POST-WAR ACUTE ULCERATIVE GINGIVITIS.

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The Army Dental Corps

INTRODUCTION.

DURING the Great War, in the winter of 1915, the attention of medical and dental officers was drawn to an acute ulcerative condition of the gums, frequently spreading to the cheeks and tonsils, which affected large numbers of officers and troops and caused their withdrawal from the front lines.

This gingivitis spread so rapidly and became so prevalent as to suggest that it was communicable and it soon became known as “trench mouth.” In view of the wastage caused by the disease and the severity of the constitutional symptoms, the importance of early diagnosis and appropriate treatment was apparent.

Before 1914 such an epidemic type of gum disease was almost unknown, only a few instances being recorded as occurring in such institutions as prisons and asylums.

To-day, under settled peace conditions, this epidemic form of gingivitis is not seen. Its place is taken by a non-epidemic type, and as its effect on the general health of the Army is not now so apparent, it has ceased to attract the attention of medical officers. The significance of early diagnosis and treatment is no longer generally recognized to-day, and the main object of this paper is to stress their importance.

The aetiology and symptoms of this post-war variety of gingivitis will be described and a simple emergency treatment indicated, which medical officers could carry out in the event of there being no dental officer available.
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Ætiology.

Acute ulcerative gingivitis is a mixed infection caused by the Bacillus fusiformis and the spirochete of Vincent. These organisms are invariably associated and their relative dominance in the tissues decides the severity and extent of the disease.

The B. fusiformis measures from six to twelve microns in length and is pointed at the ends.

The Spirocheta vincenti is a slender organism with wide, shallow, open curves.

Although these organisms first appear in the infant mouth with the eruption of the temporary incisors—the stagnation of food particles round the teeth being favourable to their growth—the disease is never seen in any mouth where the gingivae are normal. The explanation lies in the effectiveness of the barrier made by the many layers of squamous epithelium which cover the gums. As long as this epithelium is intact and the vitality of the gums not reduced, the organisms which teem upon its surface cannot gain access to the submucous tissues to cause inflammatory reaction.

The presence of the disease in any mouth indicates either (a) some pre-existing local injury to the gingivae, or (b) some constitutional disturbance which has lowered the vitality of the gums.

Both these predisposing factors are present in many cases.

Predisposing Factors.

(a) Local Injury.

By far the commonest cause of injury to the gums is the stagnation of food debris, which undergoes fermentative and putrefactive changes and causes a local inflammatory reaction at the stagnation area.

Any spot on the gum margin where food particles are allowed to collect may be the site of infection, for the inflammatory reaction produces a breach of surface epithelium through which the causative organisms gain access. Such stagnation areas are found round all teeth which are crowned, round roots and round functionless, misplaced and overcrowded teeth; at the ledges of restorations and margins of heavy tartar deposits; in the deep pocket behind the lower wisdom tooth and under the overhanging margins of teeth which have tilted; at the margins of partial dentures which are not kept clean; round the upper and lower incisors in mouth-breathers and all teeth involved in pyorrhœa alveolaris.

(b) Trauma.

Direct injury to the gum covering an erupting wisdom tooth is frequently caused by the opposing teeth, and here a breach of epithelium is rapidly made. The site is rendered more vulnerable to infection by the inflammation and food stagnation always present. Similarly, in cases of marked overlap of the incisors, the gum behind the upper teeth is injured whenever the lower incisors impinge directly on the soft tissues.
CONSTITUTIONAL DISTURBANCE.

This may be considered under three headings: (a) General; (b) Chemical; (c) Dietetic.

(a) General.

In any debilitated condition, the resistance of the gums is below par, and hospital patients who have been ill for some weeks frequently develop the disease. Especially is this the case during the course of diseases of the respiratory system, such as bronchitis, pleurisy, pneumonia, influenza, affections of the throat and chronic nasal catarrh.

Here a certain degree of mouth-breathing takes place, producing a local gingivitis which, added to the lowered resistance of the tissues, predisposes the gums to infection.

In the acute fevers there is a marked diminution in the secretion of saliva, a tendency to mouth-breathing, and stagnation of food from the "slop" diet. This combination of factors rapidly lowers the resistance of the gums to infection, and acute ulcerative gingivitis is a not uncommon complication.

In diabetes and nephritis, a marginal gingivitis is often present which, unless the mouth is kept very clean, may lead to the acute condition.

The extreme importance of scrupulous cleanliness of the teeth and gums in these various conditions is not sufficiently realized. Mouth washes as generally used are almost valueless, and until the teeth and gums are thoroughly cleansed of food debris after every meal by brushing with a correctly shaped toothbrush and soapy paste or liquid, there will be no reduction in the incidence of ulcerative gingivitis in hospital patients.

(b) Chemical.

The administration of the compounds of the metals such as mercury, arsenic, antimony and bismuth very frequently produces a stomatitis characterized by bleeding, spongy and tender gums with exudation of pus, loosening of teeth and increase in salivation. The mouth becomes foul, food stagnates due to lack of brushing because of the tenderness, and the typical acute ulcerative condition occurs in the great majority of cases.

It was thought at one time that the administration of arsenic would have a specific effect upon the gingivitis by killing the spirochetes and "606" was used to this effect. My experience tends to show that treatment by "606" and the other metallic compounds only aggravates the condition, and I have frequently seen troops with the typical ulcerative gingivitis who were actually receiving treatment by "606" and other arsenic preparations at the time.

(c) Dietetic.

Lack of anti-scorbutic vitamins in the diet produces definite pathological changes in the gingivae, as is well shown by the characteristic bleeding spongy gums in scurvy. During the war, the exigencies of the
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campaign frequently led to the absence of vegetables and fruit in the diet, and there can be no doubt that this lack of anti-scorbutic vitamins produced a general lowering of vitality of the gingivae and was a very important predisposing factor in the large number of cases of acute gingivitis which occurred.

The diet of the soldier to-day is almost devoid of fresh uncooked vegetables and fruit, but these are usually purchased in the canteens or outside barracks, and it is only when the soldier cannot obtain them that their absence in the routine diet is of significance.

LOCAL SIGNS AND SYMPTOMS.

Clinically and bacteriologically, two varieties of the disease are recognized: a mild type, in which the disease is limited in extent of surface and does not penetrate the mucous membrane deeply; and a severe type, in which a great extent of surface is rapidly involved and the mucous membrane deeply penetrated.

(1) The Mild Type.

Here the B. fusiformis predominates and the symptoms may be tabulated thus:

(a) Soreness and hyperaemia of the gum margin at the site of infection, lasting twelve to eighteen hours, followed by

(b) Edema, increasing tenderness and free hemorrhage on pressure, lasting about eighteen hours. The inflammation then spreads laterally by continuity of tissue and involves the gum margins of several contiguous teeth, the interdental gum papillae being swollen.

(c) Ulceration now begins at the sight of infection and involves the whole circumference of the gum round the tooth. This ulceration spreads laterally and is first seen in the neighbouring interdental papilla, which appear as if their crests had been snipped off. This appearance is due to the denudation of the epithelium of the crest.

(d) These points of ulceration increase in area as the tissues of the papillae are progressively destroyed, and they coalesce to form a continuous line of ulceration on both the lingual and facial aspects, involving the gum margins of several contiguous teeth.

(e) At the same time, the opposite jaw is infected, and a similar process takes place in the gingivae of the teeth which oppose those already involved. The ulcerating surfaces are always covered by a greyish-white exudate and are exquisitely tender, due to exposure of nerve-endings.

(f) Ulceration spreads rapidly and always involves a certain depth of tissue, which depends upon the virulence of the organisms and the local resistance to the infection, but in every case a considerable destruction of the soft tissues round the teeth will take place. This destruction is always greatest between the teeth and shallow pockets are formed.
If untreated, the crest of alveolus is involved and a certain destruction of bone results, which deepens the pockets.

During these changes the mouth becomes increasingly foul, owing to the cessation of tooth-brushing because of the tenderness; the saliva is thick andropy and the catarrhal secretion from the gums aids the stagnation of food debris.

The mucous membrane of the cheeks in contact with the last molars is frequently attacked, the ulcers being shallow and very tender. Such a condition due to this milder type of infection is fully established in about six or seven days and is much more frequently seen than that due to the severe type.

The Severe Type.

In this form, the S. vincenti predominates and is found deep in the tissues in advance of the B. fusiformis, causing a much more severe and rapid destruction of soft and hard tissues. The initial stages are shorter and ulceration begins very early, spreading laterally and in depth with great rapidity, passing to the opposite jaw at once and spreading to the mucous membrane of cheeks, lips, floor of mouth, tongue, hard and soft palate, and uvula. It may be regarded as an acute necrosis of the investing tissues of the teeth, accompanied by an ulcerative stomatitis, the ulcers being multiple, much deeper than in the milder type and covered by a thicker greyish membrane.

The gingivae appear as if they had been gouged out round the teeth, the alveolus is rapidly destroyed, owing to acute infection taking place very early in the condition following the loss of the protecting soft-tissue covering, and the teeth become progressively loose.

Such a condition can be fully established forty-eight hours after the commencement of ulceration and it was this type which became so prevalent during the war. When the tonsil is involved, Vincent’s angina supervenes, with its possible complication of diffuse cellulitis.

To-day, fortunately, it is much less frequent, but, at any time, the milder form may develop into the severe if the local factors are favourable to the predominance of the spirochete in the lesion and all gradations between the two extremes are met with.

Constitutional Symptoms.

(1) The Milder Type.

(a) Temperature is always above normal, varying from 99·8° to 102° F., depending upon the stage of the disease seen.

(b) The submaxillary and submental lymphatic glands are invariably enlarged and tender quite early in the condition, and the soldier sometimes reports sick for painful glands without mentioning his gums. The adenitis is generally bilateral, as the disease affects both sides of the mouth in nearly all cases.
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(c) The breath is unpleasant, the saliva sticky, and the tongue may be furred.
(d) A certain degree of malaise and depression is apparent and is due to the toxæmia, disturbed sleep, constipation and under-nourishment because mastication of the ordinary diet is painful.

(2) The Severe Type.

The symptoms just described are much more marked and rapidly produced whenever the spirochætes have invaded the submucous tissues in great numbers.
(a) Temperature may rise to 103.5° F. or more in very bad cases.
(b) The adenitis is always bilateral, the glands more painful and markedly enlarged, and the cervical lymphatic glands are now affected as well. In very severe cases with ulceration of the tonsil and soft palate, it is usual for a certain degree of deep cellulitis to supervene if the disease is left untreated. This cellulitis may be unilateral or bilateral.
(c) The breath is very foul, the tongue furred and the oral cavity presents a marked degree of superficial sepsis.
(d) Malaise and depression are invariably produced in marked degree and the soldier is quite unfit for duty.

Importance of Early Diagnosis and Treatment.

It will now be seen that we are dealing with a condition which, in its milder form, is fully established in six or seven days, and in the severe form, in two or three days. It follows that the earlier the disease is recognized and treatment begun, the less will be the destruction of tissues and also the severity of the local and constitutional symptoms will be correspondingly decreased.

But there is another point to be considered, the importance of which must be strongly emphasized. Wherever the ulceration of the gum margins between the teeth (the interdental papilla) has penetrated to a greater depth than the floor of the gingival trough, the lost tissue is not replaced in its entirety and the gingivae will never again be normal.

In the March, 1926, issue of this Journal I described in some detail the anatomy and histology of the dental tissues. It will be recalled that the gingival trough is a shallow depression, about one-eighth of an inch in depth, which surrounds each tooth at the neck. It is lined with a thin layer of squamous epithelium, and as long as this is intact, the underlying periodontal membrane and alveolus are cut off from the bacteria and fluids of the mouth. The gingival troughs of contiguous teeth are separated by a prolongation of gum—the interdental papilla—which completely fills in the triangular space under the points of contact of the teeth and prevents the impaction of food debris.

1 "Dental Sepsis, its Nature and Systemic Effects."
The sequelæ of food impaction following loss of tissue at this site are indicated in the section on pathology in the article mentioned above. It was shown that a local injury was produced, followed by a breach of the wall of the gingival trough and succeeded by infection of the underlying periodontal membrane and alveolus.

The earlier treatment is begun the more chance there is of checking the ulceration before it reaches below the level of the trough. At the primary site of infection the tissue destruction has proceeded apace and no complete restoration can take place here; in its vicinity and especially where the crests of interdental papillae are denuded of epithelium, it is often possible to overcome the ulceration in its earliest stages and induce entire replacement of tissue, provided the condition is diagnosed and treated in time. It is almost tragic to see the consequences of untreated acute ulcerative gingivitis, knowing that the pocketing between the teeth will induce, sooner or later, a true condition of dental sepsis, with absorption of toxins over a long period and eventual loss of several teeth.

**Differential Diagnosis.**

The diagnosis from pyorrhœa alveolaris, or gingivitis due to mouth-breathing and superficial sepsis, should present no difficulty. The rapidity of onset, the typical greyish-white membranous exudate covering the ulcers, the shallow ulceration of a continuous line of gum margin along several contiguous teeth, the rapid destruction of the interdental papillae, the involvement of both jaws, and the marked constitutional symptoms, are pathognomonic. If any doubt exists, a simple bacteriological examination can be carried out as follows:

1. Pick up a little of the exudate in a platinum loop, smear thinly on a slide and fix over a flame. Stain with methylene blue for about three and a half minutes, wash in water and dry. The typical *B. fusiformis* is readily recognized, and though the spirochète is less deeply stained, it shows up quite well.

**Incidence.**

Examination of the records of this department, over a period of five years, shows that the disease occurs in about 2 per cent. of the troops attending and presents an interesting seasonal variation.

In the spring and summer months it is at a minimum, and gradually increases in frequency in the autumn, till it reaches a maximum incidence in December, January and February.

**Treatment.**

There must be many out-stations, especially abroad, where the troops are visited by a dental officer at infrequent intervals, or not at all. I therefore suggest a simple treatment, which medical officers could carry out if there is no dental officer available, and which requires no special instruments.
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In acute ulcerative gingivitis the organisms are in the tissues under the membranous exudate, which is covered by a catarrhal secretion and sticky saliva. The application to be used must have the power of penetrating the saliva, secretion and membrane in order to reach the organisms, and it must be an effective germicide without being irritant or destructive to normal tissue.

Of the various drugs I have used, such as tincture of iodine, copper sulphate and potassium permanganate, none has been so effective as chromic acid (H₂CrO₄).

Chromic acid is an aqueous solution of the orange-coloured acicular crystals of chromium anhydride, CrO₃, which is stocked in the dispensary of nearly every station. It is a powerful deodorant and disinfectant, because of its oxidizing power and, as it coagulates albumen, it is also a very strong caustic.

It has an unpleasant and lingering taste, and it should be followed by the application of hydrogen peroxide, which at once removes the taste and combines chemically with the drug to produce a black or dark-brown perchromic acid.

If a drop of undiluted hydrogen peroxide is added to a few drops of concentrated chromic acid the orange colour is at once changed to a jet black. The reaction is presumably as follows:

\[2 (\text{H}_2\text{CrO}_4) + \text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{Cr}_2\text{O}_8 + 2 (\text{H}_2\text{O})\]

The strength recommended for use is 1 in 5, and not more than one ounce should be made at a time, as only a few drops are used at each treatment. The technique of the treatment is as follows:

1. Pour about twelve or fifteen drops of chromic acid into a small receptacle, such as a watch-glass, teaspoon, or glass top of an ink pot, and about double this quantity of undiluted hydrogen peroxide (10 vols.) into some similar small container.
2. Roll small pieces of cotton wool into rolls about one-third the size of a walnut, preparing six of these.
3. Flatten a wisp of cotton wool, about the size of a postage stamp, on the tip of the index finger of the left hand. Place the end of a silver probe in the centre of the wool, hold it rather loosely with the left thumb, and rotate the probe away from you with the right hand. A few turns will serve to fix the wool securely. If a probe is not available a match will serve.
4. Place the patient in a chair in a position where good light enters the mouth without the head being tilted uncomfortably backwards. Have handy a spittoon, mug of warm water and a pair of tweezers.
5. Let the patient spit in order to dry the mouth to some extent, stand at his right, raise the upper lip with the left hand and place a roll above the premolar teeth on each side. This exposes to view the gum margins of the incisors and canines.
6. Dip the probe or match in the chromic acid to saturate the wool,
and apply to the enamel surface of the teeth, starting at the left bicuspid and passing horizontally across to the right bicuspid. The drop hanging from the wool will spread by surface tension over the labial ulcerating surface, and also pass between the teeth to their palatal aspect, thus reaching the entire area of affected tissue.

The probe should not be applied directly to the ulcers, as any pressure causes severe pain. The chromic acid itself, though a very powerful caustic, causes no pain or tingling. The patient should be warned not to swallow at any time during the treatment, and though the drug is a poison it can lie on the tongue and floor of the mouth for a short time and cause no harm. Two or three large drops at most are sufficient to cover the surface exposed.

(7) Let the acid remain in situ for at least one minute, during which the rolls will prevent its passing backwards along the cheeks to the throat. Remove the rolls and let the patient rinse the mouth thoroughly three times.

(8) Place a fresh roll posterior to the tuberosity of maxilla on the left side, raise the lip and cheek well away to expose the bicuspid and molars, and apply for one minute as before. The roll will absorb the excess and prevent its tracking into the throat.

(9) Remove the roll, let the patient rinse and gargle, and repeat on the right side. The upper jaw is thus treated in three sections, each application lasting one minute.

(10) The lower jaw is somewhat more difficult, as the gums cannot be kept dry so effectively. Turn down the lower lip, place a roll on either side, between the lip and first premolar, and apply to the incisors and canines for one minute. If the head is tilted back slightly, so that the floor of the mouth is inclined backwards, the saliva will not tend to dribble over the lip.

(11) The lower molars and bicuspsids are more difficult to do because the saliva cannot be controlled. After the patient has rinsed and got the mouth as dry as possible, let him retract the left cheek with his little finger to expose the posterior teeth and apply the drug to the enamel surfaces facing the cheek, for one minute. It will run between the teeth to the lingual aspect and reach the ulcerating surfaces hidden from view, and though it may pass to the tongue, this is of no consequence.

If the mouth is very wet, and it is necessary for the patient to spit before the minute is up, two applications of half a minute each will simplify matters.

(12) Repeat on the right side.

The drug will have run over the lips, cheeks and part of the tongue, but this is unavoidable, and even desirable in moderation, as it tends to sterilize these surfaces, and so reduces the superficial sepsis. Wherever ulceration has occurred the acid will have penetrated the exudate and the true extent of the lesion will be shown up.
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The effect of the drug on healthy gums and mucous membrane is simply to dissolve the slippery mucin which coats them, to sterilize their surface, and in strong solution to cause no more than a desquamation of the superficial layer of epithelium.

Any ulcers on the cheeks, palate, uvula, tongue and lips are touched with the saturated wool and the drug left for one minute before rinsing. When the tonsil is involved the tongue should be depressed to expose the ulcers, and one drop of the acid allowed to track over them by surface tension, and left for ten or more seconds, followed by thorough gargling.

Hydrogen peroxide of 10 vols. strength should now be applied three or four times by means of a small swab of wool to all the teeth and ulcers, still using the method of surface tension, and not direct application to the infected soft tissues.

If the peroxide is at full strength the typical reaction takes place at once, the entire surface turning jet black, while at the same time the solution of the mucin of the saliva, which normally renders the mouth slippery, will cause a characteristic dryish surface, lasting only a few minutes.

If the peroxide is weak, as is likely in tropical stations, the reaction will take longer, and will produce only a dark-brown colour. It should be left in the mouth till all yellowish colour has disappeared, and then the patient should rinse several times.

The soldier should be given five-grain tablets of potassium chlorate, three or four to be sucked daily between meals; a mild daily purgative prescribed; and the depression counteracted by a tonic such as stock No. 6 tablet.

Although the disease may seem localized at particular areas, or only on one side of the mouth, it is essential to treat the entire gum surface of each jaw, for careful investigation will show that, in every case, the epithelium of distant papillae is infected long before ulceration at these sites is obvious.

The chromic acid (20 per cent. solution) should be applied in this fashion daily for three or four days, by which time the ulceration should be under control and the constitutional symptoms very much reduced, and thereafter, at intervals of two or three days, in a strength of 1 in 10 till resolution is practically complete and the sites of ulceration are covered by new epithelium.

It takes about seven days for this epithelial covering to form after all active signs of the disease have ceased, and it is during this period that relapse is common if the soldier fails to keep the mouth clean, and treatment is discontinued. The soldier’s toothbrush should be sterilized at each attendance by soaking it in a strong germicide, such as five per cent lysol, during the ten or twelve minutes taken for the treatment, and then washed with water. Isolation is essential if the disease is of the severe type, and the chromic acid should be used twice daily until the rapid necrosis is checked.

Until the condition is brought well under control it is important not to
extract any loose or painful tooth, as the infection may be conveyed deep into the bone of jaw through the socket. I have seen extensive necrosis following extractions done when the condition was still acute.

Should an acute alveolar abscess arise it is better to make an incision into the swelling, evacuate the pus, and wait until the ulceration is less severe before removing the responsible tooth.

Subsequently, if a dental officer should visit the station, or be within reach, the soldier should be referred to him at the first opportunity for the treatment of any dental condition which might favour recurrence.

The advantages claimed for this treatment are:

(1) Simplicity of application.

(2) Great effectiveness.

(3) Painlessness, although the lesions are so tender.

(4) Economy, only a few drops of chromic acid and hydrogen peroxide being used each time.

(5) No special instruments are required.