Nutritional Aspects of the Orthodontic Problem*

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THAT the necessity for orthodontic care of children is evidence of developmental failure needs no proof. The factors which are responsible for this failure, however, are somewhat obscure and can be determined only through research. It seems that any light that may be thrown upon this problem by study of the experimental animal will be of value in the clinic.

EXPERIMENTAL

On controlled experimental diets we have been able to bring about developmental failure in cats. Although Cohen[1] suggests that some human dental deformities may be the result of allergy, we have shown that allergic manifestations and dental disturbances comparable to those seen in human beings result from changes in food preparation.

The normal cat allowed to remain at large subsists upon rodents, birds, reptiles, insects, fish and a small amount of vegetation. Ordinary house cats living a semi-wild life will maintain regular features generation after generation, while cats which are prevented from hunting, subjected to a life of ease and luxury, and fed on prepared foods show certain tendencies to maldevelopment.

In our experimental work we had two groups of cats. Their food consisted of meat, raw milk, and cod-liver oil. In the two groups the only difference in diet was that the meat for one group was cooked and that for the other was raw. The meat consisted of both muscle and viscera, and the cooked meat was prepared as if for human consumption. Comparisons of the two groups showed many differences in development.

We found that the animals which received raw meat, consisting of all parts of the carcass—viscera, muscle, and bone, showed consistent conditions of the facial bones and normal dentition. Even those animals, however, were not quite as near perfect in their development as animals that forage and obtain their own natural foods. We also found that the converse of this is true. Those kittens which received the same foods, with the exception that their meat was cooked instead of being fed in a raw state, developed all types of malformation of the face, jaws, and dentition.

Adult cats which foraged until they reached their maximum development and then were put on a diet of cooked meat showed little if any change of contour in the skull, except that the animal might lose its teeth as the result of extensive decalcification and pyorrhea. When the well developed cats were put on the cooked meat diet and allowed to become pregnant, their kittens showed configuration of the skull varying markedly from the normal; and no two showed identical configuration. The conditions pro-

* Presented before the Southern California Component of the Edward H. Angle Society of Orthodontia, November 13, 1939.

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duced were similar in some respects, in spite of an adequate food intake, to those of starvation.[2] Nevertheless, it is possible for one who is familiar with the heads of kittens to tell at birth whether or not the young animals will have well developed faces. The deformities due to deficiency, when once produced and maintained by a faulty diet, progress through the second and third generations.

We have noted that overgrown kittens do not necessarily mature properly. They are not the best for reproduction. Among the changes which we have noted in the deficient animals is a failure in the development of the jaw and the middle portion of the face. Some kittens with large brain cases actually have a smaller face than is normal. This is not unlike the condition found in some children, as mentioned by Shurly.[3] In our experimental work we have also frequently found among our adult animals that the total size of the skull is actually greater in some of the second generation deficient cats

Fig. 1.—Female kitten age 12 months, litter mate of kitten in Figure 2; fed table scraps until 10 months of age. Note imperfect alignment of teeth.

than it is in the well developed animals. This apparently is due to overgrowth of the brain case. These animals have a relatively poor forward projection of the face as a whole. At times there is a marked tendency for the configuration of the skull in both male and female to approach the shape of the normal animal of the opposite sex. Some of these kittens had impacted teeth as well as marked irregularities of dentition. Most of the deficient cats showed marked failure in the development of the upper lip, preventing it from covering the incisors properly. One kitten apparently had a mandibular protrusion. Actually, there was a failure in the growth of the maxillary portion of the face.

Absence of teeth, particularly of the incisors, is quite common in deficient kittens. The normal cat cuspids pass each other in a circular arc with a perfect alignment. In certain of the deficient cats this alignment was altered by a basal narrowing and a lateral spreading of the apices of the cuspids (Fig. 1), so that the lower incisors engaged the upper lip and were a detriment to the animal's occlusion. The marked retraction of the mandible with failure in calcification, giving a poor bony support for the teeth, was common. The

deficiency was shown in the size of the tooth, the shape of the mandible and maxilla, and the alignment of the dentition.

Kittens in which deficiency was established by an inadequate diet showed stigmata which persisted throughout life. If one were attempting to improve the stock, animals with dental anomalies would never be chosen to propagate a race of normal cats. However, if deficient kittens are allowed to live in the open and feed upon rats, mice, birds, gophers, and other foods which are natural to the cat, they will show a certain degree of correction in their deformities.

For a year we had an opportunity to observe two litter mates, one of which (Fig. 1) was fed on a relatively poor diet until approximately ten months of age; the other (Fig. 2), from the time it was about 4 to 6 weeks of age, was forced to forage for itself. The mother of these litter mates was a deficient animal fed a deficient diet. The former kitten showed marked dental deformity; the latter kitten showed the effects of its deficiency but

Fig. 2.—Female kitten age 12 months, forced to forage for self from the age of 4 to 6 weeks. Note regular alignment of teeth.

made material correction in alignment of the teeth and in general physiologic stability. The improvement in this case was probably largely due to the fact that the animal began to forage for itself before it completed the development of its permanent teeth. Regardless of the improvement, the teeth of the second cat were not of proper size—although the occlusion was good. If the proper stimuli are not present at the time when expansion should take place, the jaws fail to develop. The teeth become crowded and sometimes fail to erupt. This happened in the litter mate above mentioned which was kept on a deficient diet for a longer period of time. Neither animal obtained physiological stability, and both lost their lives at 14 months as a result of their pregnancies.

I cite these two instances as representing the difference in trends shown in many of our cats which are fed on adequate and inadequate diets. The fact that they were litter mates is important.

CLINICAL

Improvement of the facial configuration of deficient children can be brought about by altering the diet. The changes in configuration can be

either progressive or retrogressive. We have had the opportunity of noting broadening of the face and development of the middle face by applying the principles learned from our research work. We have had the sad experience of seeing children who were materially improved during a two or three year period show a definite retrogression in the splendid alignment attained because they suddenly decided that the details of their dietary program were too irksome for them to continue. It is our feeling that the osseous structures in those individuals who have suffered from malalignment were not as adequately endowed with fundamental strength as those who, from the beginning, show excellent development. Therefore, it is quite logical to assume that individuals of this type would revert with much greater ease.

In applying the principles gained from our experimental work to human beings we find that

1. all people are influenced by preceding generations.
2. judging from animals, people can be healthy only if the stock from which they spring is healthy and the food upon which they subsist is adequate.

Orthodontia is not a dental problem alone; it is also a medical problem. All forms of maldevelopment, whether in the dental arch or in other parts of the man, lie in the domain of preventive medicine. This makes it important for dentists and physicians to stress the fact that departures from normal in dentition are indices of something more than just dental abnormalities. They have a definite cause which should be sought and corrected.

It seems evident that the greatest factors in the development of the face of the individual must be those which will make for normal development in general. Since the individual is a product of heredity, both germ-plasm and chemical, the way in which he develops after birth depends upon both the nutrition of his inheritance and his nutrition. Therefore, nutrition becomes one of the most important factors in human life. Some changes in the physiology of the child can be ameliorated by adequate diet. Adequate diet is one of the most important factors in the preservation of the species. Good food is important for the infant, the adolescent, the adult, and especially for the expectant mother. At any age period injury can be done by an inadequate dietary. Inadequacy in infancy and childhood alters development; but in later life, it particularly determines the efficiency of organic function, reproductivity, and the general physiologic activity of the individual.

We do not know what the essential factors for development are. We do know that the factors for maturity of the individual are not necessarily the factors which produce large bodies. Well developed and properly matured biological specimens are not always large. The vitalizing factors such as hormones, enzymes, vitamins and the like, and possibly the physical-chemical state of the food consumed, all contribute their part to the development of the individual. These factors are just as important in making up the individual's physical status and personality as the proper balance in proteins, fats, carbohydrates, and minerals.

Judging from our experimental evidence, orthodontic problems are conditioned by the nutrition of the mother before and during pregnancy and the period of lactation, as well as by the diet used during the growth period of the child. Scientists first thought they had established fairly defi-

nitely that nutrition depended upon proteins, carbohydrates, fats, and minerals, only to realize later that there are other factors such as vitamins, hormones and enzymes which are just as essential to the building of the human body. They are also now awakening to the fact that we have been destroying important growth factors by our modern methods of milling, heating, and processing foods and, furthermore, that depleted soils and modern methods of agriculture and animal husbandry are interfering with their normal production. The effect of this is being seen in many forms of maldevelopment in children.

Parents are often proud of the fact that their children are larger than they themselves were at a similar age. It is now being recognized in both animal husbandry and the human race that size is not a necessary criterion of optimum development. Perfection depends upon proper maturity rather than on largeness of size. Our experimental work has been carried out on animals in which we have observed the development from one generation to the next, and we have learned that speed of growth is not the most significant biological index but that regularity of maturity, of structure, and psychic response are more important.

We cannot go back and change the ancestors of our children, but we can prescribe for the pregnant woman and nursing mother a diet which is adequate not only from the standpoint of proteins, fats, and carbohydrates, but one in which the essential vitamins, enzymes and hormones have not been destroyed by processing. In our experimental work we find that cats living on inadequate foods are frequently unable to nurse their kittens, and we find their counterpart in many human mothers of the present generation.

DISCUSSION

When orthodontic problems are recognized, as Price[4] has suggested, as lying within the field of preventive medicine (nutrition), we shall then be able to guarantee better teeth for the children and save them from maldevelopment of the face and jaws.

Practical application to orthodontic problems requires that children who show malformation of the facio-dental structures should demand a thorough physical examination by a physician who understands the normal human being and the normal anthropometric variations—one who is capable of looking upon the human being not by systems, but as a whole individual, and one who can aid the orthodontist by guiding the individual with his medical needs. Such cooperation should materially lessen the criticism that orthodontic procedures fail in so many individuals. We learn of too many cases in which the orthodontist has obtained an excellent degree of correction within a short period of time because a child has a soft mandible and maxilla, only to find that, when the bands or retainers are removed, the teeth drift back into a position that may be as bad or even worse than before correction. Deficiency of configuration of the facial structures is but a part of a general disturbance in development, and dentists and physicians should recognize it as a warning of the probability of other developmental disturbances.

The problem of the orthodontist calls for an educational program. The

problem is not of one generation; it is a problem of time. Nutritional damage caused by inadequate diet is very difficult to correct. Prevention is a far safer course for the human race.

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