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THE DENTAL SUMMARY

THE MAGAZINE THAT HELPS

Vol. XXXIV **APRIL, 1914** No. 4

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REGULAR CONTRIBUTIONS

SOME CONTRIBUTIONS TO DENTAL AND MEDICAL SCIENCE*

A REPORT OF PERSONAL RESEARCH

BY WESTON A. PRICE, D.D.S., CLEVELAND OHIO

I AM GOING TO BE as brief as possible in reporting to you several lines of research that I have been making during the last several years, and which, so far as I know, have not been reported heretofore. I am going to ask you to anticipate that I shall be somewhat disconnected and abbreviated because of lack of time. I shall hope to cover eight different subjects, each of three of which should take an entire evening.

SILICA CEMENTS.

I first wish to speak of some researches on silica cements. You are all familiar with the directions that come with our various packages, which state very specifically how we shall mix, how long we shall wait for

*Given as the President's address, Ohio State Dental Society, December, 1913.

the cements to set, how we shall treat them with regard to moisture and protection with regard to waxes and oils, and this line of experimentation was directed to develop these two points: whether or not such substance as we should put over the surface of the cement would seriously injure the quality of that enamel cement, and also as to whether its strength, surface quality and color would be affected thereby. First, we found, with a series of experimentations with regard to the ingredient that was used to put over these cements, that the vaselines, the paraffines, and practically all the waxes, were solvents for the colors to a certain extent. The most important point that we were working for was to get information pertaining to the setting time. We are instructed to leave the rubber dam in place for thirty minutes in order that our filling may be very hard. That question of time is so important an element for both the members of the profession and for the laity that our effort was directed toward reducing that time, if possible, and we found that the addition of heat up to 175 degrees F. did not increase the total contraction seriously—perhaps one-tenth of one per cent.—did not affect the color, did shorten the setting time from one-half to one-fourth, made a stronger, harder filling under the crushing tests after 24-hour wait, and in every particular seemed to make as good or a better filling. That, in substance, is the most important result of that series of researches.

AUTOGENOUS VACCINES.

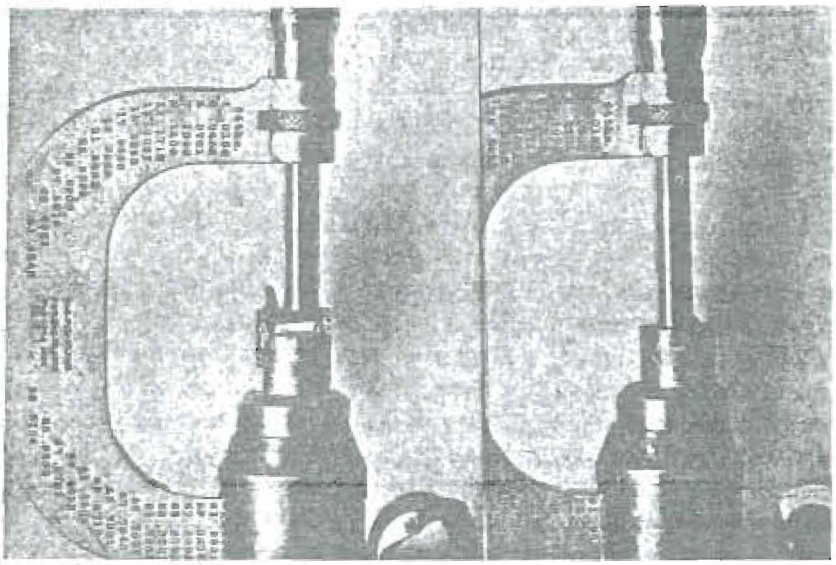
The next item I wish to speak of is that pertaining to systemic invasions of infections when treated by the vaccines when the infection seems to have come from the mouth, and particularly as pertaining to the relative value of autogenous and stock vaccines. The first series were all selected because they had marked systemic invasion. We could not prove that the invasion originated in the mouth. It perhaps did not. The cases were selected because there were gross lesions in the mouth and because the patients were suffering very serious systemic invasion from some source. In all the cases treated with the stock vaccines we found no important changes or a slight temporary improvement. In the next series which were selected because of their very grave systemic invasions, and with the possibility of a mouth origin, we found that every one responded in some degree to advantage with autogenous vaccines, and some very markedly. I am in hope that Dr. Ladd in his discussion tomorrow will speak from the technical side as to the result of these treatments, as I secured his services for making the vaccines in order that we might have the greatest skill possible along that line. In one case which I wish to recite in detail the changes in the entire picture were so great that we rarely see, even in people recovering from a serious fever, a more prompt and more definite improvement. A lady holding a very prominent position, with a great deal of responsibility, had notified the authorities that she must give up her work, because her health was declining so rapidly. I have been watching her for about 18 years from a dental standpoint, and have noticed that periodi-

cally her general constitutional picture changed. She would leave her work and go away for a few months to recuperate, and after a rest would come back to her work, only to go down again. Some time ago, when on the Pacific coast recuperating, she developed an abscess on the hip and very promptly after the formation of that abscess she had a very prompt improvement in her symptoms. I mention this case because of the grave systemic picture, not because of serious local lesions. The lady rather demurred when I suggested a vaccine treatment. I recommended that she should have her consulting physicians confer with me to see whether or not it would be an advisable thing to do. A consultation was had, and her three consulting physicians said: "It may do some good; probably not. It probably will not do any harm; try it, anyway." The culture produced a pure streptococcus from which the vaccine was made. The changes in her clinical picture were that she had a very prompt and sharp reaction and immediately after the reaction a temporarily increased flow of pus from around the teeth, which was probably partly due to what was for her too large a dose, and it was not a very large one, either. The picture changed very rapidly. Her health became very much improved. She notified her officials that she would come back and take her position at the head of that institution another year if everything went well. This was happening in May, 1913. In June she was superintending fifteen plumbers and carpenters, enlarging the dormitories. At the time of the commencement exercises, when the load was doubled and when she had expected that she would break, she said she was feeling better than she had for months, if not for years. She now looks almost as plump and as rosy as a country school girl, and is doing her work as she has not for many years. (Applause). And I want to say that the lesson to me is that she probably has been suffering from a very definite invasion arising in the mouth from those chronic innocent-looking pyorrhea pockets that I have been trying and trying to keep in a condition of toleration, and the accumulation of that poison and that invasion was marking the crisis.

CONTROL OF CONTRACTION.

The next subject I wish to speak of is the result of just one phase of the researches we have been carrying on relative to substitutes for platinum, and I shall discuss only this phase of it, namely, the progress we have made in controlling the contraction of gold. That was spoken of this afternoon, and I will ask the gentleman at the lantern to start the pictures at this time, and we will see a picture of an inlay that is made with this method of control, and it is made in an m.o.d. chamber. This form is one that the contests are being made in for a prize of $150.00 offered by the speaker for the person who would first make a restoration that would have an error of not more than 1/50 of an inch in the seating of an m.o.d. inlay, and we find that the average best operation that we may make when casting inlays and undertaking to control the contraction, with all our best methods, will still leave us an error that we can not con-

trol that will prevent an inlay from going to a more nearly perfect seating, where the cavity walls have an angle to each other of one per cent., than 180/1000 of an inch if the depth of that cavity is one-quarter of an inch. The average best inlay, in fact the best, so far as I know, that has been made in that cavity form, in which the cavity surfaces are at one per cent. bevel to each other, will not go to place nearer than is shown in this picture (Fig. 1) which is 183/1000 of an inch. The placing of a threaded Tungsten bar in that mass of metal which extends over the occlusal step



Figs. 1 and 2.

will give us a large control, because the Tungsten bar is relatively so strong and has relatively so little contraction that the mass of gold is held, as we will see by the next picture. (Fig. 2). This inlay goes to place within 19/1000 of an inch. The requirements for the prize is twenty thousandths or 1/50 of an inch. I wish to speak of this in connection with the discussion of this afternoon to the effect that many men are abandoning the casting process for m.o.d. fillings particularly because of their inability to control the contraction sufficiently to make as nearly perfect restorations as are desirable. This is one element to assist us, for the Tungsten bar so nearly contro's the contraction of gold that it allows the inlay to go to place.

MUSIC FOR SUGGESTION AND RELIEF FROM NOISE.

The next series of studies we wish to present are now devices that are designed to relieve in part the disagreeable sensations due to the vibrations of the bur in working on the tooth structure and for suggestion in anesthesia. You are all familiar with the simple experiment of taking an instrument with a rough handle and drawing another instrument across

it; when removed from the tooth the patient will not hear it, but when you touch the end of it to the tooth they hear it as a very loud noise, a disagreeable sensation and vibration. I presume that today the vibration and noise element is the greatest discomfort to our patients of any that is



Fig. 3.

still not removed. This instrument, then is designed to remove some of that discomfort. The researches were carried on along the following line: A phonographic instrument was put some sixty feet away, and out of hearing, and a wire attached to the vibrating diaphragm of the phonograph, and also against the tooth. While the patients could feel very little vibration from the bur, they could hear the music with perfect distinctness over that wire. The suggestion, then, is to inhibit that noise that comes through the tooth and bones from the bur by placing into the ear a volume of noise that is not disagreeable. It may be instrumental music,

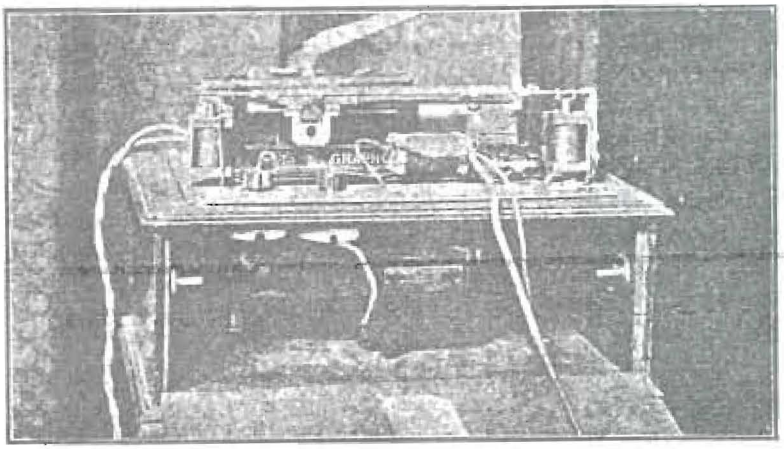


Fig. 4.

or a recitation, or a beautiful solo, and is heard only by the patient. (See Fig. 3). We have changed an ordinary graphophone by using solenoids to make the four-minute record repeat over and over without any adjusting until a new record is put in. (See Fig. 4). Another solenoid is connected with the foot engine or controller of the dental engine (Fig. 5) and each

time the bur is turned on the music starts, and each time the bur stops the music stops. If they want any more music we must also start the bur again. (Laughter). The result, for children, is remarkably good. I have been able to prepare cavities for little folks, one after another, without expression of unpleasant sensations on their part, and their expressing continually a desire that I would start the music again. Where before I could perhaps prepare only one or two cavities at a sitting, I can now frequently prepare four or five or six cavities. I don't wish to say that the "babies cry for it," (laughter), but it is an advantage that I believe will be worth a great deal to us, particularly for our little folks; and I find that the big folks very often, in fact generally, desire it as well as the little folks, for the same psychological action takes place with the big folks as with the little folks.

Fig. 5 shows all that is added to a foot controller, simply a little switch attached to the top of it, and which will go onto any controller. It auto-

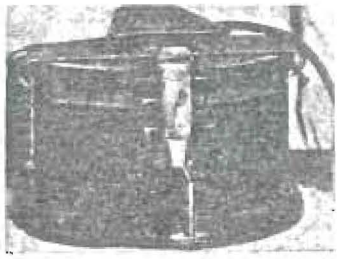
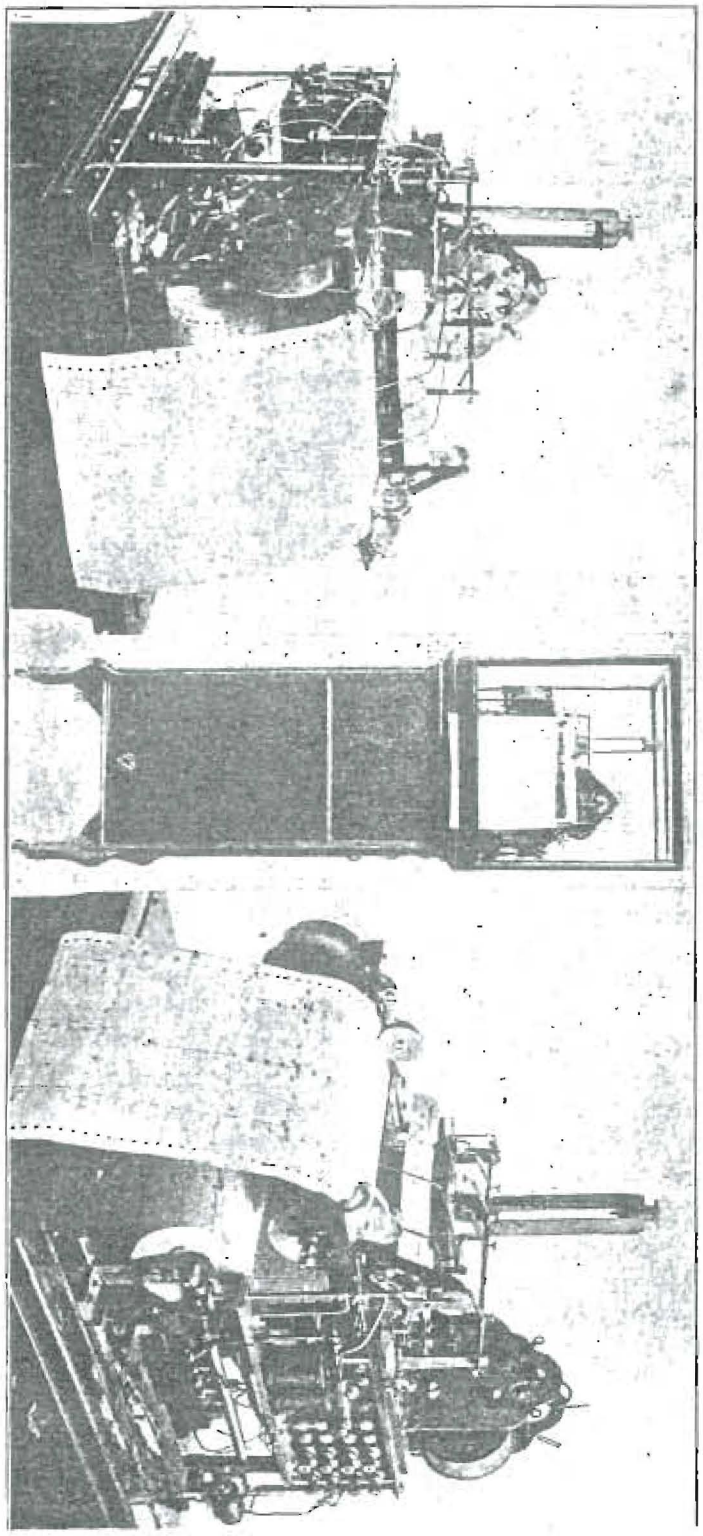


Fig. 5.

matically turns off and on the music as the engine is started or stopped. The attachment to the patient is through small ear tubes as shown in Fig. 3. It is rather more convenient to let the patients hold it in their own hands, removing it at will, and replacing it. They feel then that they are not bound or tied in any way. It is not at all in the operator's way. Another method of applying it is through the bur but that method is not so satisfactory because of the continual interruptions by the bur being moved out of the cavity and not making a perfect contact. Still another method is through small telephone receivers specially designed and attached to the head rest. This is used with great advantage by the speaker in all analgesia and anesthesia operations and he believes it will come to be generally used in these operations.

AUTOMATIC CLINICAL RECORDER

The next series of studies is along a line for helping our poor unfortunates that are in the hospitals. I think many of you have had the misfortune of lying on your back day after day with typhoid or some other fever, and have had the nurse come around at too-frequent periods and poke something into your mouth and tell you to keep your mouth shut for three or five minutes, and take your temperature and your respiration, and in the intervening time you had various kinds of misgivings, for fear



your temperature, respiration and pulse were getting away dangerously high. Many of us have felt or seen that excitement in a hospital and have seen a crisis and death come to a fellow sufferer between the time of taking these records, and that not known by the attendants, when, if some one could have known it, artificial heat could have been applied, stimulants could have been used and a life saved.

It is for these people that this next series of researches has been made. Some twenty years ago I myself was in—I was going to say a campaign of typhoid. It was one of those deadly scourges that pass over a great city or town sometimes. I was in North Dakota, and when I found myself coming down with the fever, I had some of the water bottled up and sent to Dr. Vaughan, at the University of Michigan. He doesn't remember it, but he telegraphed back, "Full of deadly typhoid germs. Be careful." In a town of 6,000, if reports were correct, 1,600 developed typhoid, and 600 died—ten per cent. died, and twenty-five per cent. took the disease. While lying on my back there, and after being moved down to Minneapolis, I was working in my mind on this instrument, for some method to take the clinical record, if possible, regularly, and mark it down. Later, when working up the pyrometer for the dental profession, I designed an application of the pyrometer to the patient that would be comparable to its application to a blast furnace; for the same pyrometer that I designed for the dental profession is now being used for those commercial industries that desire to know their working temperature. The speaker, however, has no interest in its sale or manufacture. We have been devoting about fifteen years to the development of this instrument. (Fig 6), which records, on a traveling sheet of paper the temperature, marked down every minute of the twenty-four hours, the respirations marked down every minute, and if there is a heart lesion that gives us an exaggerated motion of the heart, a record also of the heart beats, which are marked down every minute: and if at any time any of those elements go too high, or too low, at the end of the minute a warning signal is made by the lighting of a light or by the ringing of a bell, or both. Fig. 6, right and left, shows a detail side view. Mr. Lee is now recording his temperature and his respirations and you will notice that if he is breathing more often than a patient should it will set a bell ringing somewhere—it could as well be in some other part of the building; it can be in the superintendent's room of the hospital, or it can be in the nurse's room, or both. And the adaptation of the instrument is not simply to one patient, but to as many patients as there may be in a ward. Let us suppose there are twelve patients in the ward. The instrument will record one of those for five minutes, and then another for five minutes. Now it is giving a signal in the superintendent's office, because that patient's respiration rate is too high. (A bell rang in another part of the auditorium.) Every time there is a respiration it is giving a signal down in the superintendent's office. That can be half a mile away, if you wish, or it will light a red light, or both. They have got to take care of the patient, for it will keep on ringing every

minute until they do or every time it goes up to that point. If now there are twelve patients in the ward, this will record all these elements for any one patient for, say, five minutes, and then take the next patient's record for five minutes, and mark it down on a moving chart and at the same time mark the number of the bed opposite the record until it goes the rounds. So if there were twelve beds it would mark down the record for each one of those beds for five minutes of the hour, and then take the same series of beds the next hour, and so on. The nurse sitting in a side room can, at her will, keep it continually on one patient, or adjust it and take them all in series or as many beds as are occupied. You will readily see the possibilities for hospital work when means can be had for getting these records. Now, how is it connected to the patient? The de-

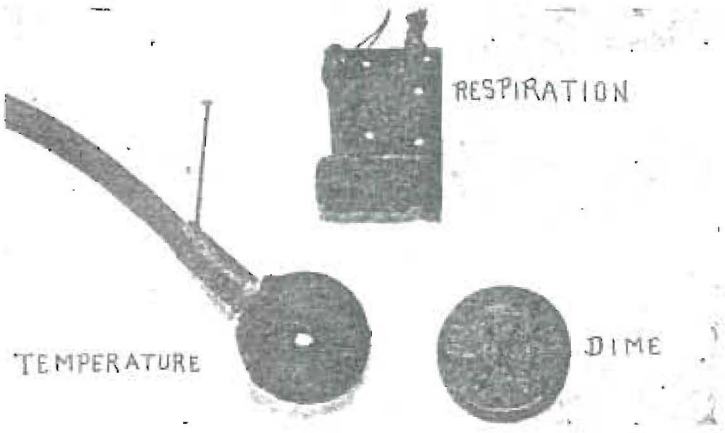


Fig. 7.

vice for making the contacts for the different beds is clearly shown. Fig. 7 shows the different attachments and their size compared to that of a dime. The element shown at the left is the heat recording instrument, and will record the temperature within one-tenth of one degree in the axilla. The essential part of the respiration recorder is shown at the top in Fig. 7. Let us assume that the axillary temperature is one or two degrees lower than that of the mouth. Variations on the part of the paient will so be recorded in the axilla. It probably will indicate all changes within one degree, though it may be one or two degrees lower than the exact temperature. It can be adjusted to read the temperature one or two degrees higher than the axillary temperature. Fig. 8, at the left, shows the temperature only. The center view shows the temperature and respiration and the one to the right all three. The lower instrument records the heart beats, and is so sensitive that a slight pulsation of the tissue is sufficient to make it respond. It doesn't matter whether the patient takes a large inspiration and then several short ones with the chest nearly inflated, or whether he has his capacity nearly exhausted and then takes several shorter breaths: it records them just the same. The tem-

perature element can be used without using the others; in fact, I think it would often be so used. And the attachment is so simple that if the patient should wish to get up and leave the bed, a little contact pulls apart at the collar, and can be reattached when he goes back to bed. The mech-

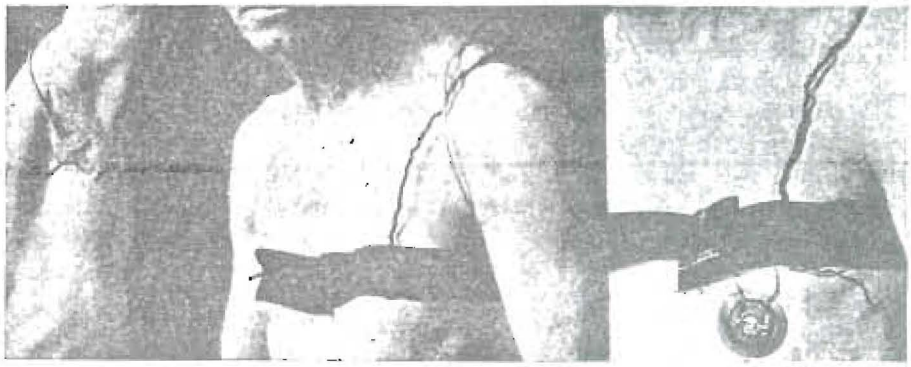


Fig. 8.

anism is so designed that you may read any of the records directly on its scale or from the chart.

BABY FOODS AND ENAMEL HYPOPLASIAS.

I wish now to talk on a series of researches on the relation of baby foods to enamel hypoplasias. This is a deformity usually of the anterior teeth and first permanent molars. I first wish to show you a skiagraph (Fig. 9) of an infant, very young, to show that at the time, or even before it has gotten any of its deciduous teeth, the permanent teeth are

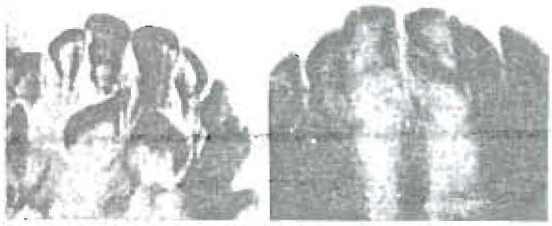


Fig. 9.

visible, and their enamel tips are forming, and it is very certain that a disturbance of the nutrition and assimilation at that period may make its markings on the enamel that is being formed at that period.

The next (Fig. 10) is a chart, showing the periods of calcification of the various teeth, and I simply put that on so that you will recognize and realize, if you have been watching it, that you may know by the markings on the teeth about at what time the nutrition changes took place.

I wish to speak of a few of the qualities of food stuffs, for you will readily appreciate that it will not do for me to speak of these by name, except in a general way. I don't want to have to go to Mexico. (See Fig. 11 from Holt). Let us take, for example, an analysis of these various foods. Nestle's food, for example, carries a fat of four per cent., a protein of 11 per cent., a cane sugar of 29 per cent., and following on down you will notice the carbohydrate of 51 per cent. Now if you will follow those

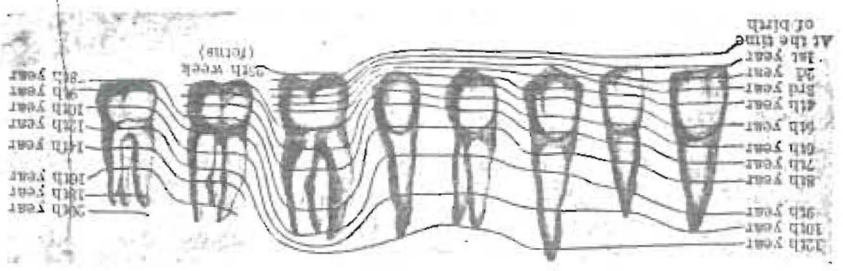


Fig. 10.

food elements through the different makes, and take fat, for example, you will notice how they vary. In Nestle's, it is 4 per cent.; in Mellen's, food .2 of 1 per cent.; in malted milk, 8 per cent.; in Ridge's, 1 per cent.; in Carnick's, 3 per cent. Now follow through the proteins, 11, 11, 5, 16, 11, 4, 14, 14 and 10. The soluble carbohydrates, 51, 80, 67, 67, 1, 1, 63, 27. Notice where these very low soluble carbohydrates come in. I may want to speak in a very general way about this, but I

THE COMPOSITION OF INFANT FOODS.

	Nestle's food	Mellin's food	Eskay's food	Malted milk	Ridge's food	Imperial granum	Lacto-preparata	Carnick's food
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Fat	4·45	0·24	1·16	8·78	1·11	1·04	12·35	7·45
Proteids	11·47	11·50	5·82	16·35	11·81	14·00	14·51	10·25
Cane sugar	29·22	....	....	....	....	....	....	....
Dextrins	6·22	19·20	14·35	18·80	1·28	1·38	....	....
Dextrose	15·95	....	53·46	....	0·52	0·42	....	....
Lactose (milk sugar)		....		49·15	....	....	63·68	....
Maltose	....	60·80	....		....	....	....	....
Total soluble carbohydrates	51·39	80·00	67·81	67·95	1·80	1·80	63·68	27·03
Insoluble carbohydrates (starch)	28·43	....	21·21	....	76·21	73·54	....	37·57
Inorganic salts	1·73	3·59	1·30	3·86	0·49	0·30	3·66	4·42
Moisture	2·58	4·73	2·70	3·06	8·58	9·29	5·80	3·42

Fig. 11.

want you to notice some of the characteristics of the chart, because I cannot call the foods by name. Observe the insoluble carbohydrates, or starch, are: 27 per cent., 0, 21, 0, for malted milk; Ridge's food, 76 per cent.; Imperial granum, 73. I shall probably speak of these foods as lactated cereal or farinaceous foods, and malted milks, etc.

Before studying the markings, I want you to study the chart, (Fig. 12 from Holt). Observe in mother's milk, at the top, what the

normal amount of protein is. This protein is an animal protein and not a vegetable protein. Observe the normal fat in woman's milk, a food that does not carry very much of the so-called acid fats. Next observe the normal soluble carbohydrates, and next the insoluble salts with no insoluble carbohydrates. On comparing cow's milk you will notice a great increase of protein, a slight increase in fat, a diminution of soluble carbohydrate, and an increase in the insoluble salts.

If we were to make a chemical analysis of those foods we would find in the insoluble salts possibly a large per cent. of the tricalcic salts.



Fig. 12.

Note in condensed milk an increase of the protein, still an animal protein —the fat is greatly reduced: the soluble carbohydrate is about the same as in mother's milk, and the insoluble salts about the same as in these other preparations.

You will notice that in canned condensed milk we probably have an animal protein. The fat is almost enough, as compared with mother's milk. The soluble carbohydrate is large: the mineral salts a little larger than in mother's milk. In Mellen's milk the fats are very low. In malted milk the protein is a little more than in mother's milk; the fats are very much less: the soluble carbohydrates sufficient; and a larger amount of the insoluble salts. In Nestle's food there is almost no fat,

the protein being sufficient. But we have, in addition to this soluble carbohydrate, an insoluble carbohydrate or starch shown to the right of the division dotted. The next, Carnrick's, is much the same. The insoluble carbohydrate or starch is very large. Imperial granum has plenty of a vegetable protein, if the vegetable protein would be adequate; almost no fat; just a slight amount of soluble carbohydrate, and a very large amount of insoluble carbohydrate or starch.

Fig. 13 is to show us the amount of calcification at two years. It shows the incisal cusps and part of the crown of the first permanent molar quite

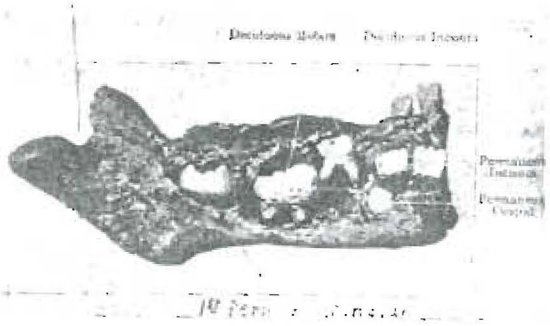


Fig. 13.

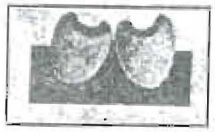


Fig. 14.

distinctly formed and the lower permanent incisor crowns about one-third formed. I wish you to differentiate and notice particularly the characteristic Hutchinson tooth, shown in Fig. 14. It lacks the central lobe and has a characteristic curve. You will observe that there are no teeth in the series that I will show that will approach this form. And in these years of collecting the models and histories I have not gotten half a dozen typical Hutchinson teeth, nor have I, in any of the cases that I shall show you, found a history of syphilis.

We will now study a series of typical cases from practice. (See Fig. 15).

(Miss H. M.) Brunette, age 20 years.

Extensive hypoplasia at about three years of age, involving all incisors and first molars, probably due to whooping cough, not to feeding. This is shown for contrast with those that are to follow.

(Master P. R., Fig. 16). Blonde, age 10 years.

FEEDING HISTORY.

Scanty breast food for ten months and then a farinaceous food without milk until a full mixed diet. He did not like milk and so did not take it.

DENTAL PHENOMENA.

Hypoplasia of tips of central incisors. Four sisters' teeth normal and mother's normal in form but irregular, deciduous teeth are normal.

(Master J. L., Fig. 17). Blonde, age seven years.

FEEDING HISTORY.

Normal breast feeding until eight months and plenty then only on a farinaceous food which was high in insoluble carbohydrates and no animal protein for eight months or a year.

DENTAL PHENOMENA.

Hypoplasia of lower incisor tips and between the cusps on molars on occlusal surface. The teeth are abnormally sensitive. Two sisters' teeth, normal and deciduous teeth normal.

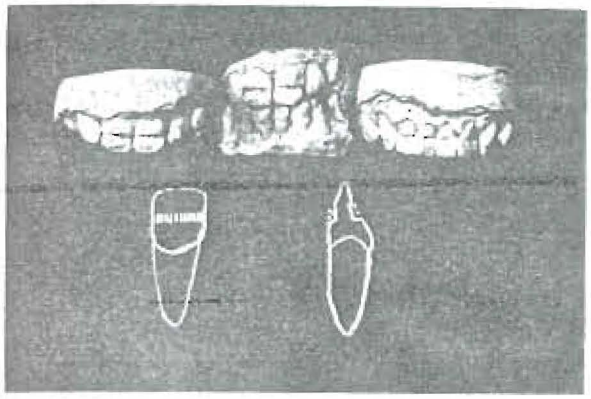


Fig. 15.

(Miss N. M., Fig. 18). Blonde, age eight years.

FEEDING HISTORY.

Breast food very scarce and abandoned at three months, followed by diluted cow's milk for two months until daily convulsions started and became severe, then a boiled malted milk. She did not try to walk until two years of age.

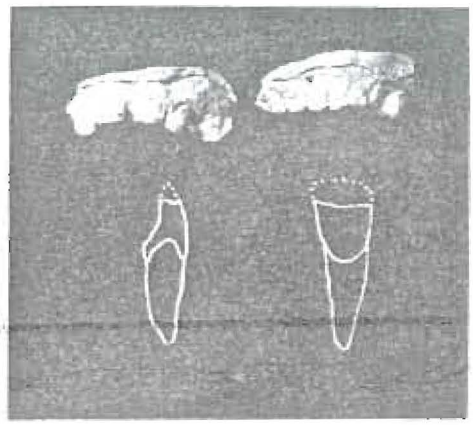


Fig. 16.

DENTAL PHENOMENA.

Extensive hypoplasia of all incisors and first molars with very sharp limiting angle or offset at margin of defect. Suddenly the incisors increased to three times their former diameter labio-lingually, which is, apparently, their normal diameter. The enamel tips of the cusps of the first molars which were forming at birth stand like crowned pyramids. Note the normal lobing of lower incisors. The teeth are very abnormally sensitive. The deciduous teeth are normal. Both dentin and enamel are involved.

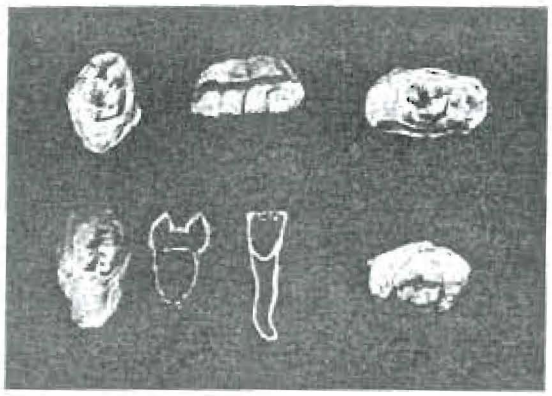


Fig. 17.

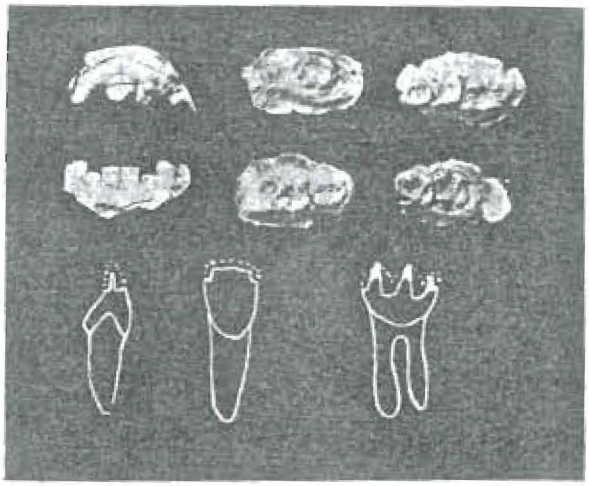


Fig. 18.

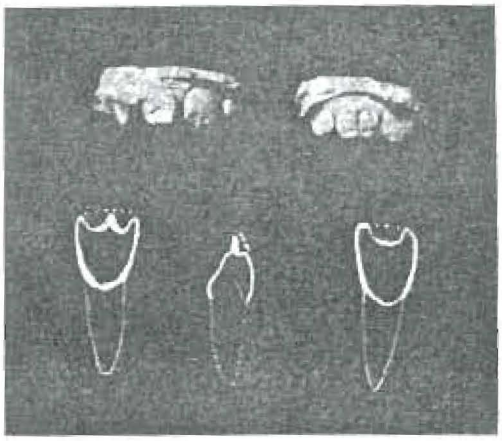


Fig. 19.

(Miss M. Z., Fig. 19). Brunette, age 10 years.

FEEDING HISTORY.

No breast feeding, used modified cow's milk very dilute and scarce by action of the nurse, who, it is said, poured two bottles daily in the sink. Child was poorly nourished. A baby food was later added to the milk and fed separately. It has not been analyzed but seems to be farinaceous.

DENTAL PHENOMENA

Extreme hypoplasia of tips of incisors and cusps of first molars with a rapid increasing of the diameter labio-lingually of incisors about end of first fourth of crown. The deformity of the two upper centrals is not uniform, the left approaching the Hutchinson type for which there is not found a supported history. Both parents' teeth normal in form, mother's have a tendency to decay. Brother has a similar history of feeding and similar condition. (See next case).

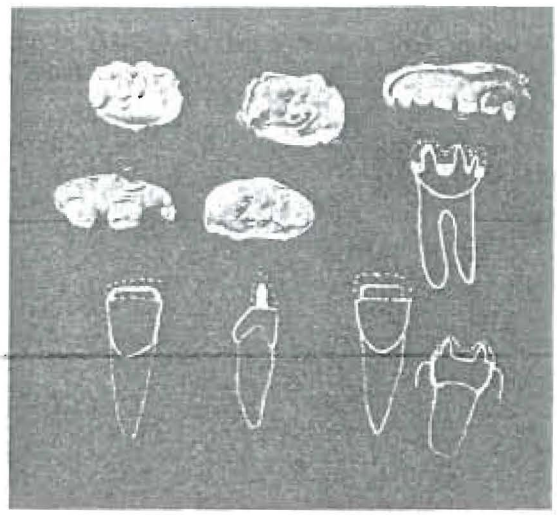


Fig. 20.

(Master J. Z., Fig. 20). Brunette, age seven years.

FEEDING HISTORY.

No breast feeding, started with modified cow's milk for few months but changed to some artificial baby food as his sister had, probably farinaceous, which was continued about two years when it was changed for a mixed diet. He got less cow's milk than his sister. (See previous case).

DENTAL PHENOMENA.

Has very marked hypoplasia of enamel of all teeth, forming at that period which ends very abruptly, producing a distinct step or offset on all sides of the teeth including all centrals, laterals and first molars. The enamel of the incisal edge of the lower incisors is better than below on the same teeth and the tips of the cusps of all the first permanent molars, which stand like pinnacles, are crowned with translucent, strong enamel. Note particularly the regularity of the hypoplasia on all teeth forming at that time, also, that he had less cow's milk than his sister at the latter part of the period and, also, a more extended hypoplasia. The mother acknowledged a fear that she had not done her full duty in not nursing her children by asking why mothers had not been warned that baby foods were not a satisfactory substitute. She revealed a guilty conscience by asking the

above after having emphatically stated that artificial foods were not used for the boy and then made a complete confession stating that she had not wanted to be restricted and have them dependent upon her always being available, etc.

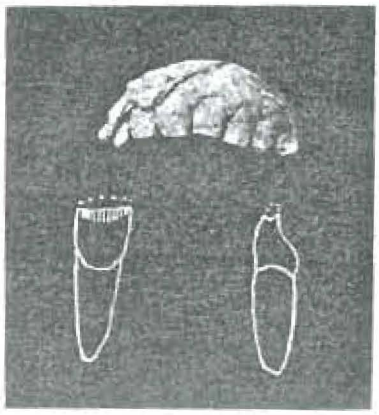


Fig. 21.

(Master H. B., Fig. 21). Blonde, age about 20 years. Healthy and full stature.

FEEDING HISTORY.

Breast food for six months, limited supply, then a farinaceous artificial food with limited breast food for three months, then a condensed milk until a mixed diet was substituted, which agreed better than the farinaceous. Delicate baby until eighteen months and frail until three years. (Eight-month baby). Sister's teeth normal.

DENTAL PHENOMENA.

Marked hypoplasia of the upper central incisor tips and of lower central and lateral incisors and of occlusal surfaces including the cusps of the first molars.

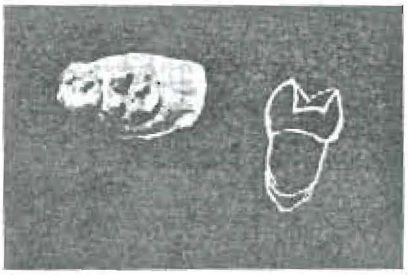


Fig. 22.

(Master W. N., Fig. 22). Blonde, age 12 years. In good health.

FEEDING HISTORY.

Natural food for nine months and never would take cow's milk. Was fed entirely on farinaceous artificial foods, with cocoa for milk, but no milk because he did not like it.

DENTAL PHENOMENA.

All first molars are very defective on their occlusal surface, though the tips of the cusps are well formed.

(Miss F. S., Fig. 23). Blonde, age 25 years. Good health.

FEEDING HISTORY.

Breast fed, scanty quantity for three months, then a farinaceous artificial food, cooked in water, for a year and a half, but started some mixed diet with it at

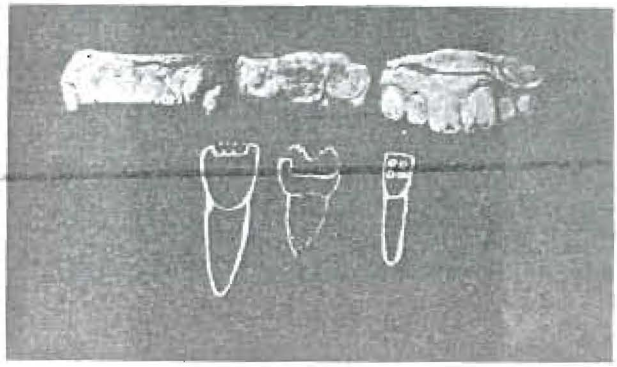


Fig. 23.

about a year. She cried most all the time for one and a half years, except during the months of breast feeding. Finally the farinaceous food was abandoned for a mixed diet because they saw it was not nourishing her. She did not like cow's milk.

DENTAL PHENOMENA.

A deep hypoplasia of the incisal edges of the upper central incisors and lower incisors and of the entire occlusal surface of each of the first permanent molars. Note, including all the cusps which broke away soon after eruption. Teeth very sensitive. Deciduous teeth normal. Sister's teeth excellent.

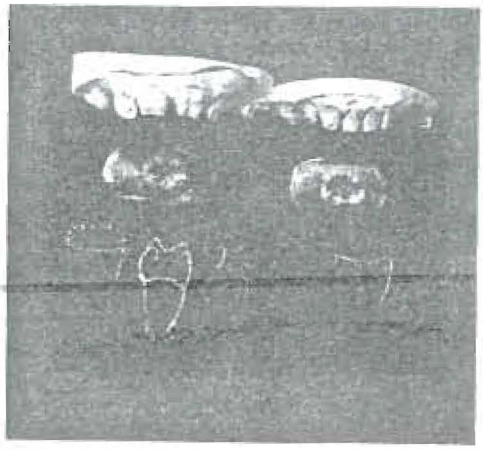


Fig. 24.

(Miss I. Mc., Fig. 24). Blonde, age about eight years.

FEEDING HISTORY.

From birth to six months no breast food, but fed on a farinaceous artificial food. From then to three years of age a sterilized milk, with fruits and common foods in latter part of period. Up to two years her health was poor, owing, as mother said, to bad blood. The child is now splendidly nourished. Deciduous teeth were perfectly normal.

DENTAL PHENOMENA.

A distinct hypoplasia of the upper central incisors and tips of laterals and lower centrals, lateral and cuspids. The molars show a distinct depression on the occlusal surface with lack of deposition of the enamel as shown in diagram and photographs. The upper central incisors look very much as though they had been cut squarely off.

(Master P. D., Fig. 25). Age 10 years.

FEEDING HISTORY.

No normal breast feeding. Was given a lactated artificial and milk from birth until put on a full mixed diet of solid food. Milk began with small amounts and was increased with age. At present well nourished and normal.

DENTAL PHENOMENA.

Very marked hypoplasia of the enamel, persisting for about one-third of the length of the lower incisors, then quite rapidly tapering to a normal contour. The incisal third of the lower centrals is only about the thickness of twice that of a postal card, and the laterals three times that of a postal card. All first molars have cusps standing as pinnacles where they have not been broken off and the contour greatly deficient.

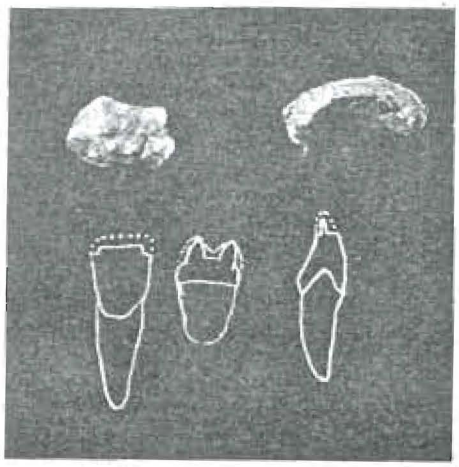


Fig. 25.

(Master H. C., Fig. 26). Blonde, age 12 years.

FEEDING HISTORY.

No normal breast feeding but raised on a farinaceous artificial food until put on a mixed diet. Was so fat and plump a baby that his parents were urged to enter him in a baby show. Did not walk until later than normal.

DENTAL PHENOMENA.

A very marked hypoplasia of the occlusal surface of all the molars and of the incisal edges of the lower incisors and slight cupping of the incisal edge of the upper incisors.

(Miss M. C., Fig. 27). Blonde, age nine years.

FEEDING HISTORY.

Limited breast feeding for three months, then put on modified milk.

DENTAL PHENOMENA.

Has two sisters and one brother, one sister has slight hypoplasia, the other sister and brother very normal perfect teeth. Father's and mother's teeth normal except that the father's show a line corresponding with a severe illness at three

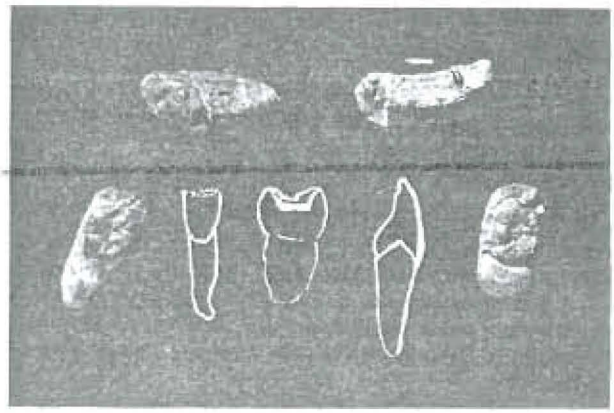


Fig. 26.

years of age. This girl's teeth show very marked hypoplasia of all incisors, upper and lower, and of all first molars. The contour of all first molars deficient, though tips of the cusps are well formed.

(Mrs. S., Fig. 28). Brunette, age 65 years.

FEEDING HISTORY.

Was told by her mother that there was insufficient food for breast feeding and various substitutes were experimented with and finally a wet nurse was secured.

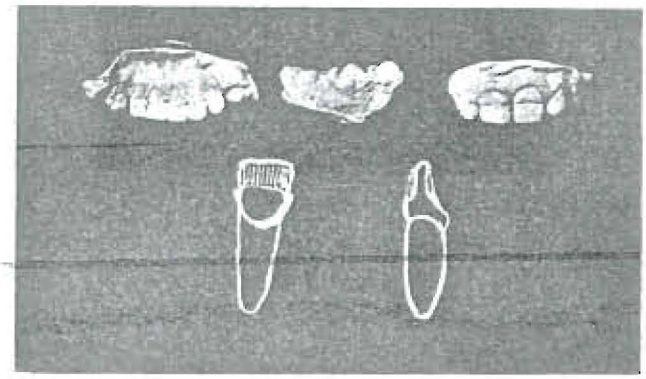


Fig. 27.

DENTAL PHENOMENA.

All first molars are lost and all but two upper incisors, which, with the lower incisors, show distinct hypoplasia involving the first third.

(Mrs. D. C. M., Fig. 29). Brunette, age 35 years.

FEEDING HISTORY.

No history of feeding but had a severe illness, thought to be inflammation of the lining of the stomach.

DENTAL PHENOMENA.

All incisors and molars show distinct hypoplasia, taking the form of restricted diameter for the incisal half of the lower centrals and laterals. All first molars have characteristic pinnacle-shaped cusps with lack of contour, including first half of the molar crown. These teeth have always been hypersensitive.

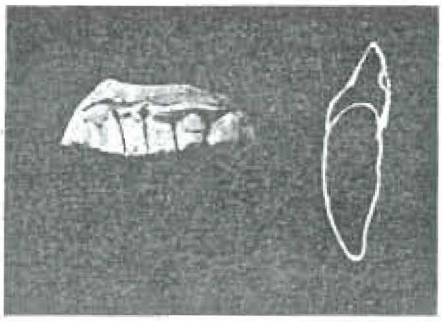


Fig. 28.

(Mrs. J. P., Fig. 30). Brunette, age 49 years plus.

FEEDING HISTORY.

Remembers that her mother told her that she was raised on malted milk.

DENTAL PHENOMENA.

All first molars are gone. The lower incisors have a marked hypoplasia involving the first fourth producing the offset screw-driver appearance. The upper

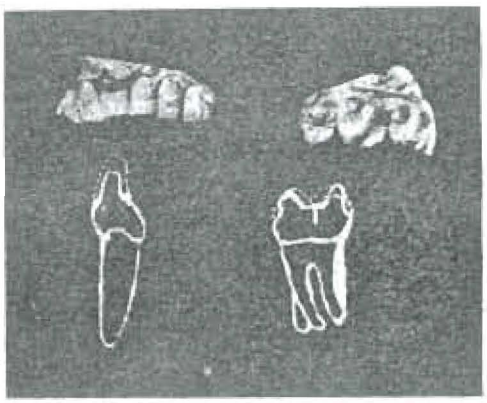


Fig. 29.

central tips have a cavity depression not from decay in the incisal edge. The line of demarcation between the defective and normal tooth structure and contour is very closely marked.

(Miss E. P., Fig. 31). Blonde, age eight years.

FEEDING HISTORY.

Normal breast food for ten months, but her father died suddenly when she was six weeks old, leaving her mother a nervous wreck and forced to earn. After the shock Ella did not grow or show fair nourishment. At ten months was placed on diet of cereals and milk. A history of stomatitis between two to four years. Present health good.

DENTAL PHENOMENA.

Ella presented unilateral hypoplasia of the right first molar, right central and right lateral. Note that this hypoplasia is entirely unlike those presented in the previous cases but involves a part of one surface only of each of the teeth named.

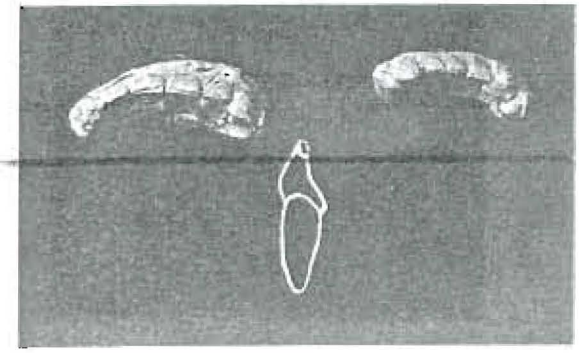


Fig. 30.

(Twins—Masters M. B. and M. B.). Blonde, age seven years.

FEEDING HISTORY.

Myron was the weaker of the two. He was nursed thirteen months and Malcolm was nursed eleven months. Both were always hungry and it was recognized that there was insufficient for both. There are two other children both having normal teeth and the parents have normal teeth. All are very healthy.

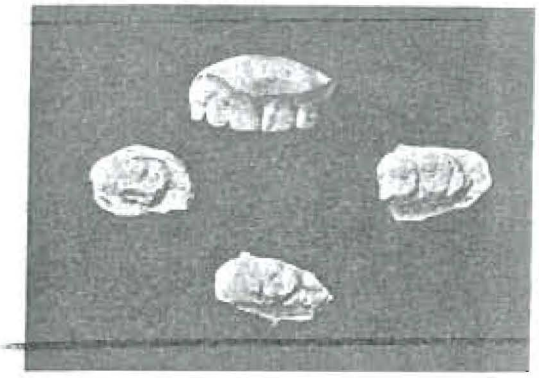


Fig. 31.

DENTAL PHENOMENA.

With both boys the lower incisors show a marked hypoplasia entirely unlike all presented heretofore. The structure and surface of the enamel seems normal throughout but the teeth are slightly lacking in contour for the first third, producing a slight tapering, resembling a taper screw-driver. It is interesting to note that this characteristic deformity is worse for the boy that was weaned first.

(Master K. P.). Blonde, age 10 years.

FEEDING HISTORY.

Normal breast feeding for first year then milk and bread and milk diet, and some solid food. Was well nourished during first year but from second to sixth

year was troubled with a constantly increasing affliction which he called the "Chokes." He was ravenously hungry but his food would keep regurgitating, involuntarily, many times during a meal. Finally the writer put a solution of bismuth subnitrate in his stomach and made an X-ray and found that a very small part of it had gone into the stomach and that the esophagus was bulged into a pouch larger than the normal stomach and that there was a constriction at the cardiac end of the stomach at its juncture of the esophagus. The condition was rapidly getting worse and after much consultation, he was taken to Rochester, Minnesota, to the Mayo's for operation, which was accomplished by difficult, gradual dilatation with the result that in a few months he was able to swallow and retain full mixed diet.

DENTAL PHENOMENA.

The structure and contour of the enamel is apparently normal except in the extreme susceptibility to caries, which spread with unusual rapidity after getting through the enamel to the dentin. The dentin is very abnormally sensitive and a very shallow cavity in each 3 central and molar exposed the pulp. The skiagraph shows the pulp chambers of all the incisors to be abnormally large, indicating a disturbance, if not an interruption, in the deposition of the dentin.

(Mrs. S.) Age 70 plus.

FEEDING HISTORY.

Was one of a pair of twins, she, the stronger of the two, was weaned to leave a normal breast food for her brother while she was fed on rice and gruel.

DENTAL PHENOMENA.

The lower incisors show a marked hypoplasia of the incisal third of centrals and laterals, and involving the tips of the lower cuspids.

(Mr. B.) Brunette, age 33 years.

FEEDING HISTORY.

Probably little or no breast food, was not able to take milk or eggs until twelve years of age. Was fed during the early childhood on scraped raw meat.

DENTAL PHENOMENA.

Hypoplasia of the cuspids, centrals and laterals, involving about three to three and one-half years of growth. The enamel is more perfect on the first fourth of upper centrals than on second fourth, ditto lower centrals and laterals.

Review of the preceding twenty-one cases, and about an equal number which would be duplicates, forcibly brings out the following information.

First. While an enamel hypoplasia of the incisors is a marking that would be carried for life, it is not nearly so common in the people available for the writer's examination among those passed sixty as those under twenty, the ratio being nearly seven to one.

Second. All cases have been counted whether the history could be obtained or not and in almost every case of enamel hypoplasia coming under the writer's observation where the history could be secured, there was not a normal diet during the first one or two years of life.

Third. None of the cases here presented are the typical Hutchinson syphilitic teeth shown in Fig. 14.

Fourth. A study of the laws of human assimilation and metabolism and the result of experiments on rabbits, guinea pigs and white ~~rabbits~~ rats made by the writer and by others has shown that the nutrition and growth of the young life is dependent on an available source of calcium compounds, for the animals fed by

the writer on a calcium-free diet failed so rapidly in health that the diet had to be abandoned in every case to prevent the death of the animals and in one instance to prevent the animals from eating each other.

Fifth. Infant human beings cannot obtain lime salts from the same sources that most animals can, for example rabbits and guinea pigs can obtain it from lettuce and green herbs the first day after birth, calves from grass from six weeks to a few months after birth, adult rabbits can even obtain it from calcium carbonate. Investigations indicate that the human infants can only obtain it from animal protein for several months after birth and later can obtain it from vegetable protein and soluble carbohydrates and probably much later from insoluble carbohydrates.

Sixth. The human infant for several years of its life cannot obtain calcium from inorganic compounds and even human adults can obtain very little from that source.

Seventh. A comparative study of the deposition of enamel in the various stages of its development in the various teeth and its relation to the age at the time of the changes in the feeding shows in the cases just recorded in detail a very positive harmony. See illustration (Fig. 10) indicating the period of calcification for the various teeth, also X-ray pictures of infant's teeth. (See Fig. 9). The published chart of the period of enamel calcification is of the upper teeth, the lowers calcifying from six months to a year earlier for the same stages and the lower cuspids two or three years earlier than the uppers. The writer's observation is that the calcification period, as indicated in most of the calcification charts, is given from three to six months too late as the average as shown by many of the skiagraphs.

Eighth. A study of the baby food substitutes indicates quite strongly that many, if not most or all of them, are far from being competent substitutes for the normal food.

Ninth. Both clinical and research data strongly indicate that even normal cow's milk does not furnish the calcium compounds in the form in which they are most readily assimilated by infants.

Tenth. The processes of modifying cow's milk entirely fails to make it a competent substitute for mother's milk, though probably the best now available.

Eleventh. The chemistry of the assimilation of calcium compounds is not perfectly enough worked out to answer the question as to how to modify artificial substitutes.

Twelfth. It is very clearly the duty and privilege of the dental profession to help to open this door and give to humanity a means for, in a large part, correcting this great and apparently rapidly increasing affliction of dental hypoplasia.

Of all the patients that have come under my observation while making these studies, covering several years, of those under thirty years of age, I find that about one in seventy-five has an enamel hypoplasia; of those between thirty and sixty, about one in two hundred, and of those over sixty, about one in five hundred. There is more than a suggestion that the increased use of baby foods is responsible for the increased frequency of this very serious deformity, a deficiency of the enamel structure. If these people died the significance is even greater for it would be in accordance with the researches made by the Swiss government upon the relative strength, endurance and resistance of their soldiers, whether fed as infants on normal breast food or on artificial substitutes.

We will now go to a study of the relation of the dentist to the plasticity of the bones of the human race. When in Paris in 1900 Dr. Michaels showed a man for whom he had made an artificial shoulder joint of silver and hard rubber placed within the periosteum, and new bone was caused to grow around them, and in time the man had an entirely new shoulder joint. I remember he showed us pictures of that man carrying a pail of water with that arm and new shoulder. That gave me a vision that the bones of the face have perhaps a great deal more plasticity and mobility than we had ever supposed they had, or at least than I had supposed they had. And these researches are studies along that line. The



Fig. 32.

first case is that of a lady who had the misfortune to have a septic infection enter her chin. It increased in severity, involving at first only the soft tissue, until finally it involved the hard tissues as well, and until she had lost all the mandible back to the second molar on one side and third molar on the other, and all of the teeth. When she came to me those angles had moved in, and the remnant of the periosteum had made a tie of bone about three-quarters of an inch long, uniting those ascending rami so closely under her tongue that she could swallow only liquids easily, and was in great fear that the thickening and enlarging of that bone which was continuing would eventually cause serious distress. She was so deformed, or thought she was, that when she was brought to the office she was not only heavily veiled, but inside of the veil had large surgical bandages. (See Fig. 32, which is a photo of a plaster cast of her face). The operation was to stretch the little bit of new bone, as shown in the next picture. (See Fig. 33C). You will notice how the chin is very seriously depressed and there is a very serious deformity of the angle. The chin proper was about one inch back of the tip of the upper incisors. (See Fig. 33E). We undertook to stretch this little bit of new bone to make an arch. In brief, we succeeded in nine months in moving the angles

laterally and the chin forward with an appliance that kept continual pressure at those points, and in that manner enlarged the arch until it had a width that would about go over the former arch and in relation to

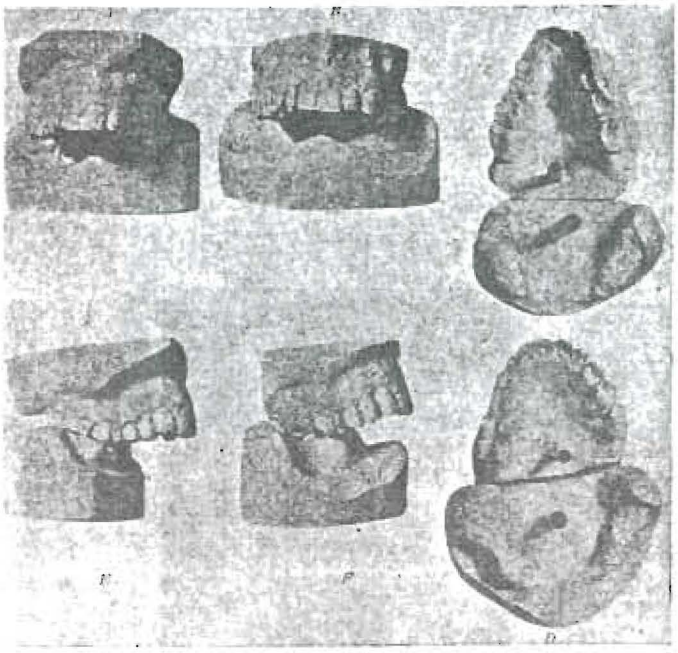


Fig. 33.

the upper incisors moved forward, as shown in the illustration, nearly to the line of the upper incisors. (Fig. 33F). Now the next picture will show us a little of the change, (see Fig. 33D), this being a comparison of the two arches without showing the appliance in place, in which there is a jackscrew in the soft vulcanized velum rubber. Pressure was made inside



Fig. 34.

of the lateral walls of the remnant of the angles, thus moving them sidewise, until we had sufficient width for her to swallow and eat coarse food with comfort. Pressure was made forward inside of the lower lip, tending to drag the symphesis to its normal position. Fig. 33D shows nine months' change which since has been much increased, as shown in Fig. 34, which

is the change in two years. The next (Fig. 35) shows her appearance later, and if you were to meet her on the street today, you wouldn't find her veiled, and I think you would never suspect that she had ever had an accident. (Applause). She is very comfortable, and very grateful.

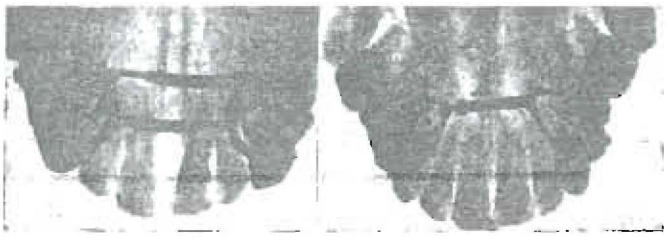
I want to say to you that the compensation from a financial standpoint is no consideration in undertaking to help these unfortunates, for



Fig. 35

they are discouraged, their life is crushed, and we cannot possibly do too much or make too great sacrifices for them.

The next will show another series of studies on the flexibility of bones, and I wish to differentiate very closely between a movement of the teeth in the bones and the movement of the bones themselves. All I wish to demonstrate in this case is the bending of the mandible, without moving the teeth in the mandible. What I want to undertake to show is that the mandible can be bent without changing the position of the teeth much in the mandible. First, I want to speak on the relation of the ventilation to the health of this boy. He could not breathe sufficiently to play ball. The nasal openings, external and internal, are so small that he was greatly fatigued upon slight exertion, and that necessitated the moving of the



B Fig. 36 A

maxillary bones laterally apart, which brings up the question as to whether or not this really can be done. In this skiagraph, (to the right in Fig. 36A), shown above, you see the position of the central incisors. The appliance was expected to move them apart, though it was not attached to them. If anybody has any doubt as to whether or not this question is disputed they have only to inquire and they will find that the members of our profession are divided into two great camps—those of one camp saying positively that it cannot be done, and those of the other saying, "Why, of course, it can be done." When these bones had been

moved, as shown, and when these centrals and laterals, which were not in any way connected to the appliance, had separated, we made a series of tests to find whether or not it was simply the pre-maxillary bones, as some claim, or the maxillary and palate bones complete, that were moved. In order to prove it we put an injection of novocaine in the hard palate, and had four reliable dentists present, Drs. Yahres, Walker, Moffet and McCauley—and I think most of them, if not all of them, are here—and passed an instrument through the separation, half an inch at least, up in between those plate bones, just forward of where the hard palate joins the soft palate, establishing the fact of maxillary separation, so far as that patient is concerned, though the skiagraph to the left in Fig. 36B clearly shows the suture open beyond the line of the first molars. Unfor-

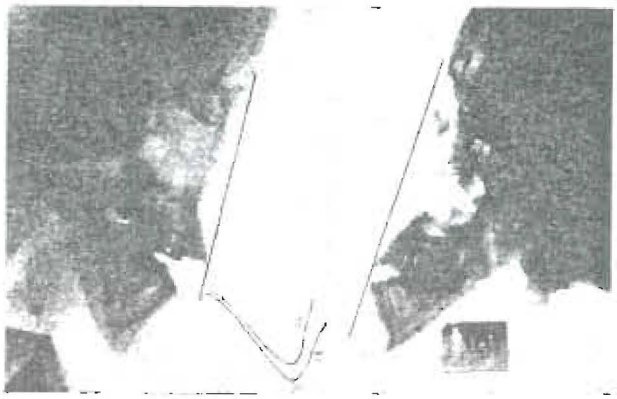


Fig. 37.

tunately, it is a difficult thing to take a skiagraph that does not exaggerate, or that does always tell the truth; for, as the men who would discuss this picture could justly say, we could easily get a projection and a curving of the incisor teeth here to such a position that it would look as though the fissure ran back the entire length of the maxillary bones, when it did not. It is very necessary to know the angle of incidence and relation of film or plate to the parts. Now, a study of the head skiagraphs in this case (Fig. 37 at right) will show us that a line drawn from the forehead to the chin will nearly touch the incisors of the lower jaw. This case is only to be reported in part at this time as it is still in progress. We here simply wish to illustrate that the mandible was bent at the point of the extraction of the first bicuspids where we were required to reduce a maxillary and mandibulary anthropoid deformity resembling the apes. The small skiagraph on the large one shows a V-shaped section cut out of the lingual and buccal plates of the mandible and this same space is practically closed in the large skiagraph to the left. If you will note the relative position of the line drawn from the forehead, it is a full half inch forward of the lower incisors after the bending operation was accomplished in about three weeks, while before it almost touches

them, and you will notice that the curve of the mandible is changed at the point where it was weakened. The curves of the lower border are reproduced graphically for comparison. The next operation then will be the bending of the bone of the upper in the same manner. This is being done at this time, and will be reported later in detail.



Fig. 38.

BLOODLESS DECOMPRESSION OF THE CELLA TURSICA.

I wish now to speak of the relation of the hypophysis cerebri of the brain, or the pituitary body, to some of the dental deformities, and the counter relation of dental deformity to the functioning of the pituitary. I first want to present a case that was in my care a few years ago, being a sufferer from acromegaly. These cuts are from plaster casts. (See Fig. 38). The first at thirty-three years of age, before the attack,



Fig. 39.

and the others at forty-four. This is another phase of functional disturbances, of the pituitary body, one where there is probably an overactivity of the anterior lobe, causing an abnormal skeletal growth with an enlargement of special bones and tissues, including the mandible. The last to the right shows my feeble efforts to improve this case by putting in

an artificial denture carrying an extra set of teeth outside his own teeth, and thereby carry the lip forward besides giving him a masticating surface. Finally the mandible moved forward until it was a full inch anterior to the upper teeth. What I did did not influence the progress of the disease at all, although it gave him temporary comfort.

Now, I wish to present a case that I have treated in an entirely different way. It is of a boy about fifteen and a half years of age. First, I want to show you the relation of the pituitary body or hypophysis cerebra to the bones of the face. It lies in what is called the sella tursica, in the base of the brain, in the sphenoid bone, (see Figs. 39 and 40), and is

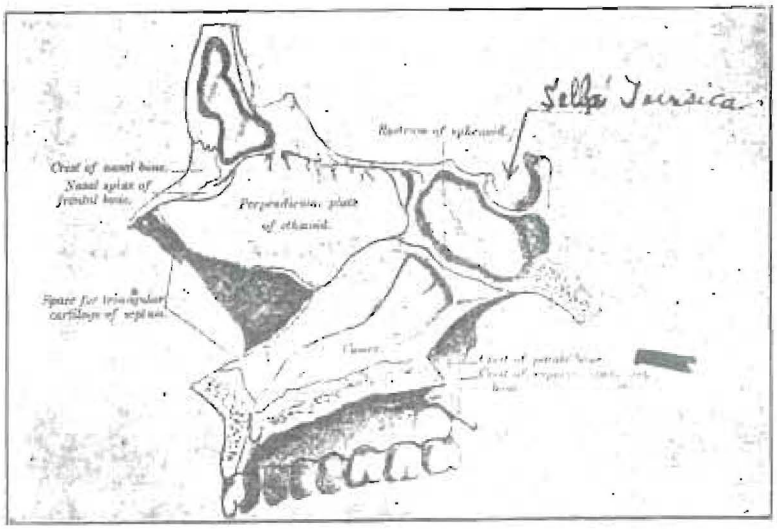


Fig. 40.

so well protected that nature must have intended that it should have great responsibility. The ancients said it was the seat of the soul. We do know that it seems to have a very large influence in determining, not only calcium deposition, but also in determining such functions as the carbohydrate assimilation, and I am glad to have learned, while coming over from the hotel, that Dr. Kirk has just been to Toronto presenting some work on its relation to caries. To me the interesting thing in the history of this case is the very marked change in his mental as well as physical condition. I wish to speak more in detail of the pituitary body. It has two lobes. The anterior lobe gives its secretion directly into the circulation, and the posterior lobe into the cerebro spinal fluid through the third ventricle. It is below the dura mater which separates it from the brain and enclosed in the dural capsule. If there is an inflammatory disturbance, involving the dura at this point, you can readily see that it may involve the infundibulum, or neck, which, passing through the dura, unites the pituitary with the brain. This boy had cerebro spinal meningitis when three or four years of age, and we find, as he appears now, that he has many of the points of development of a boy three to six years of age.

It is quite certain that there is a deficiency in the functioning of that gland. There have been a great many studies made recently on that point with animals, chiefly by Cushing. Fig. 41 shows the boy as a baby and several views as we saw him in the various expressions of countenance

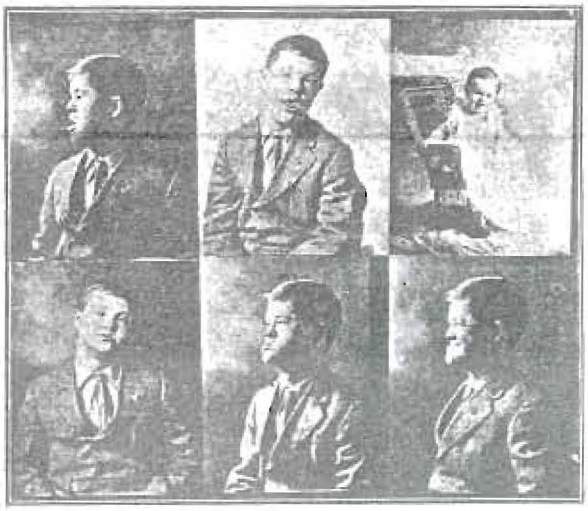


Fig. 41.

when he came to us six months ago. He had the development of a child in many ways. He played with toys and with children. He was as infantile in the development of his reproductive organs as at six years of

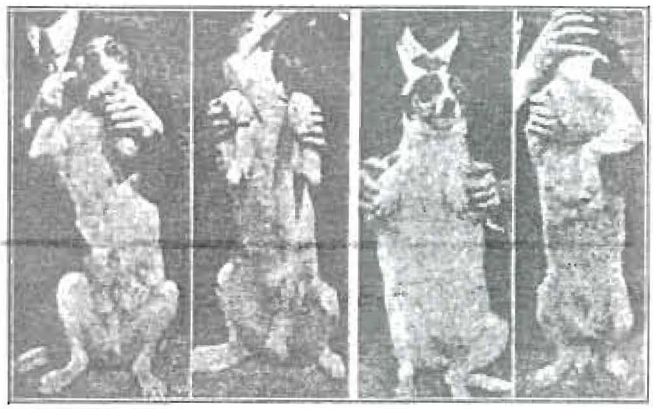


Fig. 42

age. This is characteristic of cases where there has been an interference with the functioning of this organ when the anterior lobe is involved. He was always hungry; he was always asking for a drink, and he was sleepy; his temperature was subnormal; and he had many of the characteristics that are known to be very definitely and positively present in the case of pituitary disturbance. He had blind areas in both eyes.

We will now observe some studies of dogs that were made by Drs. Cushing, Goetsch and Jacobson. They found when they removed part of the hypophysis that the dogs did not develop normally. They were undersize; they remained infantile, as far as their development was concerned, particularly the reproductive organs. They found they were stupid, sometimes really silly, in their development. They show dogs that are old

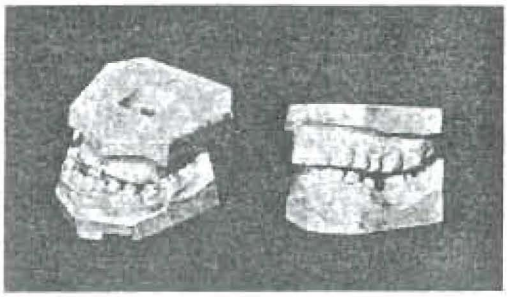


Fig. 43.

enough to be perfectly developed, and yet the reproductive organs are infantile. Their whole development is pup-like, and carries with it in brief all of those infantile characteristics. Fig. 42 shows two operated dogs and their brother and sister as checks. Dr. Cushing, of Boston, has operated on many persons for the relief of pituitary pressure as have also a few others. They usually lower the floor of the cella to allow of its development downward and thus find relief from the pressure such as a brain tumor near it. This operation usually is to go through the mouth and remove a part of the sphenoid and the floor under the pituitary body or through the temple. You will note the relation of the pituitary



Fig. 44.

body to the optic nerves and will readily see why a pressure in or about that pituitary body may be conveyed to those nerves and thus produce a bilateral disturbance of vision. There is a lack of development of the

bones of Warren's hand and you can bend the fingers backward as though they were a bunch of soft rags. They are lacking entirely in that resiliency, solidity and stiffness that a boy of that age should have. The teeth of the upper arch did go entirely inside of the teeth in the lower arch, but with a lateral wedging pressure, and you can imagine what a

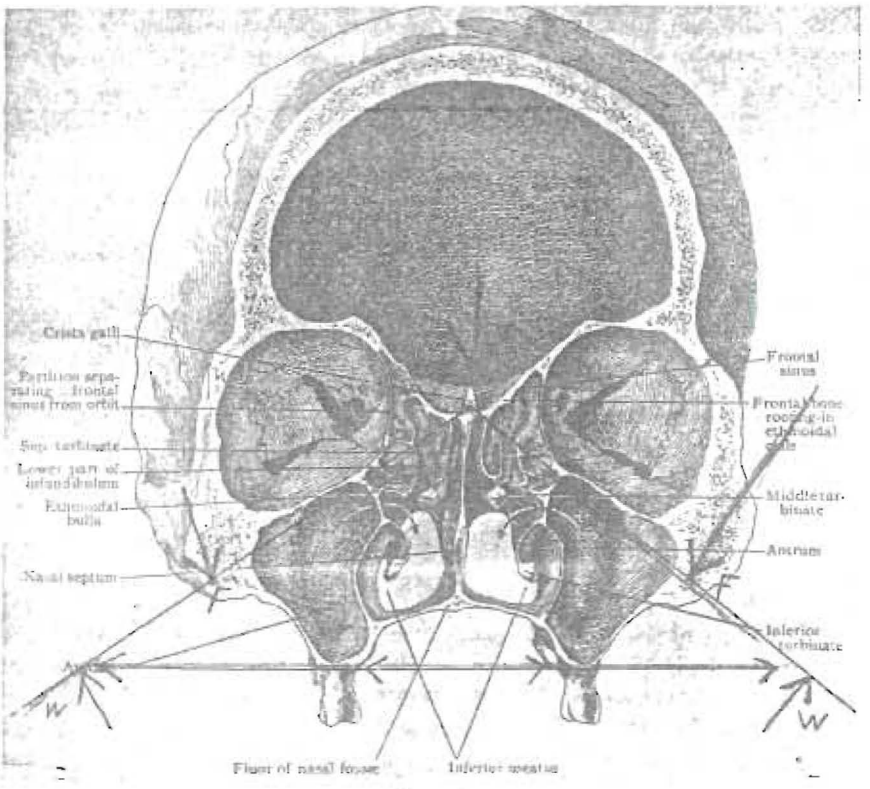


Fig. 45.

deformity that would make, and what a deficiency in his eating. (See Fig. 43). If I had time I would show motion pictures of him, before and after, which were used as part of his record. The only way he could eat was by filling his mouth so full that he could crush it between his tongue and his cheeks. He had nearly a perfectly developed upper arch, but it was that of a boy four or five years of age, with a lower arch of a boy fifteen or sixteen. Studying his head with the X-ray, we find that the relation of the upper arch to the lower arch is shown to be very far distally, (see Fig. 44 at left), and the maxillary bones are very much underdeveloped. I want you to notice later the change in the relation of the sella tursica and maxillary bones after the operation, of which I will speak. Now, have in mind, please, when studying the maxillary bones, that the sella tursica has its positive connection with them through the solid bony tissue. And when we move the maxillary bones down and forward, we modify the pressure and support of the entire central base

of the brain. Fig. 45 is a cross section through the eyes and the mouth, and I want you to notice the definite relation of the base of the brain to these bones. If now we move the maxillary bones laterally, we will necessarily widen the nares. (See Fig. 46). When we started with this boy his left nostril was entirely closed, and a rhinologist spent half an hour with adrenalin and cocain endeavoring to get water or air through it and could not. After the appliance was put on to carry these bones laterally, within three days the boy could begin to breathe through that nostril, and if I hadn't forgotten to bring it, I would show you a model of the nostril, and you could drop a slate pencil or a flattened lead pencil

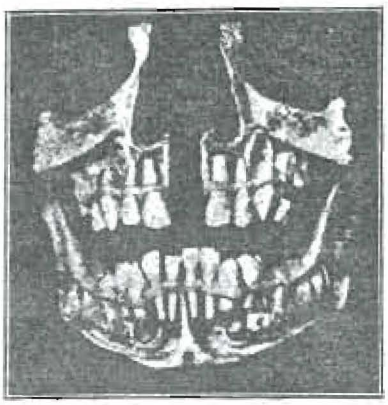


Fig. 46.

through the opening, so large has it been opened. Now, if we apply force between the teeth of the maxillary bones and cause an outward pressure, they meet a resistance in the attachment of the maxilla with the malar bones. (See Fig. 45.) We then have two forces drawing the sphenoid and cella downward, viz., the fulcrum over the malar and one like the flattening of a hoop. These are shown in Fig. 45. There are several other effects of these forces.

We will now study the skiagraphs showing the changes in the maxillary relations. No. 1 in Fig. 47 is the condition on May 3, 1913. You will see that the central incisors are in contact. The next, May 10, shows suture opening and rapidly, as shown on May 13th, 19th, 27th, June 4th.

On May 27th he had improved so much that he could do away with the pillow that had been rolled up, or a coat or something of that kind, that had to be put under his neck, as otherwise he would become suffocated from the involuntary closing of his mouth in his sleep. He did away with all that special padding without which he could not sleep before and was breathing through his left nostril, through which he had apparently not breathed for many years. The changes that you see physically were not greater than the changes mentally, of which we shall speak a little later. The movement was discontinued during the hot summer months and he returned to his home town. In the fall we renewed our

pressure, carrying these bones still further apart until we had the central incisors as you will see here, by October 1st, five-eighths of an inch apart. We then put in two extra central incisors between his own cen-

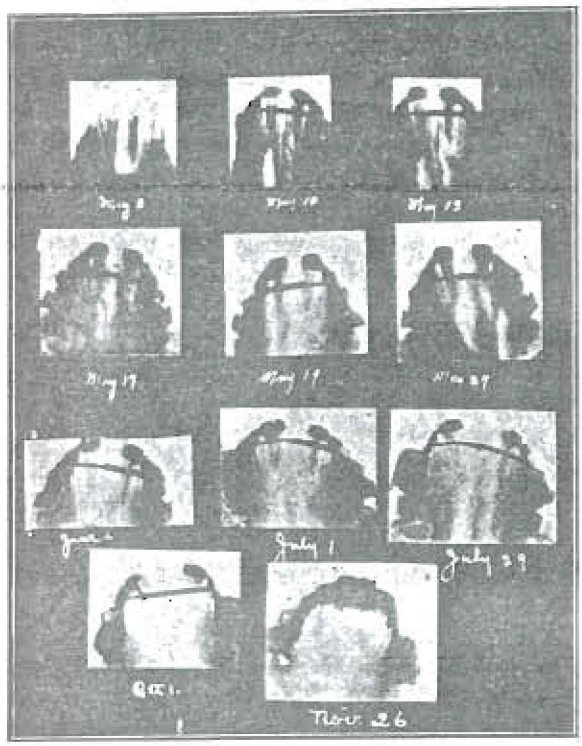


Fig. 47.

tral incisors, see Fig. 48, supported as part of the fixed retainer, and the relation of the maxillary bones to the mandible was carried forward by inter-maxillary stress, with proper anchorages on each the lower teeth and the upper teeth, and elastic force operating forward on the uppers

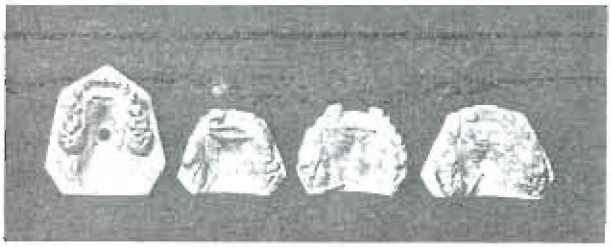


Fig. 48.

and backward on the lowers, and the mandible being quite fixed as it pressed against the outside skull resisted the elastics which were pulling all the time forward on the maxillary bones, and we were certainly also moving the base of the skull downward, as you will see. We have thus

produced the change in the position of the teeth and maxillary bones as shown in Fig 44 at right. The occlusion of the arches was changed so completely that now the upper is entirely outside the lower, while before it was entirely inside, and he eats with ease and comfort. When we study these skiagraphs (Fig. 44) we find that the relation of the maxillary bones to the mandible has entirely changed. (See Fig. 43 at right.) You will notice that the central forward mass of the head has been carried forward, and these maxillary bones are now forward and outside of the mandible, and there is also a lowering of the base of the skull. The sella tursica is very clearly shown. Warren did not suffer from any part of the treatment and gained practically continuously. The changes in the boy are many and important. I want to speak first

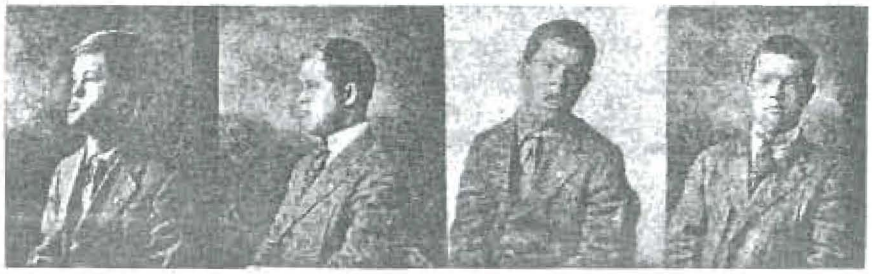


Fig. 49.

of the method of studying his voice. (A picture was shown of a record of the vibrations of the human voice in saying his name.) When I said "Warren Rang" I introduced into my voice consonants and vowels as shown in these vibrations in the upper record, and which have a definite relation to the bones of the head. When Warren said his name he made the lower record. When you compare his with mine, Warren, "wa," the "w" sound, the consonant, is entirely gone. It is almost a pure vowel, for the vowels have what we call synchronous waves. When he said his name, the sound of the "n," the characteristic nasal sound was almost lacking. "R-a-n-g." he had just one wave reproducing the "r" for "R-a-n-g." and he had mostly a vowel for "a-n-g." And that condition was largely due to the position of those bones forming the nares, which has largely been improved. Fig. 49 shows some of the changes in the boy's face, and if you will study them closely, you will see the change not only in the face but in the countenance, and the spark in his eye.

Fig. 50 shows us for comparison the profile and Fig. 51 the front view, before and after. The change I have suggested is not a physical one chiefly; it is a mental change, for Warren, who came to us six months ago, playing with little children's toys, so to speak, and choosing for his playmates those of four or five or six years of age, very quickly changed and chose those of greater age. At that time he did not care what boys or girls or women were in the room when he was undressing. Within eight

weeks his mother said he wouldn't allow his sister to be in the room, and in a very short time he asked even his own mother to leave the room when undressing, and in twelve weeks that boy's reproductive organs changed almost the complete cycle that marks the period and that usually occurs

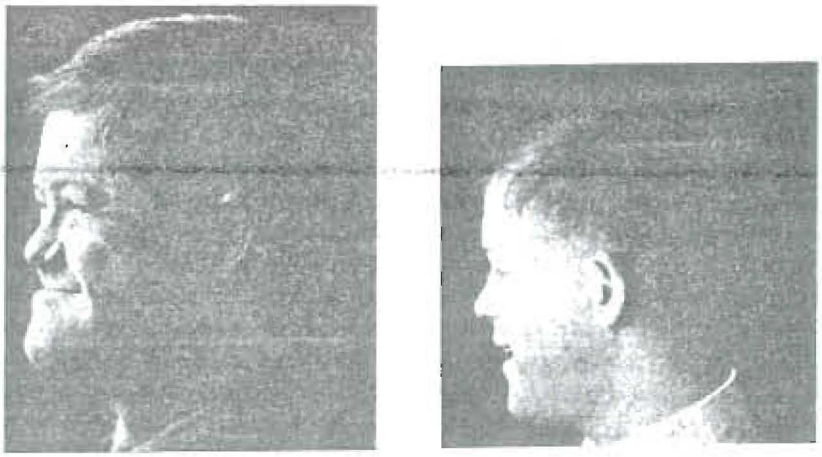


Fig. 50

when we speak of adolescence. Instead of having for playmates those of five or six years of age, if you please, he wanted my lady assistant to go with him to Euclid Beach and have a dance with him, and this within six



Fig. 51

months. (Laughter and applause.) Just a short time ago he wanted to know if he could borrow my automobile to take his mother for a ride. He wants to go to school, and almost every day as Warren would come to the office he would use new words, and I have never seen anything more interesting than to see that young life develop. We have all had a great joy in watching each day and week that he was taking in new situations, and was using new words and new phrases: for Warren, almost every time

he would come, would have some new words, and some of them very large, too, for his mental development, and he generally had them straight. He had a longing for new words and new ideas and new ideals, and it was a rapid growth. We saw him pass through the stages of hiding behind the door to scare us, of using pins and making witty remarks, some of which were very bright for him.

Now, the suggestion is that possibly we have here, not only an influence on the hypophysis by the forced movement and development of those maxillary bones, but vice versa, that the locking in of those upper teeth between the lowers, made pressure upward on the vomer and thence on the sphenoid bone and thereby making an abnormal pressure directly upon the hypophysis. And there isn't any question in the speaker's mind but that this boy's condition is partly one of hypophysis origin. He started immediately to grow a mustache, the hair starting to grow immediately as it does at puberty. He stopped asking a half a dozen or a dozen times while in the chair for something to eat. He largely stopped asking for a drink; he showed a remarkable change in his brightness, and immediately he started to grow generally and increase in stature. Now, there is not only an increase in the boy's entire stature, and a general development, but we have widened his face across the cheeks about one-half of an inch in a few months. The lesson is very clear to me that we as a dental profession have a responsibility that is very much greater than we have thought to these unfortunates who are placed in our state institutions and who can say that our responsibility to that boy is not even greater than it is to that rich man's child who need not be self-supporting. And I say that we as a dental profession have not only an opportunity but a great responsibility to go out and search, and, if possible, produce some great relief for this class of people. Our researches must, and will, include these benighted souls as soon as money can be found to make it possible.

Before thanking you for your very splendid attention, I want to say, regarding this clinical recording instrument, what I forgot to say at the time, that it is my desire, if there is any merit in it, that it shall be given to humanity and the medical profession as a contribution from the dental profession. I thank you. (Great applause).

DISCUSSION.

DR. E. C. KIRK, Philadelphia: I was told that I was to speak on the subject of the President's address, and that I should have sent to me before the address was made a transcript of his remarks, so that I might have some intimation of what it was all about. I failed to receive the transcript, and until I sat in this hall this evening I hadn't the slightest intimation of what we were to hear. I think you will sympathize with me when I tell you that I feel as though I had been called upon to discuss perhaps the latest edition of the Encyclopedia Britannica. I must ask, however, to be excused from discussing the interesting report which the President has made upon his investigation of the silicate cements, and also I want to leave for some one else to discuss the question of his studies of the conditions which govern the contraction of cast gold inlays, and that brings me down to the machine. It is

like discussing an eclipse or the aurora borealis or some natural phenomenon of that sort when we come to refer to this machine. I had hoped that this inventive genius would tell us that it would also record the gradual reduction of one's bank account, or perhaps have an attachment for paying the tailor. It really seems to do almost everything else. It certainly is a wonderful exhibit, and seriously, when we come to think of it—as we shall come to think of it much more after a while—what a boon it will be to the sufferers in hospitals, not only because of the precision with which it records the data with reference to the progress of diseases, so important for keeping the man at the helm in touch with his work, but how much it must add, just by reason of its precision and accuracy, to the saving of human life. Therefore, we can congratulate ourselves that out of the ranks of our profession has come this gift to humanity, through the medical profession from the dental.

I cannot say anything of Dr. Price himself. It isn't necessary. There are times like this when the thing itself is sufficiently impressive, so that it needs no words to express our appreciation of it.

And now I want to get down to a question that interests me in connection with some studies and some work that I have been doing for a number of years, and with some greater intensity recently; and that is the light that Dr. Price has shed upon this question of the enamel hypoplasias. But I want to say only a few words about it, because it is an intricate problem, and after all, anything that I shall say will be merely suggestive of the great possibilities of the subject. But you will see that running all through Dr. Price's exhibit the common factor is the absence of the normal nutritional supply of the child; that is to say, the mother's milk, the normal infant food supply, and the substitution of some other thing as infant food. Now, as I interpreted Dr. Price's explanation of the exhibit, he laid particular stress upon the difference in the kinds of infant foods that had been supplied to these children after they had been deprived of their normal nutritional supply. I can't say that the difference in kind of artificial food is not an important factor, but it seems to me that there is another factor which is of primary importance in this consideration, and that is just exactly the same thing that he has dwelt upon in connection with the surgical work that he has been doing relating to the development of the hypophysis cerebri. It has been pretty definitely shown by a number of observers that the secretions of certain of the ductless glands, particularly of the parathyroid, that the secretion or hormone of that body is an active principle, which has something very definite to do with the process of calcification; that where the parathyroid is destroyed or diseased, we may feed phosphatic food to an animal and it is not assimilated, and the quantity of phosphate that is taken into the stomach under these circumstances is rapidly eliminated in equivalent amount. We may present the food, but the patient cannot assimilate this phosphatic food element when there is a disease of the parathyroid. That is the trend of thought with reference to the function of that particular ductless gland. It is also pretty clear that in the milk of the nursing mother certain of these important stimulative properties of the ductless gland pass, among others the hormone of the parathyroid and though the child may receive phosphatic nutrient material in some other form it is the lack of that stimulus produced by the active principle of the parathyroid normal to the mother's milk which prevents the child from assimilating the phosphatic elements of artificial foods. So, therefore, there are two aspects of the question: the one to which Dr. Price has alluded, that of the difference in the nutritive value of the kinds of food, which makes it impossible for the nutritional mechanism of the child to secure sufficient phosphates from a particular kind of artificial food, and then there is the other, which we might call the negative aspect of the question, the lack of that stimulative property of the parathyroid, or of the thyroid gland itself, in the food which enables the child during this early developmental stage to assimilate phosphatic nourishment. Whatever may be the explanation, whether the one or the other, or both, it is particularly interesting to see what Dr. Price has brought out here, the synchronismal relation between these

dentinal and enamel hypoplasias and the question of artificial feeding. I do not dare to permit myself to speak about the immorality, as I view it, of the woman who deliberately, from her own selfishness, handicaps her offspring with such conditions as that or who attempts to justify herself in withholding from her offspring the nutrition that God Almighty meant that it should have in order to give it its normal physical send-off in life.

With reference to the closing portion of the President's exhibit I haven't the slightest doubt in my mind that he is absolutely right, not only that it is a professional duty for us to take these apparently hopeless cases on the broad ground of humanity and do something for their relief; nor have I any doubt as to the explanation which he has given as to the reasons why that particular mode of treatment has produced that particular kind of result. So far as I am able to understand the subject, his conclusions appear to be, and I believe them to be, in perfect conformity with the best that is known upon that subject in a collateral way of the activities of the ductless glands and their inter-relationship with reference to the development and growth of the body and also in regard to their controlling powers as to nutrition. It is a new subject, one which is now exciting much interest the world over, and one which has not only produced important results already, but seems destined to produce very much more important results in the future. This subject is particularly interesting to me because I have just come, as Dr. Price has said, from Toronto, where I presented a study on the relationship which disturbances of the posterior lobe of the pituitary body bear to dental caries. I cannot go into that, but I think the connection is perfectly clear. I believe that we shall find in that relationship the key to a solution of the vexed question of why it is that we have susceptibility to caries, and why it is particularly associated with youth, adolescence and childhood, and why also that it is especially associated with pregnancy. I haven't time to go into that now, but will merely tell you that that is the subject of my address and that it will be published, and it is an interesting coincidence that this subject presented by the president has so definitely developed as having a particular dental interest and relationship. Dr. Price didn't say a word about scientific research in dentistry, as I had expected he would, but if he will bear with me one minute, I would like to say a word about that. I ask you to consider what you have seen here, and then I will offer it on his behalf as a demonstration of the truth of the contention that I have been making to the dental profession for the past quarter of a century, namely, that the most practical thing in the world is the most scientific. (Applause).

DR. VICTOR C. VAUGHAN, Ann Arbor, Mich.: I have been simply overwhelmed, well nigh rendered speechless, from what I have heard here tonight. I don't know when I have been so gratified, when I have learned so much, as I have tonight. Nor have I been so enthused in a long time. I want to add a word to what Dr. Kirk has said about the value of scientific research. Medicine, including dentistry, is the application of what we get by scientific research for the prevention and cure of disease, and neither medicine nor dentistry—because they are one—can feed upon anything else save scientific research. Therefore it is fundamental to our professions that we should encourage scientific research.

I am glad that Dr. Price went to Grand Forks and got typhoid fever. (Laughter). This is a result of it. It is too bad that more people can't have typhoid fever, or something else, to stir up their intellects. I have thought how valuable such a machine as that would have been a few years ago in our own hospital. We had a serious offense—an interne was accused of kissing a nurse who was on watch in the ward, and the matter was brought before the medical faculty, and some of my colleagues said: "We will expel that interne for kissing a nurse." I said, "No." I walked some miles once to kiss a woman; (laughter) and I don't know that I am too old to do it tonight. (Laughter). I said, "I am willing to expel the young man for taking the nurse off the ward and distracting her attention from the patients,

but for kissing her I am not willing to punish him at all." (Laughter). Now, if this machine had been in use, we would have had no trouble of that kind. (Laughter). We cannot estimate the value of such a discovery as this. I think it is one of the greatest things that has been made known to us; and all through, in every part of Dr. Price's work, I was deeply interested. I dare say that the time will come when we will be taking these newspaper boys and ragamuffins and so-called degenerates and making Daniel Websters out of all of them.

Now, seriously, the medical and dental professions must, if it is ever done, regenerate the world. Descartes said 200 years ago that if man was ever lifted up to a higher degree of intelligence and the superman was ever to be brought into existence, it must be through medicine; and that, of course, includes dentistry. There should be no condition in anybody, poor or rich, which skill cannot relieve—no such condition should be allowed to go unrelieved. (Applause). A government which does not use every effort to elevate to the very highest intellectual standing its citizens is a government that is not doing its duty.

When I was a child I used to read Sunday School books. I suppose you younger men don't read Sunday School books. Now, in most of the Sunday School books there were two boys; one was good and a numskull; the other was wicked and knew something. (Laughter). And there was always a contrast between the good boy, who didn't know much, and the villain, who knew it all. Now, I am glad to say that there is a marked change in this respect, and the people of this country are beginning to realize, the people of the whole civilized world are beginning to realize, that man has his physical, his mental, and his moral being. First of all, he is an animal; and he can't be mentally developed unless he is a good animal, a sound animal; and there is no moral development unless there is mentality back of it. Talk about conscience being a guide! Were not the thumb screws of the Inquisition turned on in the belief that they were serving God? It is intelligence that we want, and we want the medical and dental professions to move ahead and point out the way by means of which the superman—because he is coming—can be brought into existence; and there is only one way in which it can be done, and it is just by this kind of studies that Dr. Price has explained to you tonight. It has amply repaid me, doubly repaid me, for coming here tonight, and I am full of enthusiasm; and if this is the kind of work that the dental profession of this country is going to do, why for heaven's sake let them have every opportunity, all the money, all the material, everything they want. The nation can make no better investment than this. I thank you. (Great applause).

DR. VARNEY E. BARNES, Cleveland: We have listened to a very interesting talk by Dr. Price and most of his presentations have appeared to be very convincing. I am very glad to have been here to see and hear them. However convincing these observations may seem to be there are some which should not be accepted as facts or go without discussion and further consideration. In making this comment I do not wish to minimize the doctor's real work in any manner whatsoever.

First, I want to call attention to the fact that in the table of infant foods Dr. Price has classified Mellen's food along with the others. This is an error because Mellen's food is a modifier of cow's milk and is to be added to cow's milk so as to make it imitate the desirable quality of mother's milk. The mixture with and modification of cow's milk produces a quality which is varied by the amounts of milk and cream to be added. Therefore this food seems to be capable of producing with cow's milk a close approximation of mother's milk and should not be classed as it has been in this instance.

The hypoplasia of enamel, as shown by Dr. Price, seems to occur at the time the artificial feeding was resorted to and it probably does to some extent. Many times previous to this the question has arisen in my mind as to whether or not this hypoplasia of enamel and the under-development of the maxillary bones may be due to a pre-natal deficient nourishment and to a post-natal deficiency in the mother's

milk prior to the artificial feeding, and I have concluded that it may be and most probably is due to this prior defect. Defective development and deficiency in mother's milk precede the necessity for artificial feeding—therefore we may not conclude that the artificial feeding is wholly to blame. We must note, however, that the infant under artificial feeding, no matter how good, after a setback with mother's milk would undoubtedly suffer from malnutrition and would be more likely to show the hypoplasia of enamel and of other structures as well. I have found in observing deformities of the maxilla and mandible that almost invariably (not always) the worst types have a history of artificial feeding and the necessity for it which is significant. We must consider the necessity for the artificial feeding before we attribute the defect in development to the infant food given—but the artificial food later becomes a great factor.

Second, I congratulate Dr. Price upon the results obtained so far in the last case of the boy with the deficient maxillary development. I can well appreciate this case for I have been operating on similar cases with good results for several years but I have never had the fortune to obtain a case like this in which the relief of pressure resulted in so great a mental gain. In these deformity cases the mental and physical ages do not agree. The greater possibility of improvement in such patients seems to be in those cases which may be designated as a maxillary deficiency as this one was. (I have been classifying two of the great classes of deformities as maxillary deficiency and mandibular deficiency as indicated by the greater defect.)

In separating the maxillary bones some ten or eleven years ago, I used a jack-screw across the mouth in a manner similar to that of Dr. Price's and the same treatment has been used by others for many years. This separating of the bones has been labeled "opening the suture," and many men have claimed that it could not be done and have based their conclusion upon "the consensus of opinion that it could not be done." Consensus of opinion is usually wrong in such observations. Dr. Price's observation of passing a probe between the maxillary bones is quite pleasing to me for I have been firm in the stand that the bones could be separated and that it was a desirable operation. I have repeatedly moved the separated bones with my fingers in those cases in which I have obtained a rapid opening of the suture.

In corroboration of Dr. Price's conclusions in this case I wish to say that in every instance, in every case of maxillary deficiency in which I have spread the bones laterally and rapidly opened the space between the centrals, the child has shown a marked mental and physical improvement. I treat all lateral expansions of the maxilla in this manner. Some of these cases have shown improvement because of a better tongue position and thus better breathing. Others have improved so suddenly that I had decided that the pituitary body might have been affected or relieved. I had even feared possible detrimental influence upon the pituitary body but not a single case has resulted in even the slightest evil effect. I had feared the possible evil result of a redeposition or overdeposition of bone, where it had separated, with a possible after-pressure but since there has been no bad result I have concluded that the method of treatment was beneficial. Whether or not these quick results are from a relief of the pituitary body, as claimed by Dr. Price, I cannot feel *certain*. In spite of much study we *know* comparatively little about the pituitary body. These cases should add much to our knowledge and it will be interesting to have a report from Dr. Price on this one after several years. I have found that some cases improve and keep on, others seem to go back again to some extent.

Now as to the effect upon the mentality. I have had and expect to obtain a good effect by this treatment in those cases in which the brain structure is good, and I expect a lesser effect upon the poor brain structures. Dr. Price's case evidently had a superior brain quality.

I might mention in particular two of my cases of poor mentality which improved markedly after suture opening or after relief of internal pressures.