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OSTEOMALACIA AND DENTAL CARIES

BY

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In the *Journal* of May 6, 1939 (p. 919), we published the results of the examination of the teeth of ten children with severe rickets, radiologically confirmed, in whom an average of 1.4 cavities per head was found. The ten children had ninety-six temporary teeth and 135 permanent teeth. This group was taken as a typical sample of children with severe rickets from the Kangra District of the Punjab. Diet and health surveys have been carried out in this district by the Public Health Department of the Punjab and also by Dr. Curjel Wilson. These two surveys show a high incidence of rickets and osteomalacia and definite vitamin D, calcium, and phosphorus deficiencies in the diets of most of the population there.

We concluded that the finding of almost perfect teeth in children with severe rickets demonstrates that diets deficient in calcium and phosphorus and the fat-soluble vitamins and rich in "anti-calcifying" cereals do not necessarily lead to a greater susceptibility to dental caries, and that other factors, including the physical nature of the diet, play a more important part.

Investigation of Twenty-two Osteomalacious Women

We have recently revisited the district and examined women with severe clinical osteomalacia. The results recorded in Table I show that in twenty-two cases of severe osteomalacia only thirty-four cavities were found in 565 teeth, or an average of 1.54 cavities per head. In eight of the twenty-two cases no dental caries whatsoever was observed. Hypoplasia was noted in seven of the women. Pyorrhoea alveolaris was present in half the number of women examined—in eight cases the disease was severe—which accounted for the majority of the teeth missing.

The osteomalacia was of a severe degree. Caesarean section had been done in five of the cases at the Canadian Mission Hospital, Palampur. In all of the cases severe pains in the back, pelvis, and thigh were or had been present, and in most of them the gait was typical of osteomalacia and the back was bent. Tetany was present or there was a history of tetany in eight cases. The women were all stunted, the average height being approximately 4 ft. 6 in. The majority gave a history of long and difficult deliveries. Many of them had had treatment for osteomalacia at the local Mission Hospital, at which cod-liver oil and calcium are given for that condition. The pains are usually relieved by the treatment in a few weeks or months, but these return when the women go back to their homes and their poor diet and when they again become pregnant.

These women come from a hill district and live in primitive conditions. The preliminary report of the diet survey of the district states that "the diet consists mainly of carbohydrates with relatively small proportions of protein and fat. Meat and vegetables are almost entirely absent." Very small quantities of poor-quality milk from deficient animals are occasionally consumed. Sugar is rarely eaten. Two meals only are taken daily, of rice and "chapatti" made of unmilled wheat ground to flour by the women themselves in their homes. They not only live on this poor diet but breast-feed their children for usually two to three years. There is no "purdah" system in the district, the women working in the fields in sunshine for most of the year.

The cause of the severe osteomalacia is thus the very poor diet, often associated with frequent pregnancies and long-continued breast-feeding.

TABLE I.—Particulars of Twenty-two Osteomalacious Women

Case No.	Age	Children		Osteomalacia				Teeth Present	Caries	Hypoplasia	Pyorrhoea
		Alive	Dead	Typical Gait	Bent Back	Pain in Back, Pelvis, and Thighs	Tetany				
1	20	1	2	Cannot walk	Yes	Severe	Yes	23	1	+	++
2	25	2	—	Yes	"	"	No	27	1	—	—
3	22	2	1	"	"	"	"	24	2	—	—
4	45	2	—	"	"	Yes	History	21	1	+	++
5	25	3	—	"	"	Severe	Yes	19	—	+	++
6	35	4	2	"	No	Yes	No	30	5	—	++
7	24	5	—	"	Yes	"	Yes	32	5	+	++
8	20	2	1	"	"	"	"	28	4	++	+
9	28	—	3	"	"	Severe	"	25	1	+	++
10	20	—	—	"	No	Yes	No	28	1	—	++
11	22	1	2	"	Yes	"	"	30	2	—	—
12	25	5	—	"	"	"	Yes	30	1	—	—
13	40	—	2	"	"	"	No	15	1	+	++
14	32	5	6	"	"	"	"	20	—	++	++
15	33	3	—	"	No	"	"	30	1	+	++
16	30	3	—	"	"	"	Yes	15	8	—	++
17	19	—	—	Cannot walk	"	"	No	28	—	—	++
18	30	5	4	No	"	"	"	16	—	—	++
19	25	—	—	Yes	"	"	"	29	—	—	++
20	26	1	3	"	"	"	"	32	—	—	—
21	23	1	—	"	Yes	"	"	31	—	—	—
22	22	1	—	Cannot walk	"	"	"	32	—	—	—
Totals								565	34		

Note.—In 565 teeth 34 cavities were found—an average of 1.54 cavities per head.

Their Children's Teeth

We also examined seven children born of these women ; all of them had severe rickets. The results in Table II show that in 144 teeth of these rickety children only two cavities were present, confirming the results obtained in the group of children with rickets previously recorded.

TABLE II.—*Children with Severe Rickets Born of Women with Severe Osteomalacia*

Cases	Age	Clinical Rickets	Total Teeth Present	Cavities	Hypoplasia
1 (Child of osteomalacia case 1)	2 years	++	18	—	—
2 (" " " 11)	4 "	+++	20	—	—
3 (" " " 14)	2 "	+++	15	1	—
4 (" " " 18)	3 "	+++	20	—	+
5 (" " " 18)	9 "	+++	23	1	—
6 (" " " 18)	15 "	+++	28	—	—
7 (" " " 22)	2½ "	+++	20	—	++
Total			144	2	—

Note.—In the 7 children only 2 cavities were present in a total of 144 teeth.

One of us (C. D. M. D.) has been studying dental fluorosis in the Punjab in recent years. In the plains of this province dental fluorosis is very common ; in some districts all children have mottled enamel. It has been recently suggested in America that mild degrees of fluorosis prevent dental caries. In the Kangra District of the Punjab dental fluorosis is conspicuous by its absence. An occasional child in whom we saw it there, among the many hundreds examined, had come from another district and had not been brought up in Kangra. Fluorine intoxication need not therefore be considered as a possible immunizing factor.

Conclusions

The above results in these twenty-two women, who appear to be typical of many thousands in this district, show that the teeth may be nearly perfect although severe decalcification of the bones has occurred as the result of osteomalacia. It is a common assumption, at the present time, that during pregnancy women's teeth show a greater susceptibility to dental caries ; and much money is spent on calcium and vitamin treatment in Western countries as a protective measure. In the light of our findings we consider, therefore, that the question of the association of dental caries with pregnancy needs more careful study.

We also conclude that as we found nearly perfect teeth in children and women with severe rickets and osteomalacia the calcification and decalcification of the bones of the body are not necessarily directly connected with the same processes in the teeth.

At a later date it is hoped that biochemical work on these cases of severe calcium deficiencies will be done in the Kangra District.

Suzanne Rossier (*Thèse de Paris*, 1940, No. 214), who records a fatal case in a woman aged 45 (the diagnosis was confirmed by a virulence test), states that diphtheritic septicaemia presents a characteristic clinical picture. The blood culture is positive, while cardiac signs are inconstant, but an acute malignant endocarditis is always found post mortem. The issue is always fatal. Diphtheritic septicaemia is the consequence of a previous bacteraemia, which would probably be found to be less rare than is supposed if minute and systematic investigations were made such as examination of the blood and urine during life and of the organs after death. The pathogenesis is still obscure, as an anatomical study does not show under what conditions the diphtheria bacillus, which is usually confined to the initial lesion, can pass into the blood. Possibly the necrotic ulcerative character of malignant diphtheria favours this passage, or a special virulent form of the organism may be responsible.

ETHER CONVULSIONS

BY

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Although I have been observing anaesthesia by ether almost daily for twenty-five years it was not until seven months ago that I saw a case of serious ether convulsions. I happened to go into the theatre ; an operation for acute appendicitis upon a girl of 13 had just been completed and artificial respiration was in progress. The patient was having convulsions of the most violent character ; at the height of the spasm the lower limbs literally banged upon the table. These fits, I learned, had been going on with increasing severity for a quarter of an hour. It was not long before the cardiac centre failed, and in spite of the combined efforts of the anaesthetist and surgeon resuscitation was ineffectual.

These ether convulsions reminded me exactly of a case of novocain poisoning which had been engraved indelibly upon my memory. Convulsion followed convulsion until the respiratory centre failed, but the pulse remained good. CO₂ and oxygen was administered, but the convulsions continued. The cardiac centre then gave out. I performed cardiac massage and the heart restarted, and three hours later the patient's condition was tolerably satisfactory. Approximately three hours later still, during the night, the convulsions restarted and proved fatal.

My interest in anaesthetic convulsions having been awakened, I consulted the literature. I could find no satisfying explanation of the phenomenon. It appeared that most cases of ether convulsions have occurred during the hot weather. (The case of ether convulsions I had observed occurred on a cold winter night.) The treatment recommended was to keep the lungs inflated. Ten c.cm. of a 10 per cent. solution of calcium gluconate intravenously had been advised, and in several instances the intravenous injection of evipan had put a stop to the convulsions. Momentary compression of the common carotid arteries had also been put forward as a suggested method of treatment. In discussing the subject with colleagues I learned that one had seen a successful issue from douching the patient with ice-cold water.

Recent Cases

Case 1.—Six weeks later, during the exceptionally cold weather of January, 1940, I had just removed an early acutely inflamed appendix from a stout but athletic man of 30. Ether convulsions started. First of all there were twitchings of the muscles of the face, and later spasms of the abdominal muscles, making closure of the incision difficult. So great were the spasms that the sutured internal oblique tore out and the peritoneum was pulled asunder. My attention was directed mainly to closing the abdomen, but I suggested to the anaesthetist calcium gluconate. There was none in the theatre. I then suggested evipan, and this was got ready. By this time, in spite of difficulty, I had succeeded in closing the abdomen. The spasms continued with increasing severity ; the legs banged upon the table just as in the case I have described above. The respiratory centre then failed, and artificial respiration was begun. The anaesthetist advised against giving the evipan which had been prepared, saying the patient was already deeply anaesthetized. We persevered with artificial respiration and the pulse remained good. Ten minutes later the heart failed. I carried out intracardiac injection of adrenaline and later performed cardiac massage, but without avail.

The bottle of ether was sealed and sent to Messrs. Duncan, Flockhart for analysis. It had been purchased recently and kept in the dark. Messrs. Duncan, Flockhart had the contents analysed and it was