

*Tracheotomy.*—This operation is an unthankful one. Out of eight cases during this year, I have lost seven; one of them died upon the table. It was a child only eight years old, the only daughter, a handsome bright child. All these cases I saw in the last stages of diphtheria or membranous croup, being called merely to perform the operation as a *dernier ressort*. The remaining cases all lived from two to twenty-four hours. They have occupied my mind and I have asked myself the question: What can be the cause of all these fatal terminations? consoling myself at the same time that others have had no better luck. In my seven cases chloroform was administered and the operation done at night by gas or kerosene light. All care was taken by myself and the necessary attention bestowed at the time and in the after treatment by the watchfulness of the attending family physicians. Now whether the chloroform, or possibly the mixture of the gas or kerosene with the chloroform may have been a factor in these cases I can not determine; but it occupies my mind at present for solution. The eighth case, a child four years old, suffered with membranous croup, the dyspnoea was very great, the patient was almost cyanosed. I operated without chloroform and quickly, on a bright day. This child recovered after careful treatment and attention by the family physician. About twelve years ago, during a season, I performed ten tracheotomies with five recoveries. It has not and may never again repeat itself. Tracheotomy for the removal of foreign bodies hardly ever terminates fatally.

*Diseases and Injuries of the Spine*, are very interesting studies, and under that head I will only say a few words about what is known as Pott's disease. The principles of the treatment of the trouble, though important, is very well understood, but of the pathology of this affection I think we can still learn a good deal by more close investigation. The question is what is the general cause; this seems even at the present day not quite settled; the opinions are various and a few cannot give up the old inherited theory of scrofulous diathesis. My observation, studies and investigation have taught me that in by far the majority of cases the cause of caries of the spine has been produced by mechanical injury. So with diseases of the joints such as abscesses, etc. The tubercular origin of such has not been and can not be satisfactorily proven; it is only a convenient theory.

Mr. President, there are other interesting topics such as congenital tumors, hernia, spina bifida, etc., but I have already taken my allotted time. One could write a good sized monograph upon every single affection. The points which I have touched upon in this paper were brought forward for the purpose of eliciting discussion upon this interesting field of surgical diseases of children

and thereby obtain the views and opinions of others in order that we might listen to the personal observations of the many distinguished gentlemen here present. I should like to have said a few words about laparotomy in children, but will reserve it for another occasion. I thank you for your attention.

### STATISTICS OF CONSTITUTIONAL AND DEVELOPMENTAL IRREGULARITIES OF THE JAWS AND TEETH OF NORMAL, IDIOTIC, DEAF AND DUMB, BLIND, AND INSANE PERSONS.

*Read in the Section of Oral and Dental Surgery, at the Fortieth Annual Meeting of the American Medical Association, June, 1889.*

BY EUGENE S. TALBOT, M.D., D.D.S.,

PROFESSOR OF DENTAL SURGERY IN THE WOMAN'S MEDICAL COLLEGE; LECTURER ON DENTAL PATHOLOGY AND SURGERY IN RUSH MEDICAL COLLEGE, CHICAGO.

In some papers read before the Odontological Society of Great Britain from 1864 to 1872, the general opinion was expressed that certain marked forms of irregularities of the jaws and teeth prevailed largely among the feeble-minded, and that when found in children they constituted a marked symptom of a low order of mental development. In May, 1864, Mr. Cartright, in a paper entitled "Reflections on the Cause and Treatment of Some Forms of Irregularities," said that irregularity of the teeth "is the result of high and selective breeding." This opinion I have already discussed in a paper read before the Indiana State Dental Society on June 26, 1888, on "Arrest of Development of the Maxillary Bones due to Race-crossing, Climate, and Soil," which was published in *The Dental Cosmos*.

In June, 1864, Mr. Thomas Ballard read a paper before the Odontological Society on "The Constitutional Ill-effects of Fruitless Sucking, and the Diagnostic Value of Deformed Jaws in Relation thereto," in which he claimed that thousands of children die annually of diseases primarily due to fruitless sucking; "but many of the sufferers escape death, and they constitute a class of defective individuals with which all classes of society abound. The worst form is the idiot, and in this class there are many degrees." Again he says: "I hold that the deformities to which I refer," but which he does not mention specifically, "are produced solely by the retained habits of sucking; and it is the children who have been exposed to fruitless sucking and consequent persistent diarrhoea, with its attendant evils, when infants, who acquire the retained habits of sucking, and thus get their jaws deformed. And as in idiots are seen the worst forms of defective growth, so also do they exhibit the most aggravated forms of deformed jaws and teeth, the habits of sucking being

retained by them to an advanced age. . . . So also are the deformed jaws and teeth commonly to be observed among the ill-grown, phthisical, and the weak and delicate members of society. The normal jaw, with well-set and perfect incisor teeth, is the principal characteristic feature of an individual possessing a sound constitution." I shall show subsequently in this paper that it is not true that idiots present the most aggravated forms of deformed jaws and teeth.

In his work on "Deformities of the Mouth" Mr. Oakley Coles attributes intermaxillary prognathism to a force operating on the intermaxillary bone, such force originating in the body of the sphenoid, and being transmitted by the intervening nasal septum. By *force* he means a direction of growth in a given line, of such energy as to overcome the resistance offered to it by surrounding structures. In regard to the sphenoid bone he says: "It may be urged that too much importance is attached to the influence of the sphenoid, but it must be borne in mind that this bone continues to grow up to about 25 years of age. This will in part explain the fact of deformities of the upper jaw appearing after the eruption and shedding of the temporary teeth, and becoming intensified towards adult life." Arguing back from the development of cases of double hare-lip to premaxillary prognathism, he thinks that we can come to no other conclusion "than that the duration and extent of the force operating upon the intermaxillary bone determines the nature and extent of the deformity that will be produced." He sees the natural objection to this view, that as the prognathism is not pronounced in early life, and as the union of the intermaxillary bones with the true maxillary bones is complete at this time, it is impossible that the intermaxillary bone can be the subject of any subsequent change. But, having shown that "intermaxillary prognathism is but a preliminary step in the deterioration of the form that will produce in a subsequent generation (subjected to like conditions of propagation) double hare-lip," he assumes that the general cranial development will in the two cases bear some relation to each other; and as Hutchinson has shown that in cleft palate cases ossification of the sutures is delayed to a period far beyond the usual date, so in cases of intermaxillary prognathism the sutures would not be so much ossified as to oppose any sufficient resistance to the exercise of the force originating in the sphenoid. He then goes on to say that many cases of prognathism are associated with such central lesions as will manifest themselves in the form of idiocy or imbecility, and distinctly asserts that such a deformity as prognathism occurring amongst the highly civilized is a distinct mark of deterioration of stock. "After carefully examining the works of various writers on the subject of microcephalic idiocy," he says,

"there seems sufficient evidence to justify the belief that premature ossification of the sutures is the rule in the majority of these cases; and we may, therefore, assume, if we cannot absolutely conclude, that this influence operates powerfully in the production of the dental deformity known as the lambdoid jaw;" a view held by Virchow, but combated by Ireland and Langdon Down.

Dr. Louis Ottofy, in his paper on "The Incipency of Dental Caries," read before the joint meeting of the American and Southern Dental Associations at Louisville, on August 30, 1888, reported an examination of the mouths of 623 children—317 males and 306 females. These children were pupils in the public schools at Grand Forks, Dak., Lebanon, Ill., and Chicago. The following table shows the percentage of irregularities:

Age.	Irregular.	Regular.
	per cent.	per cent.
5	9	91
6	27.5	72.5
7	43	57
8	14	86
9	31.5	68.5
10	32.5	67.5
11	25	75
12	20	80
13	35	65
14	28	72
15		

It will be seen that the largest percentage of irregularities is at the age of 8 years. The cuspid teeth are appearing at this time, and at least one-half of the irregularities are due to local causes. At the age of 13 but 20 per cent. of the cases showed deformities; nature and a judicious use of the forceps had corrected many of them. At the age of 15, 28 per cent. of the teeth were irregular. I venture the opinion that if these examinations could have been extended to the age of 20 years, the percentage of irregularities would have diminished. The development of the jaws at this age would allow nature to reduce many of these abnormal conditions.

The following table shows examinations of mouths of 1000 children over 12 years of age, made by myself:

TOTAL DEFORMITIES IN THE JAWS OF HEALTHY INDIVIDUALS OVER 12 YEARS OF AGE.

No.	Sex.	Normal.	Large Jaw.	Protrusion lower jaw.	Protrusion upper jaw.	High Arch.	V-shaped Arch.	Partial V-shaped Arch.	Thumb Sucking.	Saddle-Shaped Arch.	Small Teeth.
396	M.	313	11	3	5	26	5	13		12	13
604	F.	467	8	4	2	30	6	43		21	17
1000	Total	780	19	7	7	56	11	61		33	30
	Per cent.	78	1.9	.7	.7	5.6	1.1	6.1		3.3	3.0

The difference between Dr. Ottofy's percentages and those shown in the above table is accounted for by the fact that in his table both local and constitutional causes are included, while in mine the many deformities due to local causes are excluded.

Nearly all of these cases were residents of Chicago, and had been attended by the dentist regularly. These irregularities, therefore, might be classed as constitutional or developmental, as they could not be prevented by the dentist by the use of the forceps. We naturally suppose that the majority of the children examined by Dr. Ottofy, living in the country as they did, had received but little attention from the dentist—which would account for more cases being irregular than among those examined by me. It is possible also that some of those I examined had had slight irregularities corrected while they were young, thus preventing serious complications when maturity was reached. I should expect to find quite a difference in the percentage of irregularities in different parts of the country. When people are confined indoors, and do brain work chiefly, as those living in cities, they are likely to have more irregularities than country people. So also among those living in old parts of the country, as the New Englanders, rather than in residents of a newer part of the country.

*The Jaws of Idiots.*—Dr. W. W. Ireland has defined idiocy as "Mental deficiency or extreme stupidity depending upon malnutrition or disease of the nerve centres occurring before birth or before the evolution of the mental faculties in childhood." A definition that seems more inclusive, and that more clearly describes the tissues of the body, is the one given by Dr. Shuttleworth: "A vice of the entire organism; an affection not only of the nervous system but of the functions generally of organic life." Not a tissue of the body is exempt; the phenomena that check development of the brain tissue will also interfere with proper development of the other tissues of the body.

No part of the body has received the impress of disease so markedly as the osseous system, and yet pathologists have given this part of the idiotic system but little attention. The osseous system seems to have been constructed regardless of symmetry or uniformity. While in the normal individual the lateral halves are never uniform, in the feeble-minded the greatest asymmetry prevails. This want of harmony is more apparent in the maxillary bones because of their peculiar formation and environment. The close proximity of the jaws and their articulations permits of irregularities being readily observed. At the beginning of my examination I observed that other deformities than the V- and saddle-shaped existed, all of which must be considered. I found both excessive and arrested development of the maxillary bones, arrest of the one and excessive development of the other, protrusion of the upper or lower jaw, high and low vault, partial V and partial saddle-shaped arches, semi-V and semi-saddle-shaped arches, semi-V and semi-saddle-shaped on the same side, and small teeth.

Of late years some American investigators had made examinations among the inmates of our institutions for idiots, and reported that they found about the same proportion of irregularities as may be seen in ordinary practice. The varying opinions among scientific men on either side of the Atlantic led me to investigate the subject carefully. The examinations were made by myself and able dentists in the following named institutions:

Asylum for Idiots of the State of New York, at Syracuse; Massachusetts School for Feeble-minded, at South Boston; Illinois Asylum for Feeble-minded Children, at Lincoln; Asylum for Idiots, Randall's Island, N. Y.; Minnesota Training School for Idiots and Imbeciles, Faribault; Kansas State Asylum for Idiots and Imbeciles, South Winfield; Cook County Insane Asylum, Dunning, Ill.; Pennsylvania Institute for Feeble-minded Children, at Elwyn.<sup>1</sup>

The following tables show the total number of irregularities in each grade and sex:

TOTAL DEFORMITIES IN THE JAWS IN ALL GRADES.

HIGH GRADE.											
No.	Sex.	Normal.	Large jaw.	Protrusion lower jaw.	Protrusion upper jaw.	High Arch.	V-Shaped Arch.	Partial V-shaped Arch.	Thumb Sucking.	Saddle-Shaped Arch.	Small Teeth.
334 228	M. F.	190 132	33 14	10 14	36 17	84 57	16 15	44 12	2 5	51 23	16 14
562 Per cent.	Total	322 57.2	47 8.3	24 4.2	53 9.4	141 25	31 5.5	56 9.9	7 1.2	74 13.1	30 5.3

MIDDLE GRADE.

No.	Sex.	Normal.	Large jaw.	Protrusion lower jaw.	Protrusion upper jaw.	High Arch.	V-Shaped Arch.	Partial V-shaped Arch.	Thumb Sucking.	Saddle-Shaped Arch.	Small Teeth.
434 316	M. F.	261 195	34 17	19 9	22 18	41 26	25 16	45 46	1 5	33 24	11 12
750 Per cent.	Total	456 60.8	51 6.8	28 3.7	40 5.3	67 8.9	41 5.4	91 10.8	6 8	57 7.6	23 3

LOW GRADE.

No.	Sex.	Normal.	Large jaw.	Protrusion lower jaw.	Protrusion upper jaw.	High Arch.	V-Shaped Arch.	Partial V-shaped Arch.	Thumb Sucking.	Saddle-Shaped Arch.	Small Teeth.
271 394	M. F.	97 220	37 27	23 17	32 34	55 56	33 24	39 50	7 11	37 39	9 9
665 Per cent.	Total	317 47.6	64 9.6	40 6	66 9.9	111 16.6	57 8.5	89 13.3	18 2.7	76 11.4	18 2.7

TOTAL DEFORMITIES IN THE JAWS.

1977 Per cent.	1095 55.3	152 7.6	92 4.6	159 7.9	318 16	129 6.5	236 11.9	31 1.5	207 10.4	71 3.5
-------------------	--------------	------------	-----------	------------	-----------	------------	-------------	-----------	-------------	-----------

The above tables show that almost one-half of the whole number examined had irregularities of the jaws and teeth. The examined were children over 9 years of age. Under that age irregularities might be considered as of local origin, while constitutional and developmental irregularities do not appear until the eruption of the incisors and first permanent molars. As would be expected, the largest percentage of irregularities is found in the low-grade class; and it is seen that the normal class in the high and middle grades vary only about 12 per cent., the middle grade showing the largest percentage of normal jaws

<sup>1</sup> Special reports may be found in the Transactions of the International Medical Congress, 1887, and in the Annual, 1888.

and teeth, the high grade the next, and the low grade the fewest number of normal cases.

The mental capacity of the idiot can indicate in a general way only the abnormal condition of the osseous as well as muscular, venous and arterial systems of the individual; thus, a high-grade idiot might possess an atrophied condition of any of the tissues of the body, while a low-grade idiot might develop any or all of the tissues to an excessive degree, this depending of course upon the inclination and condition of the blood supply. Thus the arterial and nervous systems might be atrophied on one side, lessening the supply of blood to that side or limb, producing atrophy of the muscular and osseous tissues on that side. The opposite effect might be produced on the other side; a large amount of blood would be carried, naturally, to the extremities of the other side, causing hypertrophy of tissue.

If the tissues of the body are so prone to take on abnormal conditions, certainly the jaws must suffer more or less. I have observed three conditions that account for nearly all the irregularities of the jaws and teeth: excessive development, arrest of development, and inharmonious development of the maxillary bones. These abnormalities are developed with the osseous system, and may be properly termed constitutional and developmental.

When excessive development occurs in one jaw and the other is normal, or arrested development ensues, then the teeth in the abnormally large jaw protrude.

If the cranium is large the superior maxilla is usually larger than normal. When the inferior maxilla is involved the rami are as likely to be enlarged as the body of the bone. Sometimes the rami and body develops uniformly. When there is excessive development of a part of all of the bone, protrusion of the lower jaw and teeth takes place. I have seen cases in which one-half of the superior and inferior maxilla, as well as one-half of the cranium was larger than the other.

In these irregularities of the jaws, however, irregularities of each set of teeth are seldom seen. While it is proper to speak of these conditions as irregularities, yet they are so only as one jaw is related to the other.

I have already shown, in a paper read before the Dental Section of the American Medical Association in 1888, that irregularities of the teeth, which I have termed constitutional, prevail to a greater extent among the idiotic, deaf and dumb, and blind than among an equal number of strong and well-developed persons; that not only is the brain matter deficient in the feeble-minded, but that many cases are seen that show that the osseous system is generally defective; and that when the bone tissue is arrested in development from malnutrition, the maxillary bones are affected.

It is frequently the case that when idiocy appears in a family, other members of the family are observed to be scrofulous, deaf, dumb, blind, or insane, showing that the conditions indicating neurotic tendencies have been transmitted through generations. In his work on "Insanity in Norway," Ludwig Dahl gives many instances in which the result of this tendency is deafness, dumbness, or insanity, as often as idiocy. He says: "Acquired insanity and idiocy frequently appear side by side in the same family stock. Deaf-dumbness occurs frequently." He has traced the genealogies of a number of families, and has brought to light a number of interesting facts. In his genealogy of No. 3, the Bjvinds family have nine insane or idiotic, four deaf and dumb, and one epileptic. Other families showed a similar proportion of mentally and physically deformed persons.

In his work on "Idiocy and Imbecility," p. 528, Dr. Ireland says: "Deafness frequently occurs in families where some of the other members are idiots." And again, on page 16: "The children of epileptics are frequently insane or idiotic or hysterical, and the descendants of an insane person are often epileptic, idiotic or insane. Deaf-dumbness, chorea, locomotor ataxia, hysteria, and other disorders of the nervous system now and then occur in the descendants apparently as the result of an inherent neurotic tendency in the family."

In the report of the Commissioner on Idiocy appointed by the Legislature of Connecticut,<sup>1</sup> it was found that out of seventy cases of idiocy there were ten cases of idiotic parents, six insane parents, six insane relatives, eight epileptic parents or relatives, eight blind and two melancholic.

Dr. Howe shows<sup>2</sup> that in seventeen families in Massachusetts, the heads of which were blood relations, there were born ninety-five children, of which forty-four were idiotic, twelve scrofulous and puny, one deaf and one a dwarf. Morel and the school of investigation which he founded point out that the defective classes, *i. e.*, the congenital deaf mute, blind, lunatic, idiotic, criminals and paupers, are buds on the same tree of human degeneracy. In dealing with the evidences of degeneracy they cite defective teeth as one of the signs in most instances. These signs are atavism or reversion to lower types of structure and junctions. Many more cases could be given showing that a relation exists between the deaf, dumb, blind and insane, but it is evident that the offspring of parents showing neurotic tendencies and symptoms are subject to these conditions. Medical men have commonly classified these lesions under the same head; and some

<sup>1</sup> See Report of Commissioners on Idiocy to the General Assembly of Connecticut, New Haven, 1856, p. 35.

<sup>2</sup> On the Causes of Idiocy, Edinburgh, 1858, p. 35.

specialists go so far as to classify the criminal and drunkard in this category.<sup>3</sup> I have recently read an article from a French journal in which a left-handed person was also included.

While specialists have generally concluded that most of these conditions are derived from a common neurotic ancestry, the only common feature is a very low grade of cerebral development. In my investigations concerning the osseous system in its relations to the irregularities of the jaws and teeth, I have observed a lesion common to all these conditions. With this object in view I have made examinations of the mouths of all these classes except the criminal, and these I hope to examine in the near future. I found great difficulty in enlisting sufficient interest on the part of superintendents of Blind Asylums to enable me to make proper examinations of the blind, their reason being that the sensitive nature of the parents would not permit of their exhibiting the mouth for examination. I have made a sufficient number of examinations, however, to make some estimate of the percentage of deformities of the jaws and teeth.

*Deaf and Dumb.*—The greatest interest has been shown by the superintendents of deaf and dumb institutions, thus enabling me to make very satisfactory examinations. In some of the institutions visited the blind are retained with the deaf and dumb; when such was the case the blind were classed with the deaf and dumb. Examinations were made in the following named institutions; either by myself or by able dentists living in the town or city where the institution was located:

Minnesota School for the Deaf, Faribault; Portland School for the Deaf, Portland, Me.; Oregon School for Deaf Mutes, Salem; Colorado Deaf and Mute Institution, Colorado Springs; New Jersey School for Deaf Mutes, Trenton; South Carolina Institution for the Education of the Deaf, Dumb, and Blind, Clear Springs, S. Ca.; Milwaukee Day School for the Deaf, Milwaukee, Wis.; Washington School for Defective Youth, Vancouver, Washington Terr.; Arkansas Deaf Mute Institution, Little Rock; Iowa Institute for Deaf and Dumb, Council Bluffs; Clark Institute for Deaf Mutes, Northampton, Mass.; Evansville Deaf Mute School, Evansville, Ind.; Institute for the Deaf, Dumb, and Blind, Berkeley, Cal.; Kansas Institute for the Deaf and Dumb, Olathe, Kans.; Institute for the Deaf and Dumb, Austin, Texas; Nebraska Institute for the Deaf and Dumb, Omaha; Alabama Institute for the Deaf and Blind, Talledega; Indiana Institute for the Deaf and Dumb, Indianapolis; Western Pennsylvania Institute for the Deaf and Dumb, Pittsburg; Northern N. Y. Institute for Deaf Mutes, Malone, N. Y.

<sup>3</sup>Lombroso has called attention to deformities of the jaws among the born criminals.

The following table shows the results of the examinations of the Deaf and Dumb:

TOTAL DEFORMITIES IN THE JAWS OF THE DEAF AND DUMB.

No.	Sex.	Normal.	Large jaw.	Protrusion lower jaw.	Protrusion upper jaw.	High Arch.	V-shaped Arch.	Partial V-shaped Arch.	Saddle-shaped Arch.	Small Teeth.	Cleft Palate.
1111	M.	538	197	41	116	241	91	115	108	51	
824	F.	363	108	51	89	177	78	77	95	62	
1935	Total	901	305	92	205	418	169	192	203	113	2
	Per cent.	46.5	15.6	4.7	10.5	21.7	8.7	9.9	10.4	5.8	

Examinations were made in the following named institutions for the blind: Institute for the Blind, New York City; Maryland School for the Blind, Baltimore; Maryland School for the Blind and Deaf and Dumb, Baltimore; Kentucky Institute for the Blind, Louisville.

The results of the examinations of the blind are shown in the following tables:

TOTAL DEFORMITIES IN THE JAWS OF THE BLIND.

No.	Sex.	Normal.	Large jaw.	Protrusion lower jaw.	Protrusion upper jaw.	High Arch.	V-shaped Arch.	Partial V-shaped Arch.	Saddle-shaped Arch.	Small Teeth.	Cleft Palate.
107	M.	53	3	9	10	20	4	3	6	7	
100	F.	52	2	5	5	18	3	3	5	3	1
207	Total	105	16	16	15	38	7	9	11	10	1
	Per cent.	50.7	7.7	7.7	7.2	18.3	3.3	4.3	5.3	4.8	

In the following table are shown the results of the examinations of the mouths of the insane.

TOTAL DEFORMITIES IN THE JAWS OF THE INSANE.

No.	Sex.	Normal.	Large jaw.	Protrusion lower jaw.	Protrusion upper jaw.	High Arch.	V-shaped Arch.	Partial V-shaped Arch.	Saddle-shaped Arch.	Small Teeth.
430	M.	394	10	4	2	18	12	29	3	5
270	F.	226	8	6	4	26	14	18	9	2
700	Total	620	18	10	6	44	26	47	12	7

Examinations of the mouths of 700 insane patients at the Cook County, Ill., Insane Asylum, and the Illinois State Insane Asylum, as shown in the table, revealed the fact that only about 12 per cent. were irregular, the irregularities consisting of protrusion of the upper and lower jaws, partial V, and very few saddle-shaped arches. The high arch was quite conspicuous among these people. Some of these irregularities were due to local causes. These irregularities were among cases of congenitally insane patients, or patients that had become insane early in life. These observations were not confined to the hereditary types.

With few exceptions insanity does not appear in the individual until the skeleton has attained its normal development. There were irregularities of the teeth produced by local causes. It is probable that a large percentage of constitutional

irregularities of the teeth could be found in the mouths of inmates of our private asylums, where there are more hereditary cases. It has been suggested by Dr. Coles that high vaults and cleft palates are associated. It is doubtful if this can be proven. Out of 1,977 idiots 318 had high vaults and but one case of cleft palate. Among 2,142 deaf, dumb, or blind persons, there were 255 high vaults, and only three cases of cleft palate. This small percentage would indicate that this lesion is not inherited nor developed with the osseous system, but is merely an accident, and local in its origin.

The high arch or vault, observed among idiots, and also observed, though perhaps not so frequently, among normal persons, cannot be considered a deformity or irregularity of the jaw, although where present it furthers the production of irregularities of the teeth. This peculiar formation of the roof of the mouth was seen closely allied with the V and saddle-shaped arches, and many that have given thought to this subject, especially Dr. Ballard, believed it a part of the deformity, and that it was produced by the pressure of the thumb or finger in the roof of the mouth. I have examined a number of children while sucking the thumb or finger, and have never found that they reached the roof of the mouth. If it were possible for the high arch in the anterior part of the mouth to be produced by pressure of the thumb or finger, how can we account for the high arch in the posterior part of the mouth when the position is such that the thumb or fore-finger cannot reach it without considerable exertion? Some of the arches are higher at the median line, others at either side of the median line, while still others are high, broad or flat, showing that they could not be produced by sucking a foreign substance.

I venture the opinion that the high arch is a natural development of contour in harmony with the other bones of the face. It is produced in connection with the eruption of the second teeth, and with the development of the facial bones, by the elevation of the vault on the one hand, and the elongation of the alveolar process on the other. This is seen generally in connection with long thin faces, and long thin jaws, necks and limbs. It is connected with the typical shape of the American face, and is not so often seen in foreigners.

Irregularities of the jaws and teeth, as the V- or saddle-shaped jaws, are not confined to the high vault; they are frequently seen in connection with the medium or low vault. The high vault, as has been mentioned, aids the production of irregularities. The alveolar processes are thin and long, affording feeble resistance to the pressure of the teeth, as they force their way into the arch. The thin alveolar process gives way and either the V- or saddle-shaped jaws are produced.

The percentage of small and large teeth is small. The teeth, unlike the other tissues of the body, develop from the periphery, their development beginning as early as the sixth week of intra-uterine life. Calcification sets in immediately, and the shape and size of the teeth are determined while the surrounding tissues are yet soft. The calcific material, which is first deposited on the outer surface, protects the inner part of the tooth-structure, and unless some constitutional disturbance like eruptive fevers, or an inherited diathesis, impair nutrition, the teeth will develop normally. Generally speaking, the teeth are of the same size to-day that they have been for ages. When teeth are usually large or small they may be accounted for as an inheritance.

I have described the condition of the jaws and teeth that are not intimately connected with the three general pathological and physiological abnormalities of the jaws already mentioned, viz., excessive development, arrest of development and inharmonious development of the bone tissue. The feeble-minded patient affords ample opportunity for the study of these abnormal conditions and of bone tissue. The text books describe these conditions but meagerly, and the profession generally speak of all enlargement of tissue as hypertrophy, and of all tissue not strictly up to normal as atrophied. The different causes of these conditions are not sought after, nor are they well understood.

When excessive development of the jaws exists, the circle of the jaw is larger than the arch of the teeth. The teeth are seldom irregular under these conditions. This inharmonious development prevents the proper articulation of jaws. Excessive and inharmonious development are seen less frequently than arrested development. This is due to lesions of the nerve centres, and constitutional diseases such as syphilis, scrofula, rickets, race crossing, climate and soil, and early extraction of the teeth. The result of arrested development of the jaw is the arch of the jaw is smaller than the arch of the teeth, and consequently the teeth are irregular. The principal types being the V and saddle and kindred shaped arches. The above statistics indicate that irregularities of the teeth follow neurotic lesions, as a natural result.

Any disturbance of the function of nutrition naturally affects the osseous system. Kingsley and others, including myself, have seen that some of the lower grade of idiots, deaf dumb or blind, possess well developed jaws and teeth. It is a fact admitted by all pathologists that under certain environments the tissues of the body develop abnormally. This occurs in the osseous system. This being the case large jaws and regular teeth are sometimes seen.

<sup>4</sup> See Dental Cosmos, 1888 and 1889.