetration from several scratching fingernails, a phenomenon known as “railroad tracking.” Occasionally, a patient is so heavily infested with
head lice that systemic symptoms occur. They include enlarged posterior cervical lymph nodes, fever, anorexia, enervation, and malaise. These patients should be referred to a physician to evaluate the need for an antibiotic/antibacterial prescription.

PESTICIDE TREATMENT OF HEAD LOUSE INFESTATION

Treatment of head lice has changed radically in the last decade, as we have gradually turned away from the pesticides known as pediculicides. At that time, a trade named lindane product (Kwell) was widely recommended, a prescription product containing malathion (Ovide) was available, and the nonprescription armamentarium which contained only synergized pyrethrins had recently been expanded with the Rx-to-OTC switch of the pesticide known as permethrin (Nix). Things looked rosy for elimination of this ancient human predator. Unfortunately, the bright promise of these treatments soured in the 90s as the topical pesticides began to lose their luster. What is the current status of the pesticides?

**Lindane.** Lindane is a cyclodiene pesticide which is also the most toxic pediculicide available(6). It kills very slowly; as the lice die they twitch on the scalp, producing an uncomfortable sensation for the patient.

Lindane has several other attributes that argue against its use. It does not kill all ova (its ovicidal activity is only 45-70 percent), allowing viable ova to survive and prolonging the infestation. Its widespread use has allowed resistance to develop(4,7).

Lindane also carries the risk of human toxicity. Its primary deposition occurs in the brain’s white matter(8). Severe adverse reactions have been reported, including seizures, which may occur as uncontrolled motor activity lasting for 48 hours or longer(7,8). The risk of this is enhanced when the patient bathes before treatment, has dermatitis, or excessively thin skin. Aplastic anemia and renal disorders also may occur(7).

Kwell was a major trade name for lindane for many years, but it has been discontinued. However, generic lindane products are still available. The pharmacist dispensing the product should wear gloves while pouring it to prevent unintended contact. Patients should be warned not to use more than two ounces of lindane shampoo per application and to wear gloves when using the shampoo. Since oils enhance absorption, the patient must avoid application of any oil to the hair for several days prior to lindane use. The lather must not touch any areas other than the hair. Lindane should only be reapplied if the physician has advised the patient to do so, and it must not touch broken skin.

I was the pharmacist expert at a roundtable on lice treatment in Boston several years ago. One of the attendees was a structural pest eradication specialist. He reacted in astonishment as I described the dangers of using lindane in humans. When his turn came to speak, he stressed that lindane has been prohibited in structural use for many years due to toxicity. This should cause the pharmacist to question further any application to humans.

Although many of the adverse reactions from lindane were a result of misuse, it is prudent to take great care with a product whose misuse can be deadly. In light of the possibility of serious toxicity and the potential for resistant lice, pharmacists should not recommend that physicians prescribe lindane. Unfortunately, the patient may only be able to obtain medicament for head lice by relying on a third-party payer such as the state. If reimbursement is limited to prescription items, both patients and physicians turn to lindane, the only prescription lice pesticide. Once again, the pharmacist may choose to intervene, urging the patient to choose a lice treatment based on safety to the patient rather than only on economic criteria.

**Malathion.** Malathion was once available as the prescription product Ovide, but the odor of the formulation was offensive to patients. For this reason, its sales were inadequate to continue and the product is no longer available. This organophosphate insecticide was a safer prescription alternative to lindane, in that no systemic effects with use were noted(7). The manufacturer once suggested that the product might be relaunched, but this has not yet happened.

**Synergized Pyrethrins.** Pyrethrins are chemical insecticides produced naturally by the Chrysanthemum plant. However, lice can easily detoxify these chemicals through oxidation unless a synergizing agent is added to enhance their pesticidal activity. Piperonyl butoxide is a petroleum derivative which accomplishes this. This combination was given Category I status (safe and effective) by the FDA for pediculicidal use(9). Shampoos containing synergized pyrethrins are applied to wet the hair, while adding sufficient water to form a lather. The lather is left in place for 10 minutes only. The patient then washes the hair thoroughly with warm water and soap or nonmedicated shampoo. Since the combination is not completely ovicidal, a second treatment in 7-10 days is mandatory to kill any newly hatched lice. While some synergized pyrethrin products claim to be effective in only one dose, there is insufficient data to support this claim, and a second dose is considered by the FDA to be mandatory.

Patients allergic to either Chrysanthemums, ragweed, kerosene or any petroleum derivative must not use synergized pyrethrins. It must not be used near the eyes or allowed to contact mucous membranes. The hands should be washed thoroughly after application.

Several controversies have recently arisen in regard to synergized pyrethrins. One is the increasing resistance. Patients entering pharmacies are claiming that they have followed the directions exactly, and are still infested with head lice. In many cases, a cursory check confirms the presence of live lice. Upon close questioning, it seems that the parent or caregiver has indeed been conscientious in following the labeled directions, leading the pharmacist to suspect resistance. Although it is poorly documented at present, it seems that resistance to pyrethrins is a growing problem.

Another controversy involves several false advertising claims that were made by manufacturers. Among other things, they claimed that synergized pyrethrin products (e.g., Pronto, RID, Clear Lice Killing Shampoo) are effective in one dose, killing 100 percent of lice and eggs. One may visit the Federal Trade Commission website to view the results of an agreement by their manufacturers to settle charges of misleading consumers with these false claims. The Director of the FTC stressed that false and misleading claims such as these add insult to injury for the patient already affected with head lice(10).

**Permethrin.** Permethrin (Nix Creme Rinse) is a synthetic pyrethroid pesticide which was an Rx-to-OTC switch in the early 1990s. The patient should shampoo and towel-dry the hair and apply the product, leaving it in place for 10 minutes.
The product is then thoroughly rinsed from the hair.

Permethrin is only 70-95 percent ovicidal; the manufacturer claims that less than one percent of patients will require a second treatment. The manufacturer also alleges that residual effects protect against reinestation for 14 days. This is the basis for the advertising claim, “Only Nix—Only Once.” However, some patients will require a second treatment. Pharmacists recommending this product should caution patients to be continually vigilant after treatment to discover live lice that indicate the need for the second treatment.

Patients with a Chrysanthemum allergy may also be allergic to permethrin. Contact with the eyes or mucous membranes should be avoided. Resistance to permethrin is emerging(11).

OTHER INTERVENTIONS

The growing resistance of head lice to synergized pyrethrins and permethrin has caused many consumers to turn to alternative methods of treating head lice. Some are ineffective and dangerous, but diligent combing is rapidly emerging as the treatment method of choice.

Hair Removal. The pharmacist should advise against shaving the head of the individual infested with head lice. While it is undeniably effective, the child may become the focus of teasing among classmates.

Flammable Chemicals. Unfortunately, reports of death and injury continue to accumulate when individuals use flammable chemicals to treat head lice. Reports of these accidents are usually confined to newspapers and news media in the state where the accident occurred, which does not allow one to gain a handle on the national scope of the problem. Nevertheless, it is a growing phenomenon. In Oklahoma, a man rubbed gasoline on his daughter’s hair. It ignited, causing second-degree burns to the father(12). Gasoline use on head lice also caused an Oklahoma house fire which killed a baby. A 16-year-old girl using gasoline experienced 2nd and 3rd degree burns over 90 percent of her body when a pilot light on a water heater ignited the fumes(13).

Another family used lantern oil, which ignited, causing third-degree burns over 50 percent of the eight-year old child’s body and third-degree burns on the mother(14). Similar fires have occurred with kerosene and other flammables. In all probability, patients using old home remedies such as these have not sought the advice of a pharmacist, perhaps due to embarrassment. For this reason, the pharmacist must highlight the dangers of these and similar home remedies whenever the opportunity arises, such as any public health speaking engagement.

Dangerous Pesticides. Some people resort to dangerous pesticides which are not meant to be used on humans. For instance, some nonprescription veterinary flea preparations may list lice on the label. People assume that they are safe for human lice, using them indiscriminately on children and adults. Their toxicity is unknown and their effectiveness for human lice is questionable. They must be avoided.

Even worse, some patients resort to highly concentrated pesticides. In an Oklahoma case, a six-year-old child with head lice was treated with industrial strength diazinon(15-17). Within 15 minutes, her respiration ceased and she suffered full cardiac arrest. After almost three weeks in a hospital, she was evaluated as having permanent brain damage. Charges of child abuse were filed against the mother’s boyfriend who treated the child, with bail being set at $100,000. Eventually, the charges were dismissed, but the prosecutor appealed that decision. Pharmacists must strongly advise against any unapproved pesticide in humans.

Alternative Treatments. Several companies have begun promoting wholly unproven head lice remedies. They include tea tree oil, rue and other herbal ingredients. These herbs suffer from a twofold problem: lack of information about safety and absolutely unproven efficacy. Patients using them suffer from a false sense of security that they are actually treating the problem. This allows the head louse population to increase unchecked, worsening the infestation and associated symptoms. Pharmacists must advise against these natural herbal interventions until sufficient data proving safety and efficacy is submitted to the FDA.

Suffocating Treatments. Some patients turn to friends and Internet sources, who have heard of suffocating head lice by applying heavy oil-based products to the head for varying lengths of time. As an example, patients are advised to cover the hair with mayonnaise or olive oil and wrap the head in plastic wrap, leaving it on overnight. There are several problems with this approach. The efficacy of suffocating agents is unproven, as there are no studies comparing them to other remedies(18). The products must eventually be removed from hair, and the heavy load of oil on the hair may require multiple shampooing with harsh detergents. The net effect is irritation of the scalp. Of course, the potential hazards of sleeping all night with one’s head covered in decomposing mayonnaise or rancid olive oil are also vitally important. If one has open wounds on the scalp, as many longstanding head lice sufferers do, bacterial contamination of the mayonnaise or olive oil could cause a skin infection. Pharmacists should advise against unproven therapies such as oily suffocating agents.

Nit Cement Dissolving Agents. An old home remedy is to use acidic products to dissolve the cement holding the nit to the hair shaft. However, when patients have used acidic products such as vinegar, they have caused facial and opthalmic burns(19). Use of vinegar should be discouraged.

Several commercial products which allege to dissolve the nit cement have been marketed. Step 2 employs formic acid, but its efficacy is unproven. Clear claims that its enzyme-based approach dissolves the cement, but the manufacturer was cited by the Federal Trade Commission for falsely claiming that the efficacy was proven by laboratory and field studies(9).

Household and Environmental Sprays. Several companies have marketed aerosol sprays which patients can use to spray the environment. However, the use of these products should be discouraged for several reasons. When a household member has head lice, the major reservoir is the heads of the victims. Few lice are found out in the surrounding environment, unless they have been accidentally dislodged from the head during acts such as scratching or combing. Another problem with environmental sprays is that they foster the paranoia of affected family members, who tend to overuse them, spraying all household surfaces. Since these are pesticides, their safety upon inhalation over a sustained period is unproven. One can only imagine the toxicological effect of the pesticide on a sleeping child lying face down on a heavily sprayed mattress and pillow over a 10-hour sleep cycle. The safest and most effective alternatives the pharmacist should recommend for environmental lice removal is reassurance coupled with thorough vacuuming of the environment.
THOROUGH COMBING AS THE EMERGING TREATMENT OF CHOICE

The various pesticides marketed for control of head lice are toxic to the patient in varying degrees and lead to the development of resistance. Other treatments are of unknown safety and/or efficacy, and some are highly dangerous. For these reasons, pharmacist recommendations should shift in the new millennium to thorough combing with a highly effective comb such as the LiceMeister, which has been registered with the FDA as a medical device(5). Its use was described above as a tool to confirm an infestation. However, it also treats the infestation by removing the nits. Resistance and toxicity are non-issues with this mechanical lice removal aid.

SUMMARY

Students in their senior year realize that the real world is uncomfortably close. They appreciate learning about nonprescription products from a faculty member who is a registered pharmacist and who also continually works in a retail pharmacy. This ongoing practice paid off handsomely in the area of head lice treatment by allowing me to gain an early appreciation for the emerging problem of resistance, as evidenced by the large numbers of people with whom I consulted and for whom traditional nonprescription products were ineffective. It also allowed me to recommend an improved way to eradicate head lice, and to monitor patients who purchased it. Describing these actual work situations to students enriches the academic experience and helps students bring the most effective treatments to their patients when they enter their own practice settings.


References