INCIDENCE OF GINGIVITIS IN THE ROYAL AIR FORCE

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In the course of an inquiry into gingivitis in the Royal Air Force, initiated by Air Marshal Sir H. E. Whittingham, Director-General of Medical Services, the incidence of this condition was determined at four Royal Air Force stations.

Classification

Since the various forms of gingivitis are not clearly defined, it was decided to adopt a classification which would avoid ambiguity and which was based on naked-eye appearances. The gums of those examined were assigned to one or other of the following categories.

A. Normal.

B. *Gingivitis without Ulceration*.—In this group the gums and the interdental papillae are swollen, bluish red in colour, frequently bleed on pressure, and, adjacent to the teeth, may have a smooth shiny appearance with absence of the normal stippling. Such gums are often sensitive when touched with a probe. The lesion most frequently occurs in the region of the lower incisors. When viewed through the corneal microscope the normal cornified layer may be seen to stop short about 2 to 3 mm. from the crest of the gum. Between this point and the crest the gum is swollen and oedematous, and the capillaries lie in long loops, like hairpins, whereas in the normal gum, and in the region where the cornified layer is still present, they are convoluted. Purely local patches of hyperaemia due to obvious trauma or to toothbrush abrasions were not regarded as this type of gingivitis.

C. *Healed Gingivitis*.—The interdental papillae are missing and the gums are pale, but thickened and rolled in appearance. There is no evidence of existing inflammation; it is clearly a healed condition. Those who have suffered previously from gingivitis and have undergone treatment often have gums of this type.

D. *Chronic Ulcerative Gingivitis*.—Cases in this group usually resemble Type B gingivitis with a superadded chronic ulceration, frequently at the tip of one or more interdental papillae. The ulceration may occur more deeply, between the gums and the necks of the teeth; the appearance is then of an early periodontitis.

E. *Acute Ulcero-membranous Gingivitis and Gingivostomatitis*.—This can be subdivided into two groups: (i) arising on apparently healthy gums; (ii) arising on gums which show evidence of pre-existing inflammation. Types E i and E ii constitute the entity known as trench mouth, and often the presenting symptom is pain. This can be of two varieties: (a) pain of an aching character, localized to the region of the affected gum—throbbing may occur if the lesion is acute; (b) dull aching pain, like toothache, situated deeply and not well localized. Foetor oris is always present, and, contrary to some teaching, may be noted by the patient. Bleeding of the gums usually occurs with mild trauma, as from tooth brushing, but it can arise spontaneously, and may be the presenting symptom. The lymph glands which drain the affected area may be swollen and painful. The lips are often crusted, the lower lip and the angles of the mouth being most frequently affected. The tongue may be swollen and show marginal indentations from pressure of the teeth. The gums are swollen, hyperaemic, and turgid in appearance; the normal line of demarcation between the pale mucous membrane of the gum and the redder mucous membrane of the gingivo-labial fold is absent.

Two types of ulceration may be present, concurrently or separately. In the more acute form a narrow serpiginous band of ulceration, with apparent membrane formation, extends round the necks of the teeth; it is confined to the region of the alveolar crest. This process may stop abruptly if a gap due to previous dental extractions exists between the teeth. Rarely, ulceration occurs on that part of the buccal mucous membrane in contact with the affected gum. Ulceration may also occasionally extend on to the mucous membrane of the fauces and soft palate. The other type of ulceration does not seem to be so acute, and it is confined to the tips of some of the interdental papillae. Both types of ulceration occur about the incisor teeth, but the lesions may be generalized or they may be confined to other regions of the mouth.

The chief general disturbances are lassitude and mental depression, but these may be entirely absent. The temperature is usually normal, but it may be slightly raised. There is no characteristic blood picture, but occasionally a slight polymorphonuclear leucocytosis may occur.

Method of Investigation

At each of the stations concerned a random sample of the personnel was taken from the nominal roll. These were ordered to attend for examination. If, owing to leave, sickness, or other cause, any of those selected could not be present, the reason was stated by the section concerned. At the first station to be examined the random sampling was carried out by Dr. Bradford Hill. Each subject, when examined, was required to give details of age, sex, Royal Air Force or Women's Auxiliary Air Force trade, civilian occupation before joining the Service, and date of joining. The gums were then classified into one or other of the above groups.

Results

Tables I to IV show the incidence of the various types of gingivitis at the four R.A.F. stations.

TABLE I.—Incidence of Gum Lesions among Personnel at
Fighter Station I

Age:	R.A.F.					W.A.A.F.					Sum Total
	—25	26–30	31–35	36+	Total	—25	26–30	31–35	36+	Total	
Gums:											
Normal ..	42	19	4	9	74	41	2	0	0	43	117
Type B ..	14	9	8	11	42	12	1	1	0	14	56
Type C ..	1	0	2	2	5	1	1	0	0	2	7
Type D ..	1	0	2	16	19	2	1	0	0	3	22
Edentulous	0	2	4	10	16	0	1	0	0	1	17
Total ..	58	30	20	48	156	56	6	1	0	63	219
% Normal	72.4	63.3	20.0	18.7	—	73.2	—	—	—	—	—

TABLE II.—Incidence of Gum Lesions among Personnel at
Fighter Station II

Age:	R.A.F.					W.A.A.F.					Sum Total
	—25	26–30	31–35	36+	Total	—25	26–30	31–35	36+	Total	
Gums:											
Normal ..	41	17	17	11	86	45	5	0	0	50	136
Type B ..	20	11	14	13	58	17	4	1	0	22	80
Type C ..	0	2	1	7	10	0	0	0	0	0	10
Type D ..	1	1	2	2	6	3	0	0	0	3	9
Type E i ..	0	1	0	0	1	0	0	0	0	0	1
Edentulous	0	1	5	10	16	0	0	0	1	1	17
Total ..	62	33	39	43	177	65	9	1	1	76	253
% Normal	66.1	51.5	43.6	25.6	—	69.3	—	—	—	—	—

TABLE III.—Incidence of Gum Lesions among Personnel at
R.A.F. Bomber Station III

Age:	R.A.F.					W.A.A.F.					Sum Total
	—25	26–30	31–35	36+	Total	—25	26–30	31–35	36+	Total	
Gums:											
Normal ..	90	50	36	20	196	33	2	0	0	35	231
Type B ..	39	18	25	17	99	13	1	1	0	15	114
Type C ..	2	2	7	3	14	0	0	0	0	0	14
Type D ..	5	4	8	6	23	3	0	0	0	3	26
Type E i ..	1	0	1	0	2	0	0	0	0	0	2
Edentulous	2	8	14	14	38	0	1	0	0	1	39
Total ..	139	82	91	60	372	49	4	1	0	54	426
% Normal	64.8	61.0	39.6	33.3	—	67.4	—	—	—	—	—

TABLE IV.—Incidence of Gum Lesions among Personnel at
R.A.F. Bomber Station IV

Age:	R.A.F.					W.A.A.F.					Sum Total
	—25	26–30	31–35	36+	Total	—25	26–30	31–35	36+	Total	
Gums:											
Normal ..	74	26	21	10	131	30	2	6	2	40	171
Type B ..	24	13	20	8	65	20	6	0	0	26	91
Type C ..	2	0	3	3	8	1	0	0	0	1	9
Type D ..	2	0	3	3	8	3	0	0	0	3	11
Edentulous	0	5	2	16	23	1	0	0	0	1	24
Total ..	102	44	49	40	235	55	8	6	2	71	306
% Normal	72.5	59.1	42.8	25.0	—	54.5	—	—	—	—	—

These results have been summarized in Table V. From the figures given therein edentulous subjects have been excluded, since they are not normally susceptible to gingivitis.

TABLE V.—Incidence of Gingivitis in Personnel with Teeth at Stations I, II, III, and IV

Age:	-25		26-30		31-35		36+	
	Norm.	Ging.	Norm.	Ging.	Norm.	Ging.	Norm.	Ging.
Gums:								
Station:								
I ..	83	31	21	12	4	13	9	29
II ..	86	41	22	19	17	18	11	22
III ..	123	63	52	25	36	42	20	26
IV ..	104	52	28	19	27	26	12	14
Total ..	396	187	123	75	84	99	52	91
% ..	67.9	32.1	62.1	37.9	45.9	54.1	36.3	63.7

Table VI shows the proportions of the various types of gingivitis at the four stations where the survey was carried out. About 75% of all subjects with gingivitis have a Type B lesion. A chronic ulcerative gingivitis is present in about 15%, but the proportion varies greatly at different stations. That at Fighter Station I is significantly higher than the proportion at Fighter Station II or at Bomber Station IV. This is chiefly due to variations in the numbers of older personnel examined at each of the stations. Only 3 subjects suffering from acute ulceromembranous gingivitis were found.

In subsequent analyses all types of gingivitis have been grouped, since the numbers of all but Type B are too small to be subdivided, and since most authorities agree that in a large proportion of cases chronic ulcerative gingivitis (Type D) is an extension of Type B.

TABLE VI.—Proportions of Various Types of Gingivitis at Four R.A.F. Stations

Station	Type of Gingivitis					Total
	B	C	D	E i	E ii	
Fighter I ..	56 (65.8)	7 (8.2)	22 (26.0)	0	0	85 (100)
" II ..	80 (80.0)	10 (10.0)	9 (9.0)	0	1 (1.0)	100 (100)
Bomber III ..	114 (73.2)	14 (9.0)	26 (16.7)	0	2 (0.1)	156 (100)
" IV ..	91 (82.0)	9 (8.1)	11 (9.9)	0	0	111 (100)
Total ..	341 (75.4)	40 (8.9)	68 (15.0)	0	3 (0.7)	452 (100)

Figures in parentheses represent percentages.

The social status of 540 airmen taken at random from those examined was arrived at from their pre-Service civilian occupation (Medical Research Council, 1944), and the percentage of those with normal gums (edentulous subjects excluded) in each social grade was determined. Table VII shows these results.

TABLE VII.—Gingivitis and Pre-Service Social Status

Gums	Social Class					Total
	1	2	3	4	5	
Normal ..	7	62	200	35	11	315
Gingivitis ..	2	33	136	43	11	225
Total ..	9	95	336	78	22	540
% Normal	77.7	65.3	59.5	44.9	50.0	—

The incidence of gingivitis of all types (edentulous subjects excluded) in the different R.A.F. trades is shown in Table VIII. The figures therein have been corrected for age differences in the following manner. The age distribution of the whole of the population was first determined, and this was taken as a standard (Table IX). The incidence of gingivitis among those susceptible in each age group of each trade was then found, and was applied to the respective age group of the standard population. The results in each trade were added, the figures shown in Table VIII being obtained. This correction was necessary because of the vastly different age distribution in different trades and because of the relation of the incidence of gingivitis to age, which can be seen in Table V.

TABLE VIII.—Gingivitis in R.A.F. Trades, corrected for Age Differences. (Edentulous Personnel excluded)

Trade	% Gingivitis
Air-crew ..	22
Cooks, butchers, batmen, waitresses ..	60
Group I trades ..	34
" II ..	45
" IV ..	40
" V ..	44

Cooks and butchers, batmen, and waitresses have been excluded from their respective trade groups. Too few personnel in Group III and "M" were examined for an adequate comparison to be made. In general, Group I contains the more skilful and more highly paid workers.

TABLE IX.—The Age Distribution of the Standard Population. (This was obtained from the Average Age Distribution of all Four Stations)

Age Group	No. of Persons
-25 ..	52.7
26-30 ..	17.0
31-35 ..	17.4
36+ ..	12.9
	100.0

Table X shows the incidence of gingivitis among susceptible subjects grouped according to length of service. These figures have been corrected for differences in age distribution in the same way as those obtained for the various R.A.F. and W.A.A.F. trades.

TABLE X.—Incidence of Gingivitis, corrected for Age, according to Length of Service in the R.A.F. (Edentulous Personnel excluded)

Length of Service (mths.)	No. Examined	% Gingivitis
0-11 ..	122	41.14
12-23 ..	160	35.82
24-35 ..	275	40.22
36+ ..	152	36.11

Discussion

Sex Incidence.—Tables I, II, III, and IV show that only at Bomber Station IV was the incidence of gingivitis among airwomen different from that among airmen of the same age group. At this station the difference is statistically significant ($P=0.03$), the airwomen being worse. Furthermore, the incidence among airwomen at this station is just significantly higher than that among those at the other three stations ($P=0.05$). The reason for these differences is not known, but it would seem that there is usually no difference in the incidence of gingivitis among the two sexes.

Age Incidence.—Table V shows clearly that the incidence of gingivitis is greater in the older age groups. It is necessary, therefore, to apply a correction for age distribution when the incidences of gingivitis in two different groups are to be compared. The method of carrying out this correction has already been described; it has been applied to the different stations examined, and the corrected incidence of gingivitis so found is shown in Table XI.

TABLE XI.—Incidence of Gingivitis in the Susceptible Population of Each of Four R.A.F. Stations, Corrected for Age to the Standard Population

Station	% Gingivitis
I ..	43.6
II ..	42.4
III ..	40.0
IV ..	39.9

Incidence compared with Other Groups.—It is difficult to compare the incidence of gingivitis found in the R.A.F. with that found by other investigators among other groups of subjects, since the standards of diagnosis are so variable. During the last war Semple, Price-Jones, and Digby (1919) found that 29.5% of one unit had gingivitis. Whittingham (1932), during an extensive investigation into the aetiology of tonsillitis, examined the gums of nearly 3,000 R.A.F. and Army apprentices between the ages of 16 and 19. Table XII shows the results he obtained.

TABLE XII

R.A.F.	No. Examined	% Gingivitis
Army ..	2,085	16.9
	655	34.4

Considering the difference in age, it is seen that the incidence found in R.A.F. apprentices is similar to that found in the present investigation for air-crew, while the incidence for Army apprentices is similar to that for other R.A.F. trades. The boys who became aircraft apprentices in 1930 were of much the same social class as those now volunteering for air-crew duties, whereas people who became Army apprentices were similar to those who now enter the other R.A.F. trades. More recently Roff and Glazebrook (1940) found the incidence in naval trainees to be 17.6%. This figure again is close to that obtained in the R.A.F. apprentices, and it is probable that both groups were recruited from similar sections of the population.

MacDonald (1943) examined 614 naval personnel and found the incidence of gingivitis to be 28.5%. In this figure, however, no correction has been made for age (although the author shows

that there is an increase in the incidence of gingivitis with increase in age), and edentulous subjects—who, as he points out, are not susceptible—are included in the total. Exclusion of the latter brings the incidence to 30.5%, but this figure is uncorrected for age. For those under 30 years the incidence was 17.7%. In the present investigation the incidence of gingivitis among airmen and airwomen under 30 years (including edentulous subjects for the sake of comparison) was found to be 32.7%. The age-corrected incidence of gingivitis among those susceptible in the R.A.F. is approximately 40%.

Influence of Social Status.—The figures in Table VII show that there is a correlation between the incidence of gingivitis and pre-Service social status, the condition being less prevalent in the higher-income groups. It is beyond the scope of this paper to discuss the reason for this, but both dietetic factors and differences in personal hygiene may be involved.

Incidence in Various R.A.F. Trades.—The incidence of gingivitis among air-crews is significantly less than that among the rest of the R.A.F., due correction having been made for age differences; but it should be noted that only specially selected air-crew personnel were posted to the stations which were examined. On the other hand, the incidence among those engaged in messing and in the preparation of food is significantly higher than among the remainder, excluding air-crew. If the condition is infectious this finding is obviously important.

Whether the differences in the incidence of gingivitis among personnel engaged in the different R.A.F. trades are due to specific working conditions it is difficult to say; but the fact that different trades recruit their members in different proportions from the various social classes must certainly play a large part in producing the variations which have been found. This supposition is supported by the fact that there seems to be no relation between the incidence of gingivitis and length of service in the Royal Air Force.

Summary

A survey of the gums of random samples of airmen and airwomen from each of four Royal Air Force stations has been carried out.

The incidence of gingivitis was approximately 40%. It was higher among those susceptible in the older age groups and in those recruited from the poorer social classes. Length of service in the R.A.F. did not seem to influence the incidence of gingivitis. Significant differences were found among the various trade groups, the incidence being lower among those who were more highly paid.

The reasons for these differences have been discussed.

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RUPTURE OF AORTIC ANEURYSM INTO THE DUODENUM

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One of the rarest causes of fatal intestinal haemorrhage is rupture of an aortic aneurysm into the gut. Howland and Sprockin (1943) reported a case and found 4 similar cases recorded since 1936, when Kampmeier (1936) discovered 9 cases in the literature and contributed another. These 15 cases are included in their summary of 520 cases of abdominal aneurysm recorded up to Dec., 1942. Four aneurysms of the abdominal aorta—two rupturing into the retroperitoneal tissues, one into the duodenum, and a small asymptomatic one—have

been seen. The present case of haemorrhage into the duodenum is worthy of record, and the diagnosis was suggested before necropsy.

Clinical History

The patient, a housewife aged 64, complained of aching pain referred to both sides of the abdomen and of frequency and scalding on micturition. These symptoms, of two to three months' duration, were not incapacitating. On examination a mass the size of a cricket ball was felt to the left of the umbilicus. This was slightly fluctuant and somewhat tender, and pulsated with the heart-beat. Special examinations failed to contribute further to the diagnosis, especially as between a pancreatic cyst and an abdominal aneurysm. The urine contained *B. coli*, the blood Wassermann reaction was negative, and a fractional test meal revealed complete achlorhydria. A radiograph of the abdomen disclosed no abnormality, and with a barium meal there was no deformity of the stomach and the meal passed normally through the intestine. A urinary diastase index of 10 was normal. After rest and treatment for cystitis for three weeks the patient went home. Ten weeks later she had a very severe haematemesis and was readmitted in extreme collapse. After transfusion of three pints of blood her blood pressure rose from 60 to 85 mm. Hg systolic, but she continued to vomit blood and died in seven hours.

Pathology

Bright red blood, often in large clots, filled the greater part of the stomach and small intestine and reached to the hepatic flexure. Where its horizontal part passed into the ascending part the third part of the duodenum was lifted forwards by a globular mass adherent to its posterior aspect and to the left side of the aorta. Even after fixation this measured 6.5 by 6.5 by 4 cm. At the same level there was a vertical tear with dark red and slightly everted edges in the mucosa of the posterior duodenal wall measuring 1.5 by 0.5 cm. and communicating with the aorta through the cavity of the globular mass. This was filled with blood-clot, some of which was old and laminated, though little of it was organized. The walls were in few places more than 0.5 cm. in thickness, but there was considerable fibrosis in the surrounding retroperitoneal tissue. The entrance to this sac from the aorta was round and 1.5 cm. in diameter, while the wall of the aorta up to the very margins of the defect appeared free from stretching or scarring. The orifice of the inferior mesenteric artery was carried into the lower margin of the entrance of the sac, but its lumen contained no thrombus. The renal arteries lay above the sac and were not involved. From about an inch above the aneurysmal sac to its iliac bifurcation the intima of the aorta showed confluent hyaline plaques containing very little calcium and no grumous material. There was no intimal scarring in the region of the arch, nor adventitial thickening.

Numerous sections of the aorta showed only a little adventitial thickening and a very occasional infiltration by mononuclear cells around the vasa vasorum. The elastica of the media, even at the edge of the aneurysm, was not demonstrably altered by the fibrosed atheromatous plaques. Near the margin of the aneurysmal defect the adventitial fibrous tissue increased, and distinctive infiltrations of mononuclear cells, including plasma cells, occurred around thickened vasa vasorum and extended inwards into the media. In the disorganized wall opening into the aneurysmal sac itself the changes were less specific, plasma cells were numerous, but proliferating fibrous-tissue elements and large mononuclear cells, some containing haemosiderin, were also present, and elastic elements had almost entirely disappeared.

Complete routine histology from all organs revealed nothing of further interest apart from portal cirrhosis which was not actively progressive, the absence of the lesions of Banti's disease from the spleen, and the non-specific nature of bilateral apical lung scars.

Probably almost all these aneurysms are due to syphilis. Specific changes may be limited to small areas of the aorta, and only after very detailed study can atheroma, acute bacterial aortitis without focus elsewhere (Rappaport, 1926), or aortitis of undetermined origin (Sproul and Hawthorne, 1937) be considered. Atheroma was not unusual or excessive in the present case. The plaques were largely fibrosed, and, while the changes in the wall at the actual site of the aneurysm cannot now be known, it is reasonable to believe that the mural defect was secondary to changes in the vasa vasorum similar to those noted in the thickened adventitia and in the media at the margin of the aneurysm. Syphilitic aortitis is often the cause of an aneurysm; atheroma is much more common, and yet it is difficult to obtain evidence that it is ever responsible.

In 900 necropsies on patients over 30 years of age with complete histology of all organs, 15 thoracic and 4 abdominal aneurysms were found to be due to syphilis and only 3 were dissecting aneurysms secondary to medial necrosis. In the same material a further 29 cases showed changes which justified