A FURTHER STUDY OF THE TEETH OF 5-YEAR-OLD CHILDREN IN RESIDENTIAL HOMES AND DAY SCHOOLS

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It was brought home to one of us in 1929, when examining the teeth of some 5-year-old children in London County Council schools, that there was a great difference between the condition of their teeth and those of children living in orphanages in the Midlands. Among the L.C.C. pupils at this time there were only 4.7%* with caries-free or almost caries-free deciduous dentitions, whereas it was obvious at a glance that the number of orphanage children with caries-free teeth was much higher. In 1943 the chance arose of making a limited number of systematic inspections of the teeth of children living under different conditions. It was decided, in the first place, to see whether any changes had occurred in the teeth of L.C.C. pupils between 1929 and 1943. The improvement was so great (the 4.7% of 1929 had increased to 24.2% in 1943) that similar inspections were made in 1945, 1947, and 1949 (Mellanby and Coumoulos, 1944, 1946; Mellanby and Mellanby, 1948, 1950).

It was not until 1945 that an opportunity arose of seeing whether there was any real connexion between living conditions and dental health in orphanage and L.C.C. children. Concurrently, a similar inquiry was made among pupils attending private (fee-paying) day schools; like the L.C.C. children, they lived with their own families. Meanwhile various workers had observed a tendency for children brought up in orphanages to suffer little from caries, while others, including Collett (1935) and Schiötz (1939) in Norway, and Anderson *et al.* (1934), in Toronto, had published a few figures relating to mixed age groups indicating that there was less caries among such children than among the general population. The threefold survey of 1945 (Coumoulos and Mellanby, 1947) showed that children living in homes had the worst dental structure, suggesting poor calcifying diets during tooth development, and yet had the least caries—less than the children of comparatively well-to-do families and much less than the L.C.C. group. It would have been instructive had we been able to parallel every survey in L.C.C. schools with similar inspections among residential homes and private-school children, but this was not possible. Early in 1950, however, the two groups in question were reinvestigated. This seemed especially urgent, since the present policy of boarding-out and adoption is removing nearly all 5-year-olds from homes.

In this paper we are using the term "home" or "residential home" to cover residential nurseries and schools administered by the State or by voluntary bodies; previously we called them institutions. These are maintained

for children deprived of a normal home life for a variety of reasons, such as the death, prolonged illness, or prison sentence of one or both parents, illegitimacy, or lack of suitable housing facilities. Formerly such children were accommodated in orphanages, or institutions of various types, including workhouses.

Clinical Material and Methods

So far as possible the same homes and schools were included in the 1950 survey as previously, but others from near-by districts were added to increase the size of the sample. In all, 55 homes (mainly situated in London and the surrounding country, with a few in the Midlands) and 32 private and independent schools (in London and adjacent counties) were visited, the total numbers of children dentally inspected being 542 in the former and 560 in the latter group. In 1950, as in 1945, the average age of both groups of children was approximately 5½ years.

The standards adopted for hypoplasia and caries in the clinical examination, and the methods used in calculating the results, were the same as those employed on many previous occasions. The degree of hypoplasia was estimated with a right-angled probe: and the rougher the labio-buccal surfaces the greater the degree of M-hypoplasia. For diagnosing caries an illuminated mirror and sharp rat-tailed dental explorer of standard size were used. The teeth were neither dried nor x-rayed, since, although these aids to detection would have resulted in more caries being seen, the findings would not have been comparable with those of past surveys; moreover, the diagnosis of the presence and extent of caries by any known method often comes in for criticism. For this type of work the important thing is to have agreement on the standards to be adopted, followed by adherence to these standards on the part of the investigators, who must work in close collaboration.

The method of presenting the findings, especially those relating to caries, is also open to criticism. We have considered the arguments for and against our system and the schemes adopted by some other workers, but for various reasons we prefer to retain our own. Most dental research workers concentrate mainly on the incidence of disease, including evidence of past decay, in recording the dental status of any given group of the population. They often ignore the structure of the teeth, apart from the grosser forms of defect, and its bearing on the liability to caries. We, however, feel strongly that both should be considered, and that, in accordance with the precepts of preventive medicine, the emphasis should be on the well-calcified and the caries-

*This figure of 4.7% included children with up to three teeth with very slight caries (C₁ cavities) since the number of caries-free individuals was negligible.

free teeth rather than merely on the incidence of defect or disease. In giving the results of the surveys, therefore, we mention first the more ideal state, which it is hoped more children will ultimately attain.

In assessing the quality of the teeth, division was made into those which were externally smooth (no hypoplasia) and those with varying degrees of roughness of the labial or buccal surfaces. M-hypoplasia (King, 1940) was graded M-Hy₁ to M-Hy₃, according to the increasing severity of the defects, while teeth with certain well-defined types of surface irregularity were, as before, classified separately as gross or "textbook" hypoplasia. The numbers of teeth in the various categories of hypoplasia are expressed in the tables as percentages of the total number of teeth examined. Any teeth which were so carious or had such heavy deposits of tartar that the surface structure could not be gauged were omitted from this classification, and thus from the tables dealing with structure. The average extent of surface texture defects of the M-type is represented by the average hypoplasia figure (A.H.F.); this, in conjunction with the percentages of hypoplastic teeth, is, we believe, useful in assessing the improvement or otherwise in the dental structure of successive samples of children—for example, 5-year-old L.C.C. pupils examined between 1943 and 1949.

Caries is expressed both as incidence and as extent for each type of tooth, and for the sum of all types, in each group of children. The incidence of decay by itself, whether given as a percentage or as the D.M.F. (decayed, missing, and filled) figure, can be misleading, since a group of individuals with small cavities would appear in the table to have the same amount of caries as a group in which the cavities were large. For this reason the extent of caries in each decayed tooth is described as being of grade 1, 2, or 3, according to the estimated size of the cavity in relation to the size of the tooth. The average caries figure (A.C.F.), like the A.H.F., is some fraction of 3, and measures the estimated average extent of caries in the teeth. In our opinion the advantage of this method as against those involving tooth surfaces is its relative simplicity; also the results so expressed are comparable with those previously given in this series of reports and those published by others using the same method (Deverall, 1936; Davies, 1939; King, 1940; Coumoulos, 1946; Stones *et al.*, 1949).

In all the surveys made since 1943 it has been possible to calculate from the published figures the D.M.F. values. For instance, the percentage of carious teeth, as expressed in Table IV and in earlier papers, is equivalent to the D.M.F. per 100 deciduous teeth, while the total number of carious teeth divided by the number of children and then multiplied by 100 gives the D.M.F. per 100 children. Since the deciduous incisors are in process of being shed between the ages of 5 and 6 years, the missing ones are considered, in all our surveys, to have been lost naturally, and are therefore omitted from the tables. On the other hand, any absent canines and molars would almost certainly have been extracted for caries at this period; they are therefore included in the caries totals (grade C₃). It will be seen from Table I that the majority of missing incisors in this age group are lower centrals, in which there is very seldom any decay, so that the total number of decayed teeth which might have been present in those counted as "shed" must be small. It is obviously more difficult to analyse caries figures for children of mixed age groups, espe-

TABLE I.—Percentages of Teeth Present at Time of Inspection

Type of Tooth	Residential Homes		Private Schools	
	1945	1950	1945	1950
Upper:				
Centrals ..	94.0	93.3	93.5	94.9
Laterals ..	97.8	98.6	99.2	98.7
Canines ..	99.8	99.9	100.0	100.0
1st molars ..	99.5	99.4	98.2	98.1
2nd molars ..	99.8	99.4	99.5	99.2
Lower:				
Centrals ..	85.7	81.5	76.0	76.3
Laterals ..	98.5	98.9	97.4	97.7
Canines ..	100.0	100.0	99.5	100.0
1st molars ..	98.6	98.9	95.4	95.5
2nd molars ..	99.2	98.6	98.4	98.2
All types ..	97.3	96.8	95.8	95.9

cially those between 7 and 12 years, because the times of eruption and shedding vary widely. For the 5-year-old children the task is relatively simple. From Table I it is also seen that nearly all the teeth are still *in situ*, with the exception of the lower central incisors, which are normally shed relatively early.

Results

Table II shows the percentages of children in the two groups who were caries-free and those who were nearly so, together with the numbers of D.M.F. teeth per 100 children.

TABLE II.—Children Caries-free or Almost So, and the D.M.F. Values Per 100 Children in Residential Homes (R.H.) and Private Schools (P.S.)

Group Investigated	No. of Children Examined		% Caries-free		% Almost Caries-free		% Caries-free + Those Almost Caries-free		D.M.F. per 100 Children	
	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950
R.H.	325	542	57.2	58.7	8.9	14.9	66.1	73.6	204	139
P.S.	371	560	50.4	40.0	4.3	18.0	54.7	58.0	275	246

Although the figures for caries-free children are given here to conform with the reports of all the earlier surveys of the series, it has throughout been realized that where the differences between the various groups under review are not spectacular a better picture is gained by considering teeth rather than dentitions. Thus some 10% more private-school children had dental decay in 1950, yet the total percentage of caries-free teeth (C₀) was actually greater than in 1945. In other words, the disease was more widespread at the time of the later survey, but was of a milder form (see Tables II and IV).

The findings relating to the teeth as opposed to the whole dentitions of the children are given in Tables III to VI. In considering them, a comparison will first be made between the 1950 and the 1945 results for each of the two groups of children separately. Then the results for the residential homes and the private-school groups will be compared. Passing references to the findings in L.C.C. schools in 1949 and 1945 will also be made, although the interval between examination was six months less for them than for the other groups.

Surface Structure of the Teeth

Residential Homes in 1950 and 1945.—It will be seen from Table III (column 4) that 42.0% of all the teeth were perfect or nearly perfect in structure—that is, hypoplasia-free—in 1950 as compared with 32.3% in 1945. This improvement was found in all types except the upper first molars, which remained the same as before, and the upper second molars, where the

percentage decreased. (It is realized that tartar deposits found on a proportion of upper molars, especially second molars, may mask the actual surface texture, thus making it difficult to assess the structure and therefore any change. This applies to all our surveys.) There was very little M-hypoplasia of the most severe grade (M-Hy₃) in any type of tooth in 1950, less than 1% of all the teeth examined falling into this category, as compared with the slightly higher figure of 1.7% in 1945. The A.H.F. had decreased for every type of tooth except apparently the upper second molars, the total having fallen from 0.92 to 0.76. Gross hypoplasia, though relatively low in both series, was lower in

1950 than previously, 1.7% of all teeth, as compared with 4.8% in 1945, being affected by this form of defect.

Private Schools in 1950 and 1945.—Among these children the dental structure was substantially the same in 1950 as in the earlier survey. There were 52.3% of the total teeth free from hypoplasia as compared with 54.0% previously (Table III, column 4). Some, such as the upper incisors and canines, showed improvement in the five-year-period, while others, notably the molars, were not as good as formerly.

As in the case of the residential homes, very few teeth had really severe structural defects (M-Hy₃), the

TABLE III.—Comparison of Tooth Structure in Residential Homes (R.H.) and Private Schools (P.S.)

(1) Type of Tooth	(2) Group	(3) Total No. of Teeth Examined for Structure		(4) Good Structure (Hy ₀)		(5) Slightly Defective Structure (M-Hy ₁)		(6) Defective Structure (M-Hy ₂)		(7) Very Defective Structure (M-Hy ₃)		(8) Gross Hypoplasia (G-Hy)		(9) A.H.F.*	
		1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950
Upper:				%	%	%	%	%	%	%	%	%	%		
Central incisors	R.H.	609	1,001	32.2	51.7	39.2	34.5	20.5	11.6	1.6	0.2	6.2	2.0	0.91	0.59
	P.S.	689	1,053	51.8	63.5	30.9	30.3	14.2	5.4	0.6	0.0	2.5	0.8	0.63	0.41
Lateral incisors	R.H.	635	1,062	32.9	43.3	53.5	46.6	8.3	8.1	0.5	0.2	4.6	1.8	0.75	0.65
	P.S.	722	1,096	64.4	65.0	26.3	32.1	6.5	2.4	0.6	0.0	1.8	0.5	0.42	0.37
Canines	R.H.	647	1,079	30.0	49.3	57.2	44.8	9.1	4.4	0.5	0.0	1.4	1.4	0.79	0.54
	P.S.	735	1,113	63.8	75.7	31.2	23.1	3.3	0.7	0.3	0.0	1.0	0.3	0.39	0.25
1st molars	R.H.	639	1,070	7.7	7.6	36.9	49.0	46.6	40.3	2.7	0.8	6.1	2.3	1.47	1.35
	P.S.	725	1,095	24.8	12.5	47.2	60.0	23.2	27.2	2.9	0.1	1.9	0.2	1.04	1.15
2nd molars	R.H.	644	1,070	6.2	3.0	32.6	36.5	51.7	53.3	5.4	5.1	4.0	2.1	1.59	1.62
	P.S.	736	1,105	19.8	7.2	51.4	49.8	24.9	42.4	2.8	0.5	1.1	0.0	1.11	1.36
Lower:															
Central incisors	R.H.	552	869	78.1	93.3	20.5	6.4	0.4	0.2	0.0	0.0	1.1	0.0	0.21	0.07
	P.S.	559	845	92.5	97.3	7.1	2.7	0.2	0.0	0.0	0.0	0.2	0.0	0.08	0.03
Lateral incisors	R.H.	636	1,064	66.8	76.5	31.3	22.4	0.8	0.7	0.0	0.0	1.1	0.5	0.33	0.24
	P.S.	718	1,088	87.9	86.3	11.1	13.5	0.4	0.0	0.0	0.0	0.4	0.2	0.12	0.14
Canines	R.H.	647	1,079	50.1	64.1	40.2	32.3	2.2	1.3	0.0	0.0	2.3	0.8	0.48	0.36
	P.S.	736	1,118	81.8	81.0	13.7	17.9	1.6	0.2	0.0	0.0	0.7	0.4	0.18	0.18
1st molars	R.H.	631	1,068	16.6	21.0	40.4	48.1	30.7	27.5	1.9	0.4	10.3	3.0	1.20	1.08
	P.S.	698	1,067	37.0	21.0	41.5	62.6	18.1	16.2	2.1	0.0	1.1	0.2	0.85	0.95
2nd molars	R.H.	637	1,064	8.8	20.4	40.0	56.1	36.4	19.5	4.2	0.8	10.5	3.1	1.40	1.01
	P.S.	718	1,094	24.2	22.8	44.6	62.3	26.7	14.2	2.8	0.6	1.7	0.1	1.08	0.93
Totals	R.H.	6,277	10,426	32.3	42.0	39.5	38.3	20.9	16.9	1.7	0.8	4.8	1.7	0.92	0.76
	P.S.	7,036	10,674	54.0	52.3	31.0	36.1	12.1	11.1	1.2	0.1	1.3	0.3	0.60	0.59

*A.H.F. (average hypoplasia figure) =

Total hypoplasia figure
Total No. of teeth examined for structure (excluding those with G-hypoplasia or unclassified hypoplasia)

A few of the teeth included in column 3 could not be classified into any of the grades shown in this table. Therefore the percentages do not add up to 100 in all instances.

TABLE IV.—Caries Incidence and Extent in Residential Homes (R.H.) and Private Schools (P.S.)

(1) Type of Tooth	(2) Group	(3) Total No. of Teeth		(4) No Caries (C ₀)		(5) Slight Caries (C ₁)		(6) Moderate Caries (C ₂)		(7) Severe Caries (C ₃)		(8) Total Carious Teeth (i.e. D.M.F. per 100 Teeth)		(9) A.C.F.*	
		1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950
Upper:															
Central incisors	R.H.	611	1,011	89.7	90.3	2.3	5.9	6.2	3.3	1.8	0.5	10.3	9.7	0.20	0.14
	P.S.	694	1,063	88.8	90.6	3.0	3.9	6.5	4.9	1.7	0.7	11.2	9.4	0.21	0.16
Lateral incisors	R.H.	636	1,069	95.0	96.4	1.3	2.2	3.5	1.3	0.3	0.1	5.0	3.6	0.09	0.05
	P.S.	736	1,105	94.2	96.7	2.4	1.1	2.7	1.6	0.7	0.5	5.8	3.3	0.10	0.06
Canines	R.H.	650	1,084	97.1	99.2	0.3	0.4	2.3	0.3	0.3	0.2	2.9	0.8	0.06	0.01
	P.S.	742	1,120	95.8	97.8	1.6	0.1	1.9	2.0	0.7	0.2	4.2	2.2	0.07	0.05
1st molars	R.H.	650	1,084	86.3	93.5	5.7	1.8	5.5	3.3	2.5	1.4	13.7	6.5	0.24	0.13
	P.S.	742	1,120	79.8	84.5	4.7	4.1	9.7	8.8	5.8	2.7	20.2	15.5	0.42	0.30
2nd molars	R.H.	650	1,084	74.6	88.1	13.2	6.4	10.2	4.6	2.0	0.9	25.4	11.9	0.40	0.18
	P.S.	742	1,120	72.4	76.3	9.3	11.8	14.2	10.4	4.1	1.5	27.6	23.8	0.50	0.37
Lower:															
Central incisors	R.H.	557	883	98.9	99.7	0.4	0.1	0.7	0.0	0.0	0.2	1.1	0.3	0.02	0.01
	P.S.	564	855	98.9	99.5	0.5	0.0	0.5	0.2	0.0	0.2	1.1	0.5	0.02	0.01
Lateral incisors	R.H.	640	1,072	99.2	99.4	0.5	0.3	0.3	0.0	0.0	0.3	0.8	0.6	0.01	0.01
	P.S.	723	1,094	99.4	99.6	0.1	0.1	0.4	0.2	0.0	0.1	0.6	0.4	0.01	0.01
Canines	R.H.	650	1,084	98.9	99.1	0.3	0.6	0.6	0.4	0.2	0.0	1.1	0.9	0.02	0.01
	P.S.	742	1,120	97.3	98.8	0.3	0.3	2.2	0.8	0.2	0.1	2.7	1.2	0.05	0.02
1st molars	R.H.	650	1,084	83.5	86.2	4.2	5.2	7.2	6.5	5.1	2.1	16.5	13.8	0.34	0.25
	P.S.	742	1,120	69.9	71.4	4.5	7.5	14.6	14.3	11.1	6.8	30.1	28.6	0.67	0.56
2nd molars	R.H.	650	1,084	72.7	77.9	10.2	13.1	9.2	5.9	7.0	3.1	26.3	22.1	0.49	0.34
	P.S.	742	1,120	65.1	61.1	11.5	18.6	14.3	15.4	9.1	5.0	34.9	38.9	0.68	0.64
All types	R.H.	6,344	10,539	89.5	92.8	3.9	3.6	4.6	2.6	1.9	0.9	10.5	7.2	0.19	0.12
	P.S.	7,169	10,837	85.8	87.3	3.9	4.9	6.9	6.0	3.5	1.8	14.2	12.7	0.28	0.22

*A.C.F. (average caries figure) = Total caries figure
Total No. of teeth (including extractions)

proportion being 0.1% of all the teeth examined, as compared with 1.2% in 1945. The only teeth coming within this grade in the more recent survey were the molars. There was very little variation in the A.H.F. for the different types, and the figures for all types together were the same. Gross hypoplasia was again very uncommon in either year, the total amount in 1950 being 0.3% of all teeth examined—1% less than in 1945.

Comparison of Homes and Private Schools.—It will be seen from Table III that the children in the residential homes in 1950 still had worse dental structure than those in the private schools, 58.0% of all teeth as compared with 47.7% showing some degree of hypoplasia (A.H.F. 0.76 as against 0.59). Since, however, in the former group there had been an improvement during the past five years—that is, the percentage of hypoplastic teeth had fallen from 67.7 to 58.0, a 14% reduction—whereas in the latter group there had been none, the disparity was less.

L.C.C. Schools.—Among the L.C.C. group examined in 1949, although the percentage of hypoplastic teeth had increased somewhat since 1945, being 68.0% as compared with 62.0%, the A.H.F. was much the same, 0.88 compared with 0.91.

As regards dental structure, therefore, these observations indicate a general improvement among the residential homes population since 1945, but little change among private schools or the L.C.C. group. The private-school children had on each occasion the best-formed teeth, while the positions of the other two groups were reversed at the time of the second inspection, the residential homes group having better calcified teeth than the L.C.C. group, though not reaching the standard of the private-school children.

Caries of the Teeth

Residential Homes in 1950 and 1945.—Table IV (column 4) shows that, in spite of the fact that a large percentage of the teeth were caries-free in 1945, there was an improvement during the five years between inspections, the respective figures being 89.5% and 92.8% of the total number examined. This improvement was reflected in each type of tooth, but especially in the molars, and in particular in the upper molars. With regard to disease incidence, there were very few carious teeth in these residential-home children in 1950, only 7.2% of the total number being affected, as compared with the previous figure of 10.5%, which was in any case very low. In passing, it may be noted how small was the proportion of carious teeth graded C., remembering that this category includes extractions. The extent of caries, as expressed by the A.C.F., fell in 1950 for every individual type of tooth, the figure for all types together being 0.12, as compared with 0.19 in 1945.

Private Schools in 1950 and 1945.—The private-school children showed a slight improvement in the five-year interval. The total percentage of caries-free teeth rose from 85.8 to 87.3, and each type, with the exception of the lower second molars, showed improvement. The percentages of carious teeth at the two inspections were thus 14.2 in 1945 and 12.7 in 1950. The A.C.F. for each type of tooth in 1950 was the same as or lower than before, so that the total A.C.F. showed a slight reduction (0.28 to 0.22).

Comparison of Homes and Private Schools.—The figures given in Table IV indicate that, as in 1945, the teeth of the residential-home children examined in 1950 still had less disease than those of the private-

TABLE V.—Incidence of Caries in Teeth with Varying Grades of Structure

(1) Grade of Structure	(2) Group	(3) Incisors				(4) Canines				(5) Molars				(6) All Types			
		Total No. Examined		% Carious		Total No. Examined		% Carious		Total No. Examined		% Carious		Total No. Examined		% Carious	
		1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950
Good (Hy ₁)	R.H.	1,261	2,603	0.5	0.9	518	1,224	0.0	0.3	250	554	0.4	8.1	2,029	4,381	0.3	1.7
	P.S.	1,970	3,142	0.8	1.4	1,071	1,749	0.8	0.6	758	690	3.0	17.0	3,799	5,581	1.3	3.1
Slightly defective (M-Hy ₁)	R.H.	891	1,134	2.7	5.7	630	831	2.1	1.4	956	2,026	8.6	13.3	2,477	3,991	4.8	8.7
	P.S.	523	841	8.8	8.7	330	457	6.4	3.5	1,330	2,557	20.6	22.6	2,183	3,855	15.6	17.3
Defective (M-Hy ₂)	R.H.	185	211	21.6	14.7	73	61	[13.7]	[0.0]	1,057	1,503	29.8	12.7	1,315	1,775	27.8	12.5
	P.S.	149	83	[30.2]	[9.6]	36	10	[38.9]	[40.0]	669	1,095	56.8	34.7	854	1,188	51.4	33.0
Very defective (M-Hy ₃)	R.H.	13	4	[38.5]	[25.0]	3	0	[0.0]	—	91	77	[58.2]	[18.2]	107	81	54.2	[18.5]
	P.S.	8	0	[75.0]	—	2	0	[0.0]	—	77	14	[89.6]	[42.9]	87	14	[86.2]	[42.9]
Gross (G-Hy)	R.H.	80	44	[38.8]	[22.7]	24	24	[0.0]	[0.0]	197	112	19.8	12.5	301	180	23.3	13.3
	P.S.	34	16	[38.2]	[25.0]	12	8	[0.0]	[0.0]	42	5	[38.1]	[60.0]	88	29	[33.0]	[24.1]

Note.—For some grades of structure the numbers of teeth were relatively small. The percentages based on these probably have little significance, and are therefore given in brackets.

TABLE VI.—Extent of Caries in Teeth with Varying Grades of Structure

(1) Grade of Structure	(2) Group	(3) Incisors				(4) Canines				(5) Molars				(6) All Types			
		Total No. Examined		A.C.F.		Total No. Examined		A.C.F.		Total No. Examined		A.C.F.		Total No. Examined		A.C.F.	
		1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950	1945	1950
Good (Hy ₁)	R.H.	1,261	2,603	0.01	0.01	518	1,224	0.00	0.004	250	554	0.004	0.11	2,029	4,381	0.004	0.02
	P.S.	1,970	3,142	0.01	0.02	1,071	1,749	0.02	0.01	758	690	0.04	0.24	3,799	5,581	0.02	0.04
Slightly defective (M-Hy ₁)	R.H.	891	1,134	0.04	0.08	630	831	0.04	0.02	956	2,026	0.12	0.21	2,477	3,991	0.07	0.13
	P.S.	523	841	0.15	0.16	330	457	0.11	0.07	1,330	2,557	0.36	0.36	2,183	3,855	0.27	0.28
Defective (M-Hy ₂)	R.H.	185	211	0.42	0.23	73	61	[0.25]	[0.00]	1,057	1,503	0.51	0.20	1,315	1,775	0.49	0.19
	P.S.	149	83	0.56	[0.20]	36	10	[0.75]	[0.90]	669	1,095	1.11	0.59	854	1,188	1.00	0.57
Very defective (M-Hy ₃)	R.H.	13	4	[0.69]	[0.25]	3	0	[0.00]	0.00	91	77	[1.09]	[0.31]	107	81	1.01	[0.31]
	P.S.	8	0	[1.63]	0.00	2	0	[0.00]	0.00	77	14	[2.17]	[0.93]	87	14	[2.07]	[0.93]
Gross (G-Hy)	R.H.	80	44	[0.81]	[0.30]	24	24	[0.00]	[0.00]	197	112	0.39	0.18	301	180	0.47	0.18
	P.S.	34	16	[0.76]	[0.50]	12	8	[0.00]	[0.00]	42	5	[0.86]	[1.20]	88	29	[0.70]	[0.48]

Note.—For some grades of structure the numbers of teeth were relatively small. The A.C.F. based on these probably have little significance and are therefore given in brackets.

school children, 7.2% in the former group compared with 12.7% in the latter being carious. Though in both cases there had been an improvement in the five years, this was proportionately greater in the former (a drop from 10.5% to 7.2% of carious teeth—a reduction of 32.0%—compared with a drop from 14.2% to 12.7% in the private-school group—a reduction of 10.5%), so that the gap between the groups had widened slightly.

L.C.C. Schools.—In contrast to the slight improvement in the above-mentioned groups, the 1949 survey of L.C.C. school-children showed no improvement in the caries position as compared with 1945. The proportions of carious teeth in the two years were 26.5% in 1945 and 26.7% in 1949, while the corresponding average caries figures were 0.55 and 0.54.

So far as caries is concerned, then, the children of the residential homes had fewer diseased teeth than those of the private schools and many fewer than those of the L.C.C. schools at both inspections. It must be emphasized again that the caries incidence and extent both in residential homes and in private schools are so low that improvements are inevitably small.

Relation between Structure of Teeth and their Susceptibility to Caries in 1950

It was found in the latest survey, as in 1945 and all other surveys of this series, that within each of the groups of children the better-formed teeth—that is, those with no hypoplasia—were less liable to caries than the M-hypoplastic ones, and that the more severe the defect the greater the liability to the disease (see Tables V and VI). This is true for individual types (incisors, canines, and molars) as well as for all teeth taken together. To demonstrate this point figures are given for three grades of structure in Table VII.

TABLE VII

Structure	% of Teeth Caries-free (C_0)		% of Teeth with Considerable Caries ($C_2 + C_3$)	
	R.H.	P.S.	R.H.	P.S.
Good (H_y)	98.6	96.9	0.6	1.3
Slightly defective ($M-H_y$)	91.3	82.7	3.9	10.0
Defective ($M-H_y$)	87.5	67.0	5.9	20.8

There were insufficient numbers of $M-H_y$ teeth to give a statistical result for this group.

In all cases it will be seen that for a given grade of structure there was less caries among the children from residential homes than among those in the private schools. Further reference to this point is made in the discussion.

Filling and Extraction of Carious Teeth

Table VIII shows the considerable increase in treatment for both residential homes and private-school children over the past five years, especially as regards fillings. Much more treatment was recorded in both surveys among the private-schools group than among the children in the homes, approximately three times the

TABLE VIII.—Percentages of Carious Teeth Extracted and Filled

Group	No. Carious Teeth (Including Extractions)		% Extractions		% Filled		% Total Treated	
	1945	1950	1945	1950	1945	1950	1945	1950
R.H.	664	754	2.9	5.6	4.7	11.8	7.6	17.4
P.S.	1,019	1,378	6.3	7.3	18.5	29.7	24.8	37.0

Note.—The few teeth treated with silver nitrate are omitted from this table.

number of fillings being present. It must be pointed out, however, that slightly over 50% of the carious cavities in the residential homes were very small (C_1 grading), while fewer (38%) of the private-school cavities were graded as C_1 .

Staining of the Surface Enamel

The superficial staining of deciduous teeth, which is often confined to the gingival margin and molar fissures, has been commented on by several workers. In past surveys a note was made of this condition and it was found that those children with definite black or brown staining on few or many teeth had less caries than children with none, or children whose teeth showed definite green staining. In this most recent survey there was very little difference between the caries susceptibility

TABLE IX.—Amount of Caries in Relation to Superficial Staining of Teeth

Type of Stain	Group	No. of Children		% Carious Teeth		A.C.F.	
		1945	1950	1945	1950	1945	1950
No stain	R.H.	106 (32.6%)	294 (54.2%)	11.5	6.7	0.21	0.11
	P.S.	246 (66.3%)	458 (81.8%)	12.9	12.9	0.25	0.23
Black and brown stain	R.H.	109 (33.5%)	179 (33.0%)	5.7	5.8	0.11	0.09
	P.S.	25 (6.7%)	27 (4.8%)	2.9	10.7	0.05	0.19
Green stain	R.H.	32 (9.8%)	20 (3.7%)	20.2	14.4	0.39	0.22
	P.S.	64 (17.3%)	28 (5.0%)	22.5	18.7	0.46	0.33

of mouths with black and brown stain and those with none (Table IX); but in this connexion it must be remembered that there is very little caries anywhere. Mouths with green stain appear more susceptible, but the numbers of children with this stain are small. Indeterminate varieties of colour were omitted from the calculations. An interesting point was the large proportion of residential-home children—about 33% at each inspection—who showed brown or black stains, as compared with less than 7% of private-school children.

Arrest of the Carious Process

There was an apparent decrease in arrested caries among both groups compared with 1945, but this may have been due partly to the personal factor in examination. Arrest is a gradual process, and it is not always easy to agree on a specific standard and maintain it from year to year. The difference between the two groups, on the other hand, is real, the children in the residential homes showing more teeth with arrested caries, 13.5% of all the untreated carious teeth, compared with only 2.9% in the private-school group. So far as they go, therefore, these figures also indicate greater resistance to the carious process in the residential-home children.

Discussion

The object of the 1950 survey among children in residential homes and private schools was twofold: (1) to find out if the differences observed in 1945 between the two groups were still evident; and (2) to see whether there had been any change in dental status in either of the groups over five years.

In both 1945 and 1950 the structure of the deciduous teeth of the residential-home children was not as good as that of the private-schools group, while their caries incidence was lower. Since 1945 there had been improvement in their dental structure (42.0% of the teeth were perfect in structure, compared with 32.3% in 1945—an improvement of nearly one-quarter) and decrease in

caries (from 10.5% to 7.2% carious teeth), in spite of the fact that at the time of the earlier survey the total incidence and extent of the disease were already very low. The private-schools group, on the other hand, which had comparatively good tooth structure in 1945, showed no improvement, while the decrease in caries in 1950 was very small (14.2% of the teeth were carious in 1945 and 12.7% in 1950). Thus the number of carious teeth found in homes children was reduced by nearly one-third, that in private schools by only one-tenth.

Whether the results given in this report are merely periodic fluctuations cannot be stated. No examinations of these two groups were made in 1947, which was the peak year for caries-free teeth in L.C.C. school-children; it is possible, although unlikely, in view of the already small incidence of the disease, that the findings might have been still better then.

What are the reasons for these differences? A comparison between the two surveys does not suggest that the reduction in decay is due to any variation in the sugar content of the diets or to the amount of dental treatment given. The strict rationing of sweets and sugar during the war ensured little difference in this respect throughout the post-eruptive period for the two groups examined in 1945, and those inspected in 1950 would have had, if anything, more sugar and sweets in their diet. Again, there was more treatment in both the groups seen in 1950 than in 1945, but for both years the percentage of carious teeth treated was much greater in private-school children than it was in the homes children.

There may be many contributory factors, but in discussing the differences between the two groups examined in 1945 it was suggested on the basis of experimental and clinical investigations previously made (Mellanby, 1923, 1934) that "the calcifying properties of the respective diets at different periods, both pre-eruptive and post-eruptive, are an important key to the situation." It was pointed out that, as a whole, the relatively well-to-do mothers were more likely (from financial and other considerations) to follow medical advice, then becoming commoner, to take plenty of milk and some source of vitamin D during pregnancy and lactation, than were the poorer mothers of the children who later entered the homes.

It also seemed likely that the mothers in better circumstances would continue to give their children such foods in the months immediately after weaning. During both of these periods the deciduous dentition would be developing and erupting. In the post-eruptive stage, however, there would often be a change in the respective positions of the children from this point of view. Dietary discipline would tend to be relaxed in the case of children living in their own homes, especially where likes and dislikes of such things as eggs, milk, and cod-liver oil were concerned. In the communal life of the residential homes, on the other hand, fads and fancies would be much less in evidence and regular meals of high nutritional and calcifying quality, including an ample allowance of milk and a daily dose of cod-liver oil, were the routine, as was ascertained in the course of the survey.

Thus it seemed probable that the post-eruptive diet of the relatively well-to-do child might not be as good for the teeth as the pre-eruptive diet, whereas the later diet of the residential-homes child would in all probability be much better than that given during the period of tooth development; in this way the resistance to

caries of the teeth of the private-schools group would tend to be weakened, and that of the homes group strengthened.

In general these same relative conditions would, in our opinion, be likely to obtain in respect of the children examined in 1950; but whereas the pre-eruptive and post-eruptive diets of the private-school children had probably remained on much the same level in the interim (thus resulting in a rather similar dental condition), there had been certain important modifications, especially in the pre-eruptive period, in the dietary of the homes children. The uncertain quality of diets taken by expectant and nursing mothers and weaned infants in 1938-41 (affecting the structure of the teeth of children seen in 1945) had given place to the rationing of important foods, plus a system of special food priorities for these vulnerable groups, by 1943-6 (when the teeth of the children examined in the later survey were developing and erupting). This priority scheme should have been of especial benefit to the poorer mothers, the section of the population from which the majority of residential homes children are derived. These priorities were available on ration books, and would in many cases be taken as a matter of routine, especially as the milk could be obtained at a reduced price, or even free, and the cod-liver oil and vitamin tablets were issued free to all.

In addition, more was being done than formerly through maternity and child-welfare services to disseminate knowledge of better nutrition. Some of the children entered the homes at the age of a few weeks or months, and in these cases there would be time for the excellent infant and weaning diets given there to exert their effect on calcification, especially of the deciduous molars. In such homes feeding had become even better than in the early war period, owing to stricter planning and supervision, thus increasing, if anything, the favourable post-eruptive influences of such diets.

The work of Schiötz (1939) and Collett (1935), and a small investigation by King (1946), suggested that the earlier in life the children were admitted to the orphanages and the longer the period of residence, the less the incidence of decay. There was evidence of this nature in the data obtained in the 1945 survey, though it was not published; the results obtained in 1950 are now being analysed from this point of view.

The improved dental structure observed in the residential-home children in 1950 can therefore largely be attributed to the better nutritional status in the period of early tooth development as compared with the similar period for the 1945 group. This would of itself tend to result in a reduced caries incidence; but in regard also to the post-eruptive diet these children leading a communal life would appear to benefit greatly. Not only are the diets in residential nurseries and homes well planned, but under the British rationing scheme there is, and has been since 1942 (Ministry of Food, 1947), actually more of the important foods available per child in these homes than can be obtained for children living with their families. Moreover, in the latter case any special allocation for the children may be all too often pooled with the food for the rest of the household. Furthermore, these children have far more say than those in the homes in regard to what they will or will not eat, and in many instances they are able to spoil their appetite by eating food of low nutritional value between meals.

In our opinion, few families in Britain, whatever their economic status, provide for their children diets which

are as good in their calcifying properties as those served in children's residential homes to-day, and in few is the intake of cod-liver oil and even milk likely to be nearly so regular or so long maintained. It seems to us, therefore, that the excellent diet given in these homes is responsible for their low caries incidence. The reduction noted since the previous survey five years ago is no doubt partially the result of improvement in dental structure, but it may have been enhanced by the even better diets provided for these children in recent years.

It is a challenging thought that, on the whole, children brought up in orphanages and other public institutions have a better chance of remaining free from caries (at least up to the age of 5 years) than children of the same age brought up in private families.

Summary

The new results given in this paper are compiled from the individual dental charts of a survey in 1950 of 542 children aged 5 years living in homes (orphanages and institutions) and 560 children of the same age attending independent and private day schools, mainly in London and surrounding counties.

These two groups of children are compared with similar groups examined in 1945 and with each other, as regards both dental structure (according to the standards originally set up by May Mellanby) and caries incidence and extent. Reference is also made to surveys among L.C.C. school-children in 1945 and 1949.

Among the children in the homes, tooth structure was found to have improved since 1945, there now being 42.0% of the teeth free from both gross and M-hypoplasia as compared with 32.3% previously. Concurrently there was also a reduction in caries incidence from 10.5% to 7.2%.

The private-school group showed much the same average structure in 1950 as before, while the caries incidence had declined only slightly, 12.7% of all teeth being carious as compared with 14.2% previously.

The average dental structure of the residential-home group still lagged behind that of the private-school children, but the difference between the two groups was not as great as before.

In spite of worse dental structure, the children in the residential homes had a lower caries incidence and extent.

The relationship between dental structure and caries in both groups in 1945 and 1950 was such that the greater the degree of M-hypoplasia the greater was the liability of the teeth to caries, but for each grade of structure the residential-home children had less decay than the others. This relation between structure of the teeth and liability to decay has been observed in all similar surveys where the same standards have been adopted.

In each group of children there was an increase in the amount of dental treatment, both fillings and extractions, but particularly the former. At each inspection the percentage of filled teeth among the private-school group greatly exceeded that among the residential-home children.

Approximately 33% of the children from residential homes showed black or brown staining on their teeth in both years, as compared with only 6.7% and 4.8% in the two groups of the private-school children.

Suggestions are made to account for the differences found in both structure and caries incidence between residential homes and private schools, and for the change occurring between 1945 and 1950.

We would like to put on record our grateful thanks to the many people who have so generously assisted us, and without whose help this survey would not have been possible. Particularly we acknowledge our indebtedness to the medical officers and governing bodies for permission to examine the 5-year-olds in children's homes, and to the superintendents, matrons, and teachers who helped with the actual inspections. In the case of the private-school children we thank sincerely all the principals

and teachers who so willingly gave us time and assistance to further our researches. We also much appreciated the help given by Miss Irene Allen, of the Medical Research Council's Statistical Department.

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POSTERIOR GASTRO-ENTEROSTOMY IN PEPTIC ULCER: LONG-TERM RESULTS

BY

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Gastro-enterostomy in the treatment of peptic ulcer has been the subject of many reports, often conflicting and in recent years seldom favourable. Although to-day abandoned by many, there are still some who champion its cause. In this country Sir James Walton (1950), on careful and complete follow-up of a large series of cases, has found a constant incidence of stomal ulcer of only 2%, but most other workers put the figure much higher, even as high as 40%. The results obtained by Heuer (1944) agree with the experience of the majority of recent writers. In his series of 159 cases followed for periods of 3 months to 10 years (85 followed from 5–10 years) 21.4% developed recurrent symptoms.

In comparing the end-results of gastro-enterostomy and gastrectomy, Heuer found on both short-term and long-term follow-up that the outcome was 10% in favour of gastrectomy; but, as he pointed out, this advantage is reduced by the lesser immediate mortality of gastro-enterostomy. To the debit side of the gastrectomy will have to be added a still undetermined but probably considerable percentage of unsatisfactory results in the form of "small-stomach" syndromes. It is also probably fair criticism of the more extensive procedure that when medical men, and especially surgeons, contemplate operation as a personal issue gastro-enterostomy is given more than fleeting consideration.

With such thoughts in mind, it was felt that a further report on the results of gastro-enterostomy, stressing the long-term results, would be of interest.

Clinical Material

The material in this review consists of 330 patients subjected to gastro-enterostomy for peptic ulceration during the 14 years between January 1, 1924, and December 31, 1937. All cases were under the care of one surgical unit in the Western Infirmary, Glasgow.