STOMATITIS IN CHILDHOOD

BY

CLIFFORD G. PARSONS, M.D., M.R.C.P.*

Stomatitis is a common complaint which is usually considered to run a benign course, although Ebbs (1938) has suggested that during infancy certain forms of the disease may have serious consequences. An attempt has been made to throw further light on the matter by the study of one-hundred-and-fifteen children suffering from stomatitis who attended the Casualty Department of the Children's Hospital, Birmingham, between August 12 and December 14, 1938.

The term stomatitis means an 'inflammation of the mucous membrane of the mouth' (Stedman, 1936), and many varieties of the disease have been described. Amongst the terms in more or less common use are the following: aphthous (follicular, herpetic, vesicular) stomatitis; catarrhal (simple) stomatitis; mycotic (parasitic) stomatitis or thrush; ulcerative stomatitis (infective, Vincent's ulcer-membranous, necrotic or infectious gingivo-stomatitis); gangrenous stomatitis or noma; and symptomatic stomatitis such as occurs in acute leukaemia and scurvy. It has been found that it is not always possible to classify the cases according to these groups, but it seemed that as a rule the clinical and bacteriological features of stomatitis in children under the age of two differ from those of older children. The cases have therefore been grouped according to age.

Sixty-seven of the 115 children were girls. The youngest patient was thirteen days old, the oldest eleven years. Over half of the cases occurred before the age of two years, and four-fifths before the third birthday, the incidence of the disease diminishing progressively as age increased.

Children under two years of age (67 cases)

History. When taking the history certain specific enquiries were made to ensure uniformity, but the use of leading questions was carefully avoided. The children had been ill for an average of 7-7 days, and one baby's mouth had been sore for six weeks before medical advice was sought.

'White mouth' was apparently well recognized by the mothers as a cause of minor upsets, and the majority noticed 'something wrong with her mouth,' 'the white mouth,' or 'ulcers on the tongue' as the earliest sign of anything wrong. It is possible that failure to take feeds readily, or excessive dribbling,

* Work undertaken during the tenure of a Hills' Scholarship, University of Birmingham.
drew attention to the local lesion. The presenting symptoms are shown as follows: in some cases two symptoms were noticed simultaneously:

Sore mouth, 24 cases; Malaise, 14 cases; Vomiting, 13 cases; Anorexia, 10 cases; Diarrhoea, 9 cases; Earache, 2 cases; Swollen glands, 2 cases; Fever, 1 case.

One child, whose first symptom was swelling of the cervical glands, had been under observation for ten days before the oral infection became apparent, and in the meantime, the reason for the considerable glandular enlargement had remained a mystery.

By the time the children were first seen at hospital no less than fifty-five of the mothers had observed the stomatitis, although they did not all look upon it as important, and at this stage most of the children were restless, peevish and prone to cry. Many slept badly; a few were drowsy. Anorexia was practically invariable, and was probably due to pain, since a number of the infants cried or refused to suck when offered food, and, to the complete bewilderment of their parents, failed to be pacified by a dummy. The fact that some of the patients were constantly dribbling saliva suggested that there was also discomfort on swallowing.

Thirty-six of the children had vomited before they were brought for treatment, twenty-one had numerous relaxed stools, and seventeen of the remaining children were constipated. A normal bowel habit was unusual. Unfortunately it was difficult to judge from the history whether alimentary disturbances predisposed to, or were the result of, oral infection; on fifteen occasions a sore mouth was said to have preceded an attack of gastro-enteritis, and in seventeen children the reverse was true.

The frequency of pyrexia was also rather difficult to estimate from the history alone, but thirty-one of the babies were reported to have been feverish, and this was often confirmed. The temperature rarely exceeded 101° F., and was more usually about 100° F. Although parents did not as a rule remark on the fact spontaneously, pallor had been noticed in about half the patients.

An attempt was also made to determine from the parent's story whether there were any factors which influenced the development of the disease. Sixteen children had had stomatitis on a previous occasion, and one infant was actually seen during two attacks separated by an interval of about three months. There seemed to be no reason to suspect dietetic deficiency as a cause of the condition, for there were only four instances in which neither orange juice nor cod-liver oil had been given, or in which there were signs suggestive of vitamin or other deficiency such as nutritional anaemia. Neither the nutrition of the child, nor the social grade from which it came appeared to affect the incidence of the disease. Teething was obviously to be expected at this age, and so could not be implicated. Indeed the only significant discovery was that, of thirty-six mothers who were questioned on this point, only one could claim that her baby had been given neither bottle nor dummy. One instance was known in which two infected children sucked the same dummy.

Contact with other children suffering from stomatitis or with adults afflicted
with sore throats or herpes labialis was recognized in eight cases, but it is interesting that no common infecting organism could be found in the mouths of those contacts from whom swabs were taken.

Examination. Some of the patients looked healthy and well, but most were tired, peevish and hollow-eyed. A pinched face and a leaden grey colour, which was so characteristic that it allowed the diagnosis to be made at sight on more than one occasion, often implied that the baby also had gastro-enteritis. Ebbs (1938) described this curious colouring in cases of thrush oesophagitis. The lips were dry and sometimes excoriated from excessive dribbling, but herpetic and impetiginous lesions were exceptional.

Various kinds of stomatitis were encountered, and these may be described as follows:

1. Pure thrush, in which there was 'exudate' but little or no ulceration or inflammation. The mycelium either resembled milk curds, or was more granular, like a patch of damp table salt. It was found especially on the cheeks, but also on the palate or tongue, and was fairly easily removed with a swab, leaving a raw, or even a bleeding, surface. Enlargement and tenderness of the cervical glands was absent or minimal.

2. Aphthous stomatitis was characterized by the presence of small vesicles, or more usually shallow ulcers, of greyish-white colour, surrounded by a narrow but bright halo of inflammation. The ulcers were exquisitely tender to the touch, rarely measured more than two mm. in diameter, and were situated in order of frequency on the tongue, cheeks, the inner surface of the lips, the palate, and the fauces. There was sometimes slight enlargement, but rarely tenderness, of the glands.

3. A combination of the above two types was by far the commonest form of stomatitis met with in children under the age of two. On one or two occasions the tongue was literally covered with small aphthous ulcers, which gave the mouth a peculiar dusky cyanotic appearance; mycelium was present on the cheeks; gastro-enteritis was the rule, and in these cases the prognosis was hopeless.

Instead of aphthous ulcers there were sometimes irregular areas on the cheeks or tongue from which the superficial layer of mucous membrane had been stripped. The bases of these large ulcers were either clean, or covered with a yellowish-grey exudate.

4. Amongst the younger children the Vincent's type of stomatitis was seldom encountered in its fully developed form, but it was seen in older children and then presented the following characteristics. The gums were greatly inflamed, a dusky red colour, bleeding easily and extremely tender. They were swollen, turgid, bulging up between and around the teeth, which were inclined to be loose. The shallow pits in which the teeth appeared to lie were filled with yellowish debris. Ulcers, in the form of grey streaks parallel to and close to the gum margin, were sometimes seen. The breath was foul: the tongue heavily furred; the throat red, but not obviously infected; and there was enlargement and tenderness of lymphatic glands, particularly of the submental, submaxillary and tonsillar groups.
5. Aphthous ulceration occurring in combination with the above picture affected ten of the younger children. Incidentally it may be pointed out that the less the gingivitis and odour, the more closely did this variety of stomatitis resemble that described in section 3 above. Indeed, overlapping of clinical features made a hard-and-fast distinction between thrush, aphthous and Vincent’s stomatitis impossible, although they are usually considered to be separate diseases. Bacteriological examination, which will be discussed later, likewise failed to help materially in a clear classification of the clinical types. In general, it can be said that in children under two the mycotic, mycotic-aphthous and aphthous forms of stomatitis predominated over the aphthous-Vincent or Vincent varieties.

Certain complications occurred with a frequency which implied that they were not merely coincidental. Severe gastro-enteritis was particularly important in this respect; it was present in twenty-four cases and proved fatal in nine of these. Probably a tenth child also died, since he was in extremis when last seen, but had to be transferred to another institution, and so could not be followed. All of these ten babies had typical mycotic stomatitis, and thrush was cultured from the mouth. In two or three cases mycelium was also found in the stools, and in others thrush oesophagitis was demonstrated at autopsy.

Six children had a napkin rash, but only one of these had gastro-enteritis; seven cases were complicated by otitis media.

Bacteriology. Bacteriological examination was undertaken when the children first attended the department. An ordinary cotton covered throat swab was rubbed firmly over the affected area and was despatched immediately to the laboratory, where after a direct smear had been made on a clean glass slide, a plate of Sabouraud’s medium was inoculated. It was found in practice that the significant organisms were usually revealed in the smear. Failure to demonstrate expected organisms, for example from cases of thrush which were quite typical clinically, may have been due to the practice of taking only a single swab in each instance.

Sixty children were examined bacteriologically, and of these forty-one showed the spores or mycelium of thrush. Thrush was the only organism obtained in pure culture (fifteen cases), and it was isolated from examples of all the clinical varieties of stomatitis, including eight of the ten cases of the aphthous-Vincent type. Thus the problem of classifying stomatitis clinically was reflected in an exactly similar difficulty from the bacteriological standpoint.

Other bacteria were found as follows:—

Staphylococci (aureus, albus or citreus) in twenty-six cases; pneumococci in twenty-one cases; streptococci (haemolytic, non-haemolytic or viridans) in eighteen cases; micrococcus catarrhalis in sixteen cases; unidentified cocci in four cases; micrococcus tetragenus in one case. Bacillus fusiformis was isolated eight times, twice in association with spirochaetes and three times with thrush. Organisms met with less frequently were leptothrix, diphtheroids, bacillus Friedlanderi and influenzae (table 1).
Of twenty-four patients with well-marked symptoms of vomiting or diarrhoea, thirteen were found to have thrush, two had signs typical of thrush but no swab was taken, and swabs from the remainder showed neither spores nor mycelium. Material taken from aural discharges and from skin lesions of the buttocks or fingers failed to demonstrate a direct connexion between these and the stomatitis, although on other occasions at the Children's Hospital thrush has been cultured from the ear.

**Blood counts.** Blood, for examination of the white cells, was taken from thirty-one cases at the same time as the swab. The total number of leucocytes ranged from 4000 to 29,000, averaging about 14,000. There was some immaturity of the granulocytes, but the most striking alteration in the differential white cell count concerned the monocytes, which were present in numbers varying from 2 to 17 per cent. of the total count. In twenty-one of the thirty-one children examined, monocytes constituted 6 per cent. or more of the white cells, and in fourteen cases 10 per cent. or more.

This monocytosis was so characteristic that the haematologist, knowing nothing of the clinical history, was often able to make a diagnosis of stomatitis immediately he looked at the blood film. It was something of a surprise to discover that the blood changes appeared to have no connexion with the type or severity of the stomatitis, nor with the organism which caused it. For example, seven of the cases with a monocytosis of 10 per cent. or more had positive cultures for thrush, and seven negative cultures. Likewise no relationship could be traced between the blood findings and the presence or absence of complications such as gastro-enteritis.

Blood counts were repeated in some cases after the mouth was completely healed and the monocytosis was still present; it is not known for how long the abnormality persisted. It may be mentioned in passing that during this period large numbers of blood films were being examined from children of the same ages, some healthy and others suffering from a variety of diseases, yet no comparable blood changes were encountered.

**Treatment.** Before the relative merits of different forms of treatment can be assessed, something must be known of the natural course of the disease in the untreated patient. Information on this point was gathered from the history, which gave the impression that the disease was not self-limited, since the children had been ill for an average period of a week, and in many cases for two or more weeks, before treatment was started.

As a further control certain children were treated with saline mouth washes only, and others with local applications of glycerin, borax and honey in different combinations, as these are the favourite remedies of parents, medical practitioners and clinics in the district. One child recovered during treatment with glycerin and borax, but no other patient in the control group improved until other therapy was instituted.

The efficiency of different kinds of treatment was measured by the time for which therapy had to be continued before the stomatitis was entirely healed. Healing was judged by a careful inspection of the mouth, since symptoms as a rule disappeared several days before the local signs.
As soon as the mouth was healthy treatment was stopped, but the patient was examined again a week later to ensure that cure was complete. This final visit enabled four mild relapses to be recognized, all of which responded immediately to further medication.

Treatment was for the most part entirely local. No specific alteration was made in the diet, but in one or two unselected cases a mixture containing potassium chlorate and iron perchloride was ordered. The mouth was painted daily with one of four different applications. Whenever possible this was carried out by nurses in the department, so that progress could be watched. The painting was done with a cotton wool swab wrapped round either a pair of forceps or the little finger, and special care was taken that no part of the mouth should escape attention. The four applications were: (1) 1 per cent. aqueous solution of gentian violet; (2) novarsenobillon, 0·6 gm. dissolved in 6 c.c. of glycerin and 12 c.c. of water; (3) 10 per cent. aqueous solution of sodium perborate; (4) solution or tincture of merthiolate (Lilly). (The tincture was preferred as it was coloured, but no distinction has been drawn between the two in estimating results.) All solutions were freshly dispensed at intervals of about one week.

Fifty-nine cases were followed, but nine of these have been excluded from consideration, as they died from gastro-enteritis after the stomatitis had apparently responded satisfactorily to treatment. The average duration of therapy before cure was complete was 6·7 days for gentian violet and merthiolate, 7 days for N.A.B. and 10 days for perborate. One failure was experienced each with gentian violet and N.A.B. Symptoms were relieved rapidly, especially with merthiolate and gentian violet, and parents were delighted that often within twenty-four hours the appetite had returned, and restlessness and peevishness had disappeared.

Children over two years of age (48 cases)

History. Several children were seen on the day of onset, but on the average it was not until the fifth day that the patient first arrived at the hospital. One boy (excluded in calculating the average) had been ill, with remissions and exacerbations, for six months before advice was sought. The presenting symptoms, sometimes occurring in combination, were as follows:—

Sore mouth, 18 cases; Malaise, 14 cases; Anorexia, 11 cases; Vomiting, 3 cases; Sores on face, 3 cases; Swollen cervical glands, 2 cases; Odour of breath, 1 case; Sore fingers, 1 case; Earache, 1 case; Sore throat, 1 case.

Listlessness, drowsiness, extreme irritability and general malaise were practically constant by the time that the child reached hospital. Headache, occasionally intensely severe, was a troublesome symptom in nineteen of the patients, and the parent's attention had been drawn to the mouth in all but three of the cases. The offensive odour of the breath, noticed by forty-one of the parents, apparently taxed their powers of description, for it was likened to an abscess, a lavatory, to 'something awful,' and to a drain. It is therefore not surprising
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that nausea was often complained of by the patients. In eighteen cases there was vomiting. Constipation was usual, and diarrhoea was very uncommon.

There was usually a history of feverishness, and the temperature was generally higher than amongst the younger children, sometimes reaching 103°F. Twenty-eight of the mothers had noticed that their children were paler than normal: complaint of sore throat was unusual.

Of thirty-eight patients who were asked, ten had had previous attacks of stomatitis. The type of stomatitis from which they had suffered in the past was often not known, but as it occurred in infancy it was probably thrush or aphthous ulceration. One child was said to have had three attacks of aphthous stomatitis.

As would be anticipated, dummy sucking was less prevalent amongst these older children, and was met with on only five occasions. One child with nutritional anaemia provided the only evidence of dietetic deficiency.

When two adults suffering respectively from peritonsillar abscess and herpes febrilis are included as possible sources of infection, contact could be established in nineteen of the forty-two cases in which the point was raised. Swabs were taken from six pairs of contacts, but no conclusions were possible from the results obtained.

Examination. The majority of children were pale, had a toxic appearance and were listless and miserable, but only two or three were sufficiently ill to necessitate in-patient treatment. The characteristic nauseating smell was common, and thirty-one of the patients had the Vincent's type of stomatitis already described. Aphthous ulcers or large irregular superficial erosions were often present in addition, particularly on the lips, tongue and cheeks: the tongue was furred and the throat red, but tonsillitis was distinctly unusual. Enlargement of the regional lymph nodes was almost invariable (forty-three cases), and tenderness was noticed in about half the cases. Sometimes the glandular swelling was as great as that seen in the 'bull-neck' of diphtheria. Suppuration occurred only once; it is rarely encountered as a result of stomatitis.

Ulceration with little or no gingivitis was also seen, but the pure mycotic or exudative lesion was not encountered. The ulcers were very tender, as certain members of the staff of the department can witness from personal experience.

Whilst several children had carious teeth, it is doubtful whether this played any part in the production of the stomatitis, although in one case the gingivitis apparently arose as a direct consequence of dental extraction.

The commonest complication, observed nineteen times, was a herpetic lesion affecting the lips and sometimes the nose, frequently secondarily infected and then resembling impetigo. Sore fingers or paronychiae were seen three times, and conjunctivitis twice; both were probably a consequence of finger sucking. The spleen was enlarged sufficiently to be easily palpable in four children, whose ages ranged from two and a half to six years, and a fifth child had a generalized enlargement of the lymphatic glands which made it necessary to exclude a number of other possible diagnoses. Bronchitis and otitis media each complicated the disease on four occasions, and napkin rash was present once.
The development of erythema nodosum in two children whilst under treatment is interesting. One girl almost immediately afterwards developed signs of rheumatic carditis; her mouth was infected with staphylococcus aureus haemolyticus. The other child had a tuberculous family history.

**Bacteriology.** Thrush was again the only organism found in pure culture and it was isolated from children up to the age of ten. The accompanying table 1 summarizes the bacteriological findings, and allows comparison with the children of the younger age group. It is apparent that just as there is a change in the clinical picture, so also the emphasis has passed from thrush to the anaerobic organisms associated with the Vincent type of infection. But despite this general agreement between clinical and bacteriological pictures, it was difficult to prophesy what organism would be found in any individual case.

### TABLE 1

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th>IN 60 CASES UNDER 2 YEARS</th>
<th>IN 39 CASES OVER 2 YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thrush (Monilia albicans)</td>
<td>41</td>
<td>10</td>
</tr>
<tr>
<td>Bacillus fusiformis</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>Spirochaetæ (Vincentii)</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Staphylococcus (all types)</td>
<td>26</td>
<td>27</td>
</tr>
<tr>
<td>Streptococcus (all types)</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Pneumococcus</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>Micrococcus catarrhalis</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td>Other cocci</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Leptothrix</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>Diphtheroid</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>H. Influenzae</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Bacillus Friedlanderi</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Other bacilli</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

**Blood counts.** The white cells of twenty-five children were counted, and the total number of leucocytes was found to vary between 5000 and 21,000, averaging about 12,000 per c.mm. There was some immaturity of the granular cells, and in one case there were 7 per cent. of eosinophils. Once again a monocytosis constituted the characteristic abnormality: these cells ranged from 0 to 14 per cent. of the total count, amounting to 6 per cent. or more of the leucocytes in seventeen cases, and 10 per cent. or more in six cases. Again no relationship could be found between the symptoms, signs, or infecting organism on the one hand and the monocytosis on the other.

**Treatment.** The methods of treatment, and the criteria for comparison, were the same as those used for the younger patients, and the average length of time in days before cure was complete, is set out in table 2.

### TABLE 2

<table>
<thead>
<tr>
<th>TYPE OF STOMATITIS</th>
<th>N.A.B.</th>
<th>PERBORATE</th>
<th>GENTIAN VIOLET</th>
<th>MERTHIOLATE</th>
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<tr>
<td>Vincent's type</td>
<td>8·1</td>
<td>9·7</td>
<td>6·9</td>
<td>7·3</td>
</tr>
<tr>
<td>(B. fusiformis in smear)</td>
<td>7·6</td>
<td>9·1</td>
<td>6·0</td>
<td>6·9</td>
</tr>
<tr>
<td>Aphthous type</td>
<td>5·7</td>
<td>7·6</td>
<td>6·4</td>
<td>4·8*</td>
</tr>
<tr>
<td>(Thrush in smear)</td>
<td>7·0</td>
<td>12·0*</td>
<td>5·7</td>
<td>2·0*</td>
</tr>
</tbody>
</table>

* Average taken from two cases or less.
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The impression gained was that there was little to choose between N.A.B., gentian violet and merthiolate, although symptoms appeared to be relieved less rapidly by N.A.B. than by the other two preparations, both of which often improved the appetite and general condition in quite a dramatic way. Two adults who developed aphthous ulceration during the course of the investigation were loud in their praises of gentian violet, which brought almost instantaneous freedom from pain. A few failures were encountered, two with gentian violet, and one each with merthiolate and N.A.B. There were no relapses when the course of treatment had once been completed.

Discussion

It was calculated that about 5 per cent. of patients passing through the department during the autumn of 1938 had stomatitis. As the great majority of these children were under the age of three, the proportion was considerably greater in this age group, and so constitutes a matter of social importance. The number of cases may perhaps have been influenced by an autumnal rise in the incidence of the disease (Black, 1938), but stomatitis is a common ailment at all times of the year. It is also possible that the numbers may have been swelled somewhat by children being referred from other departments, as the study was known to be in progress. In whatever way the numbers are accounted for, the fact remains that in four months 115 children were seen with stomatitis, and over half the cases were infected with thrush. This is particularly interesting since it is believed by many that thrush is on the wane. There seems no valid reason to suppose that thrush is more common in Birmingham than in other parts of the British Isles, although it is certainly commoner in this country than it is in the United States, where 'It is fair to say that . . . acute infectious gingivo-stomatitis occurs four or five times as often as all other specific types of acute stomatitis in infants and older children combined. Thrush and aphthous stomatitis come next in frequency.' (Black, 1938.)

A possible explanation of this difference, which has support from the evidence of this paper, is that the English dummy is seldom used in America. All of the cases of thrush oesophagitis described by Ebbs (1938) were artificially fed. If thrush is indeed associated with the bottle and dummy, and is so rare amongst the breast fed, then it is difficult to agree with Cassie (1938), who commenting on Spence's eulogy of breast feeding, remarks that artificial feeding is both easy and safe.

It is true that thrush, like other forms of stomatitis, is supposed to be a benign condition, but nevertheless nine, and probably ten, children of the present series died, and Ebbs has pointed out that monilia oesophagitis is frequently fatal. Unfortunately there was no material evidence to help to decide the relationship between thrush and gastro-enteritis. When treatment had once been instituted gastro-enteritis did not develop in any child with thrush, but the reverse phenomenon was seen on one or two occasions. Even so the conviction remains that thrush may cause vomiting. Moreover, in spite of the observation by Ebbs that diarrhoea is never an outstanding sign in thrush oesophagitis, the present study shows that it is often associated with mycotic
stomatitis. Since the mycelium has been shown to infiltrate the walls of the oesophagus and has been recovered from the stools of babies with diarrhoea, there is no doubt that the fungus may invade the intestinal tract, and it is not altogether unreasonable to assume that it may be the cause of the diarrhoea. Even if stomatitis is not responsible for the alimentary disturbance, association of the two conditions is exceedingly common, and the prognosis appears to be increasingly bad according to the severity of the mouth lesion.

The problem of etiology is an absorbing one. It has been pointed out that there is so much overlapping of both clinical and bacteriological characteristics that hard-and-fast division into the recognized types of stomatitis is impossible. This agrees with Black's (1938) opinion that 'many of the cases at one period or another could have been classified according to any one of thirty or more synonyms in more or less general use.' He holds, and the present study confirms his observation, that the ulcers of acute infectious gingivo-stomatitis cannot be distinguished from the lesions of aphthous stomatitis. On this evidence he concludes that the two conditions may have the same primary cause. It is apparent that exactly similar ulcers may also be associated with thrush, and this leads to the belief that aphthous ulceration is merely a symptom, and not a disease entity. If this were so it would be easy to understand the overlapping of clinical features.

With the exception of thrush, all the organisms which were isolated have been demonstrated in normal healthy mouths, and this supports the view that they are secondary invaders, although as such they may become pathogenic. The evidence also suggests that in younger children thrush may act as the primary cause of pure mycotic, aphthous, or even of Vincent's stomatitis, since it may provide the ground on which secondary invaders may become active.

If the child is over two years old then it may be responsible. It has been shown by Dodd and her colleagues (1938, 1939) that if material obtained from the buccal lesions is inoculated into the cornea of a rabbit, a kerato-conjunctivitis develops corresponding exactly with that produced by the herpetic virus. Clinical support is given to this belief by Levine et al. (1939), who describe an epidemic of aphthous stomatitis with herpetic complications. This agrees with the observation in this study of the prevalence of herpes labialis in children of the older age group, and the development of two cases of stomatitis after contact with adults suffering from herpes febrilis. Further, when swabs were taken from contacts, in whom it would be expected that a common infecting organism might be demonstrated, no such organism could be found. If a virus is the primary cause of the stomatitis of older children second attacks will probably be rare, and Black (1938) maintains that this is so. A history of previous stomatitis was elicited from a large number of older children, but a good description of the nature of these earlier attacks was not obtained. As they developed during early childhood it is probable that they were due to thrush, and infection by monilia apparently does not confer immunity. One child was said to have had three attacks of aphthous stomatitis. Second attacks of stomatitis in later childhood were not encountered, perhaps because thrush is less common.
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This may also account for the general differences in the form of stomatitis below and over the age of two.

There was no evidence to support the belief that stomatitis is due to dietetic deficiency. This corresponds with the view of several recent writers. Herlitz (1938), who investigated the vitamin C saturation of children with and without gingivitis, was unable to find any significant difference between the two groups. Similarly Topping and Fraser (1939) concluded that there was no definite relationship between the commoner mouth lesions and vitamin deficiency. The very fact that deficiencies of so many vitamins have been implicated as a cause of the disease is itself a point which throws doubt on their importance.

In neither age group did the disease appear to be self-limited as is the case in America, but local treatment brought about rapid relief of symptoms and speedy cure. Whilst there may be no rational use for the local application of N.A.B. (Black, 1938) this paint was certainly more effective than perborate. It might be argued that it was the glycerin in the application which was responsible for the results, but if this were so it would be difficult to explain the failure of glycerin and borax. The most impressive results were obtained from a 1 per cent. solution of gentian violet or from merthiolate. Both these paints are coloured and there is therefore no difficulty in telling whether the affected areas have been thoroughly treated. Gentian violet has the advantage that it is considerably cheaper than merthiolate. It is also non-toxic, and has been administered by mouth in doses of 60 minims, until the stools were stained, in an effort to kill mycelium in the oesophagus and gut of babies, without causing any toxic effects. Merthiolate may be safe when administered in similar doses, but the manufacturers did not encourage its use in this way. Mirvish (1938) has advocated the use of tannic acid jelly in infantile stomatitis and this preparation was employed in a few cases at the end of the study. An insufficient number of children was treated to enable this form of treatment to be compared with other methods, but on the whole gentian violet appeared to be more effective. The etiology and treatment of stomatitis was discussed recently at a meeting of the American Pediatric Society (1939). Smith and others pointed out that American dental surgeons have used chromium trioxide (chromic acid) as a local application with great success, and although the results do not seem to be any more satisfactory than those obtained with gentian violet, a trial of the method will be made when an opportunity arises. Abt was of the opinion that chromic acid had no effect on the duration of the disease, but agreed that it was a most soothing form of treatment.

The changes which were observed in the white cells have apparently not been described previously, although Peeney (1939) says that he has seen a similar monocytosis in adults afflicted with Vincent's stomatitis. Black (1938) noticed no change in the differential leucocyte count of the cases which he studied. The monocytosis is difficult to explain. It appeared to be specific for stomatitis and yet not for the type of stomatitis, the organisms isolated, the severity of the disease, nor its complications. Perhaps it might be used as an additional argument for the existence of an unrecognized primary cause for all these types of stomatitis.
Summary

A hundred and fifteen cases of stomatitis have been studied. Girls were affected more frequently than boys, and four-fifths of the cases were under three years of age.

A rough distinction was noticed between the stomatitis found under and over the age of two. The commonest presenting symptom in both groups was sore mouth, and anorexia and malaise were almost always present. Diarrhoea was common in children of the young group, constipation in the older children. Vomiting was frequent in all. Pyrexia was considerably higher in the older group. Toxic, greyish pallor, without obvious anaemia, was an exceedingly common symptom.

Stomatitis in young children occurred in the artificially fed, or those who sucked dummies. It was usually due to thrush, even when aphthous ulceration was the chief sign. There was little or no odour and the cervical glands were not involved. Gastro-enteritis was an extremely serious complication. There was no distinct division between this type of stomatitis and the one occurring in older children.

The stomatitis of older children was of the Vincent type, but was often complicated by aphthous ulceration, whilst inflammation, offensive odour, and glandular enlargement were the rule. The organisms concerned were anaerobes, but an underlying organism of unknown character, possibly a virus, was probably the cause, and aphthous ulceration merely a symptom.

An absolute and relative monocytosis was found in many cases of stomatitis in all age groups. It was quite characteristic but the reason for its occurrence is unknown.

Various forms of treatment were tried, and local application of either 1 per cent. aqueous solution of gentian violet, or tincture of merthiolate (Lilly) were most effective. Symptomatic relief was particularly rapid. There was no evidence to implicate vitamin deficiency as playing any part in the condition.

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