THE SOLDIERS' FEET AND FOOTGEAR.

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ASSOCIATION, 1914.

THE SOLDIERS' FEET.

The soldier's foot has not only to support the whole weight of the body, but also to act as a buffer, and prevent shocks being transmitted to the knee and hip joints when jumping or doubling over rough ground. The Germans found that lifting the foot high when marching made the troops more surefooted, and that while before its adoption, 25 per cent. of the men stumbled, and 10 per cent. fell in a charge over rough ground, the new method practically eliminated such misfortunes. Any horseman will recognize this, for not only is it safer to canter than to trot on rough ground, but a horse that does not lift its feet is a danger anywhere, not only to himself, but to the rider.

The soldier's foot must be capable of standing the strain of long marches without becoming incapacitated by pain and loss of power. The medical officer should reject as unfit any recruit who suffers from the following conditions in a bad form:

1. Flat-foot.	4. Ingrowing toenail.
2. Hallux valgus.	5. Corns.
3. Hammer toe.	6. Bunions.

Some of these conditions can be cured so as to give a man a serviceable foot, but with others it is quite impossible. In the former case a recruit should not be accepted until he has undergone treatment, and been cured, while, in the latter, he should be unconditionally rejected.

1. *Flat-foot*, if of a slight degree, may be disregarded, as in many cases it does not get worse with long marching. Some medical officers refuse all cases of flat-foot, but in my opinion this is too drastic. I know a well-known quartermaster, rejected twenty-nine years ago by the 17th Lancers on account of a slight degree of flat-foot, who was accepted next day by the Grenadier Guards, and who assures me that he has never had any trouble with his feet from that day to this. In a great number of cases the healthy outdoor life of a soldier, coupled with the physical exercises and marches, tones up the muscles which support the arch. The formation and maintenance of the arches was fully discussed earlier in this paper; when the muscles and ligaments have yielded, the head of the astragalus and scaphoid may even rest upon the ground, on standing. The flat-footed person walks with the toes turned out, and the heels do not leave the ground, so that all elasticity in walking disappears. In a bad case a man complains of pain along the inner side of the foot, and in the calf on marching, and gets tired very quickly. I make it a rule to reject a man with flat-foot if he is quite unable to raise himself on his toes and restore the arch by the action of the muscles of the calf. If the flat-foot is only slight, tip-toe exercises, combined with massage of the deep muscles of the calf and sole of the foot, improve the condition. Mechanical supports are not to be encouraged in the soldier, though they may be of use in civil life. I am of opinion that careful lacing of the boots, so as not to

Fig. 5.—Hallux valgus, showing bunion and deformity; A, bunion.

retard too much the increasing convexity of the tarsus in the act of rising when walking, considerably helps matters, and a good plan is to tell the men to knot their laces low down (as for a shoe) and then to continue to lace less tightly in the upper holes. The heel and sole of the boot may be made continuous on the inner side, or the inner border may be raised so as to throw the foot on to its outer border.

2. *Hallux valgus*, if in an advanced state, incapacitates a man for marching, for the great toe, being abducted at the metatarso-phalangeal joint, is compelled to pass either above or below the second toe, thus crowding the

liability to cross. The head of the first metatarsal bone is pressed upon by the boot and gives rise to a bunion.

It is not within the province of this paper to discuss the operative treatment of this deformity, but one may unhesitatingly say that a man with such a foot should be rejected. Slight cases may be treated by giving a boot with wide toes and a straight inner border, and by keeping the great toe in a straight line by mechanical means.

3. *Hammer Toe*.—In this condition the toe is flexed at

Fig. 6.—Hammer toe, showing deformity and favourite situation of corns.

the proximal phalangeal joint, on the top of which there is generally a corn. At the end of the toe, where it presses on the boot, another corn is often found, and

these corns become exquisitely painful and prevent a man from marching.

Formerly the toe was amputated, but to-day the proximal phalangeal joint is excised or the toe straightened by section of the flexed tendon and the lateral ligaments at the first interphalangeal joint. If either of these treatments be adopted successfully there is no need to reject a man, but if operative treatment be refused he should be found unfit for service.

4. *Ingrowing Toenail*.—This is an extremely painful condition, caused by wearing boots with narrow toes. In a slight case the boots having been corrected, the nail should be cut square and a wedge-shaped piece taken from the centre, or the centre of the nail should be scraped and filed down and the pressure relieved by packing plugs of cotton-wool under the free ends and sides of the nail. If this does not relieve the symptoms, the nail should be removed by one of the recognized methods.

5. *Corns*.—Hard corns, caused by the pressure of tight boots, are most commonly found on the sides of the toes, under the tread, and on the heel. Soft corns, caused by dirt and sweat, are usually found between the toes. Corns are more painful in wet than in dry weather, and are said to "shoot," a condition due to a sudden increase of activity in the vascular and sensitive papillae, on the approach of damp weather. The treatment of corns may be divided into palliative and radical, but it should be remembered that if the boots fit properly without undue pressure the soldier should be free from them. If no chiropodist is at hand the corns may be rubbed down daily with pumice stone, and if tender, protected with a piece of stockingette plaster, stretched over the corn with a good margin. For the radical cure the area of corn is painted with tincture of iodine, and all the thickened epidermis is cleared away with a scalpel, this being facilitated by making the skin tense with the left fingers. Then the concentrated apex or ridges, which are the actual cause of the pain, are lifted out with a sharp-pointed straight scalpel. Often there is a small adventitious bursa, which should also be removed, and an antiseptic dressing placed in the cavity. Circular plasters are seldom effective, as the portion on the distal side of the corn may press back in walking, and irritate, but it is advisable to pad with a crescent-shaped piece on the posterior aspect of the wound, and cover with a stockingette plaster.

6. *Bunions* are generally associated with hallux valgus, and, if accompanied by synovitis, prevent marching. To alleviate the pain a wedge-shaped felt pad should be worn between the great and second toes at the base, and, in addition, a crescent-shaped adhesive felt pad on the metatarsal aspect, posterior to the joint. This condition is greatly helped by a 1-in. zinc oxide strapping round the shafts of the metatarsal bones, sufficiently tight to hold them a little closer together, as with a bunion there is

Fig. 7.—b, Wedge-shaped piece of felt; c, bunion.

liability to cross. The head of the first metatarsal bone is pressed upon by the boot and gives rise to a bunion.

always a lateral expansion of these bones. This strapping should be put round slightly diagonally, encircling the foot twice and overlapping, so that the total width is $1\frac{1}{2}$ in. Leslie's zincoplast is the best for this purpose, as it causes no irritation and can be worn for a fortnight without discomfort. Incipient bunions may be painted with iodine or rubbed with iodox; if there is much inflammation the joint can be quickly reduced by an application of antiphlogistine.

SORE FEET.

The disabilities of the foot already mentioned, although coming under the general heading of sore feet, as used in military parlance, do not constitute the ordinary variety met with after a march. Sore feet are of several varieties and degrees of severity, and, if promptly and properly treated, may be quickly cured. When the skin of the foot is irritated by the boot or sock either pressing or rubbing on it, or when, through lack of cleanliness, sweat and

Fig. 8.—Common situation of blisters.

various germs collect on it, the foot becomes hot, swollen, and tender. If the condition is not suitably and quickly treated, blisters form, especially under the heel and above it, at the sides of the feet, between the toes, and at the anterior roots of the toes. If this in turn is neglected, there is a danger of the hard, horny skin being rubbed off, and the tender deep layer of the true skin being exposed, and if this is not treated there is every possibility of the deeper tissues being involved, and of an ulcer forming. The causes of sore and blistered feet after a march are:

1. *Boots.*
 - (a) Too tight, causing pressure.
 - (b) Too loose, causing friction.
 - (c) Too hard, through lack of oil or dubbin.
 - (d) Shrunk, through getting wet.
 - (e) Nail or seam inside boot.
 - (f) Improperly laced boot.
2. *Socks.*
 - (a) Too tight, causing compression of toes, or heel of sock getting under sole of foot.
 - (b) Too loose, causing wrinkles.
 - (c) Dirty socks.
 - (d) Socks with holes.
 - (e) Too thin and non-absorbent socks.
 - (f) Badly darned socks.
3. *Feet.*
 - (a) Dirty feet.
 - (b) Sweaty feet.
 - (c) Deformed feet.
4. *Accidental.*
 - (a) Grit or foreign matter in boot.
 - (b) Burn or scald when cooking.
 - (c) Punctured wound from external object.
 - (d) Weight, such as rifle, falling on foot.
 - (e) Kick or stumble.
5. *Vasomotor.*
 - (a) Frost-bite.
 - (b) Chilblain.

Practically all these causes can be avoided if a little care be exercised, and it is seen that:

- (a) The boots and socks fit properly.
- (b) They are periodically inspected.
- (c) The boot is kept soft and supple.
- (d) The sock is kept clean and well darned.
- (e) The feet are washed and thoroughly dried daily.
- (f) There is a regular foot inspection.
- (g) The chiropodist is consulted early.

In the paper on "Common Ailments in Camp" which I read this year at the annual meeting of the British Medical Association,¹ I said: "One of the greatest troubles in camp is blistered feet, and a large percentage of men is rendered unfit for duty for one or more days on this account. The men should be taught to see that their feet are washed and thoroughly dried every day after work is over, and if this is found to be impracticable, the feet

should be thoroughly wiped with a wet towel, especially between the toes, and then dried. The socks should be greased on the outside with soap, and when they show a tendency to shrink they should be stretched and worn on the opposite feet. I would suggest that a regular foot inspection be conducted by the medical officer in conjunction with the company officers, so that all feet requiring attention can be treated and at the same time the boots and socks inspected." I have little to add to this except to put forward a few suggestions as to the best means to adopt to prevent the tender foot from blistering.

It cannot be denied that some men's feet blister more readily than others, and it is wise in such cases to try to harden the skin and make it less susceptible. When a man's feet are sore and inflamed, but not blistered, it is advisable for him not only to carry out all the rules laid down in this paper, but also regularly to do one of the following:

- (a) Rub the feet night and morning with spirit, to which may be added 1 to 2 per cent. of salicylic acid.
- (b) Paint the tender parts once or twice a day with either a saturated solution of picric acid, or a solution of chromic acid (2 to 3 grains to the ounce).
- (c) After drying the feet, sprinkle with a powder composed of talc and salicylic acid (salicylic acid 2 grains, talc 1 oz.).
- (d) Soak the feet in a bucket of cold water to which potassium permanganate, salt, alum, tannic acid, or saltpetre has been added.

Men who complain of excessive sweating of the feet should soak them daily in a solution of formalin and water (1 to 800), dry them, and dust them with zinc oxide or some other powder. Tender feet may be well greased with zinc or boracic ointment, or the soles of the feet may be soaped. When a man's feet are normally fatigued at the end of a long march, after he has washed and dried them, he will find great relief if he lies down and raises the feet by resting them against some firm object.

If, in spite of all these precautions, a blister forms, the fluid should be evacuated aseptically and the surplus skin, liable to cause pressure, cleared away. An antiseptic ointment should then be applied and the blister covered with stockinette plaster. As, after the heel, the most common situation for a blister is the plantar aspects of the fourth and fifth toes, it is in this case advisable to use animal wool round and under the toes to counteract the flexion which causes the pressure on these parts.

The commonest cause of *chilblains* is sitting over the fire with wet, cold boots, and these are best treated by restoring the circulation by gentle massage and by wearing warm footgear. Lead and opium plaster may be applied, or the internal administration of tincture of opium may act as a charm in some cases.

Frost-bites, caused by exposure to cold, have given the soldier trouble in the past, and will do so in the future if the circulation is not kept in a vigorous condition and the foot warmly clad. In treating any case of frost-bite a great amount of patience is necessary to restore the circulation gradually. If the toes are frost-bitten, it is advisable to do this before taking the soldier into a warm place, and on no account should he be brought near a fire until the circulation has been restored. Begin by rubbing the affected part gently with snow, and bathe the feet with water, increasing the temperature gradually until the circulation is fully restored, when the affected parts may be wrapped in cotton-wool or flannel.

One cannot leave the question of the soldiers' feet without mentioning the fact that the gonococcus is responsible for many foot disabilities in the army. The *fons et origo* of the trouble should be drastically treated and the serum injections resorted to, but a man with gonococcal arthritis or flat-foot should be rejected, as he will always be a danger to his unit. In no small measure the question of the marching power of a soldier depends upon the medical officer, for not only has he the power of rejecting an unsuitable man, but also he has the responsibility of seeing that the soldier keeps his feet in good order, and ready for efficient service. To do this means constant supervision and advice, and he should remember that there is no *deus ex machina* to remedy the disability immediately, when it occurs.

SUMMARY.

To make the soldier as perfect a marcher as is consistent with the human foot, I would, in addition to what is being done at present, suggest the following:

Feet.

(a) No recruit with any bad degree of foot deformity should be accepted as medically fit until the condition is cured.

(b) Every soldier, on enlistment, should be given a printed pamphlet explaining the importance of foot cleanliness, and he should be periodically lectured on it by an officer.

(c) Foot parades should be more thorough and more frequent.

(d) The battalion chiropodist should be more often and sooner consulted.

(e) It should be made compulsory for the feet to be washed after every long march.

(f) No medical officer should find any difficulty in obtaining adequate supplies of chromic and picric acids, formalin, and dusting powders, or any other drugs he considers necessary.

Boots.

(a) The army boot might be improved by allowing more depth over the toes. This could be accomplished by boxing up the anterior part of the vamp and having the end more rounded.

(b) Printed instructions and lectures should be given on the best means of keeping the boots in good condition.

(c) No man should be allowed to wear new boots until they have been well softened.

(d) The proper fitting of a boot should be considered an art and not a nuisance. Fully one half of the foot troubles are caused by careless or too rapid fitting.

(e) The boot should allow more ventilation of the foot. It is a debatable point which is the worse of the two evils, namely, the possibility of a little water percolating into the boot or the continuous saturation of the foot and sock with stale sweat. In my opinion a wet foot in free communication with the air is less likely to cause trouble than one which is rendered sodden, soft, and offensive by being bathed in its own sweat, without aëration. To give more ventilation, the tongue of the boot should not be attached to the uppers to the exclusion of all air, and the quarters should be perforated by ventilating holes so as to admit fresh air and allow the escape of foul emanations and gases arising from the heated and fatigued state of the foot.

Socks.

(a) These should be fitted as carefully as the boots.

(b) They should be issued *after* having been shrunk.

(c) They should be washed after a long march, and different pairs should be worn on alternate days. This should be compulsory.

It may be argued that many of these points are already known to the men, who have been lectured on them by their officers. Even so, it does not follow that they carry out what they are taught and know to be correct, any more than when a man is taught to be good he becomes a saint, or a gouty subject abstains from port because his medical adviser told him to do so. Further, we must remember that we are discussing the feet not only of the regular army but those of the Territorial Force and Kitchener's Army. If every soldier were taught to take as much care of his feet, boots, and socks as his rifle, and, in addition, were compelled to do so, sore feet would cease to give trouble. The civil surgeon may inquire, "Why all this toil for the triumph of an hour?" and my answer is "*Finis coronat opus*." The crowning hour of success may be gained by men whose feet can carry them to victory, but can never be won by those who cry in despair, *Volo, non valeo*.

REFERENCE.

¹ BRITISH MEDICAL JOURNAL, August 29th, 1914, p. 385.

DR. H. P. PICKERILL, Professor of Dentistry in the University of Otago, informs us that with the New Zealand Expeditionary Force coming to Europe are two dental lieutenants. These gentlemen were senior students at the Otago University, but on the outbreak of war were given special examinations, and thereafter granted special dental commissions.

INSECTS AND WAR:

VII.—MITES: THE HARVEST MITE
(*Trombidium*).

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Natura in minimis maxime miranda.

LINNAEUS.

WE do not know what life is, but we can at any rate record its manifestations, and we know that it is always associated with an extremely complex substance called by Purkinje "protoplasm." This substance Huxley described as "the physical basis of life." Protoplasm, though we know of what elements it is composed, defies accurate analysis, and, indeed, is never the same for two minutes together. It is constantly changing, it is in a state of flux, and is, in effect, a stream into which matter is continuously entering and continuously leaving.

Protoplasm may be living, or it may be dead, and when dead it soon undergoes dissolution; but there is no life without protoplasm. Somewhere or other Dr. David Sharp has stated that out of the total amount of protoplasm "in being" in the world, the real volume of the life-material, at least one half is wrapped up in the body of insects. But insects only form one group out of the several which make up the Phylum *Arthropoda*, or those animals which are distinguished from others by possessing externally jointed legs—that is, jointed appendages. This phylum includes also the Crustacea, the multi-segmented Centipedes, and the Arachnids or spider-like animals.

Insects, like acropalanes, dominate the air; the crustacea, like submarines, inhabit the water; the poet has passionately asked:

Ah! who has seen the mailed lobster rise,
Clap her broad wings and soaring claim the skies?

But the answer is, in the language of those curious creatures the politicians, "in the negative." Crustaceans are essentially aquatic. On the other hand, centipedes and spiders are earth-loving animals, and some have unhappily developed parasitic or pseudo-parasitic habits.

The last-named subgroup, the Arachnids, comprise many subdivisions. There are the spiders, the harvest-men, the scorpions, the king-crabs, and so on. But one of the most numerous of the subdivisions of the group are the mites and ticks (*Acarina*). I have for years been trying to find some organ or structure shared by insects and mites and ticks, and not found in any other group of arthropods. If I could do this I would invent a long polysyllabic word—with lots of Greek in it—which would replace the word "insect" at the head of this article; it is, of course, hopelessly bad zoology to class Mites with Insects. These Acarines are for the most part small, and they differ from spiders in having no waist. In fact, the three divisions in which the body of an arachnid is divided—head, thorax, and abdomen—are indistinguishable in mites, the body forming an unconstricted whole. As a rule, these little creatures breathe, as do Insects, by tracheae, or, if these be absent, by the general surface of the body. They live for the most part on vegetable and animal juices, and their mouth parts are, as a rule, piercing and suctorial; but in some species the appendages of the mouth are capable of biting as well as piercing. The adults have typically eight legs. The larval stages are very numerous, and at times six distinct moults of the skin are recognizable. With few exceptions the larva emerges from the egg as a six-legged creature. In fact, mites undergo a metamorphosis

Fig. 1.—*Trombidium holosericeum*.
Female, dorsal view. $\times 20$.