



Studies on certain aspects of the aetiology
of malocclusion of the teeth and concomitant
jaw anomalies.

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A PROGRESS REPORT OF THESE STUDIES PUBLISHED IN 1933.

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INTRODUCTION.

The study of orthodontics can be traced almost as far back as the study of dentistry itself. But comparative success in its practical application to treatment of irregularities in positions of human teeth did not arrive until Angle definitely established it as a special branch of dental treatment.

It can be stated with safety that the whole trend of orthodontic study has been for many years rather in the direction of overcoming the mechanical and manipulative difficulties involved in actual treatment, than in pursuit of understanding the biological influences concerned in the production of tooth irregularities. It is true that Angle, Case, Kingsley and others have written much that is of inestimable value towards understanding these problems; but their work, while deservedly retaining our highest respect, cannot be accepted as revealing the fundamentals of orthodontic science.

In his now classic teachings, Angle showed, by orthodontically bringing the upper and lower teeth into regular alignment and into positions where their crowns were under the influence of 'normal' occlusal contact, that in some cases the positions of the teeth gr

continued to improve both aesthetically and functionally long after the completion of active orthodontic treatment. This subsequent improvement was accompanied by bone growth which produced greater aesthetic and functional harmony of the teeth with their supporting bones. This observation led to a wider acceptance of the hypothesis that "occlusion" was the main consideration in the aetiology of dentofacial anomalies. It was maintained that, if the teeth erupt into correct occlusal positions, or if abnormally placed teeth are brought into correct positions "occlusal forces" will tend to bring about harmonious development of the masticatory mechanism. On the other hand, perversion of these occlusal forces by environmental influences, may, according to this hypothesis, cause the teeth to take up irregular positions and mal-occlude. Malpositions, once established, are then considered to be maintained and sometimes accentuated by these perverted "forces of occlusion".

No doubt, in those cases where the inherited size and form of both tooth and bone are in harmony according to the accepted anatomical standards, the so-called "forces of occlusion" play their part in assisting in harmonious dentofacial development, whether the teeth have erupted into normal positions or whether they have been orthodontically placed in these positions.

However, the large number of cases in which the above-mentioned post-operative improvement did not take place were ignored; presumably because they did not support the hypothesis.

From the above it will be seen that, firstly, a comparatively high degree of skill in empirical orthodontic treatment has developed; and, secondly, the success of this empirical treatment has resulted in a working backwards from the effects of treatment by illogical deductions to the

establishment of a hypothesis of aetiology of dentofacial anomalies.

It is not only in the study of dentofacial anomalies that an aetiology has thus evolved. In the field of bacteriology there has been an analogous line of thought on the aetiology of infectious diseases. The somewhat successful application of knowledge of bacteriology to the treatment of disease resulted in a relative neglect of study of the inherent differences of the "host". In the present century, however, more attention is being paid to heredity in relation to susceptibility and resistance to bacterial infection.

It must be emphasised again that orthodontics has developed for many years as a rationale of treatment — a study of technical procedures — rather than as a pure science. Orthodontics, or the study of irregularities of the teeth and concomitant anomalies of the jaws and their treatment, must surely depend fundamentally on a clear conception of the biological influences concerned in the development and eruption of the teeth and of the development and structure of bone and other tissues which are the support of the teeth in the jaws. Perhaps more important still is a consideration of the manner, direction, and rate of growth of the teeth and adjacent bone.

In the general study of structures of the human body it was probably not until Broca and others of his time, that methods of study commenced to take the form of quantitative analyses rather than of the purely descriptive or qualitative means of approach. In this type of investigation were laid the foundations of the relatively modern science of biometrics.

For years only the major and more obvious of man's physical structures were measured and studied in the statistical manner. The present century has seen these methods ap

more and more in the study of the detailed structures of the human body. Outstanding examples of the application of biometrics to the study of the jaws and teeth are the comparatively recent works of Keith and Campion, Franke, T. D. Campbell, Middleton Shaw and C. Smyth.

The discovery of the work of Mendel at the beginning of this century and the recognition of its importance have re-awakened the whole study of heredity with the result that genetics is now established as an important science.

Evolution is dependent on variation — the ability to vary is a fundamental characteristic of all forms of protoplasmic life.

In the science of genetics, these biological variations are called mutations or alterations, and are known to take place in the genes of the nuclear chromosomes of the germ plasm; but the causes of these alterations are still not understood. Those biological alterations which are considered to be best adapted to their environment are recognised as the "normal" as they gradually become more numerous by supplanting their less adapted fellows. On the other hand disadvantageous hereditary alterations are placed in the category of anomalies. However, with an alteration of environment, previously advantageous alterations may become disadvantageous and vice versa. Therefore, from the broad evolutionary aspect, there does not appear to be that essential difference between the normal and anomalous as is implied by the universally accepted nomenclature.

It has been the custom to approach aetiological problems firstly by a study of "normal" conditions so that the knowledge, thus acquired, will contribute to a better understanding of anomalous conditions. No doubt this is correct procedure; however, there seems to be the danger among many workers forming preconceived views on the aetiology of the condition being dealt with, thereby considerably influencing the of the investigations.

Therefore, throughout the studies comprising this thesis which deals with the aetiology of dentofacial anomalies mainly from the hereditary aspect, an attempt has been made not to consider those conditions, which deviate from the accepted standard of the normal, as anomalous in the usually accepted sense of this term. Indeed an endeavour has been made to keep in mind, that from the standpoint of heredity, there is no line of distinction between the normal and the anomalous; that these arbitrary distinctions are applicable only when "environment" is the chief consideration.

Ever since publications have been devoted exclusively to the science of orthodontics, there has been, and still is, an almost continuous appearance of contributions dealing with the aetiology of dentofacial anomalies. In these contributions most of the explanations put forward to account for the production of the anomalies are purely hypothetical and are unsubstantiated by statistical or any other methodical investigations.

Environmental influences, usually of a local and "mechanical" nature, were, and still are, the agencies usually attributed to the production of the anomalies. The ingenuity of these hypotheses brings about their wide acceptance. However, before enthusiasm for a new "theory" has quite abated, it is supplanted by another, newer and even more plausible; its only virtue being that it has depredated its predecessor.

Again, when dentofacial anomalies are found in parents and their children, the probability that they are inherited is frequently dismissed by the explanation that the habit which has produced the anomaly in the parent, has been mimicked by the child.

No doubt, many dentofacial anomalies are produced by non-hereditary influences, either local and of a mechanical nature, or general metabolic disturbances. However, it cannot be claimed that the majority of the anomalies are produced in these ways until further investigations on a large scale show the extent to which the facial architecture may be affected by environmental influences. In addition to this, it does not seem logical to refute the possibility that the majority of dentofacial anomalies are inherited until exhaustive investigations of a genetical nature ^{have been} ~~are~~ carried out.

The knowledge of genetics has been advanced sufficiently for determinations to be made in most cases whether variations found in individuals are hereditarily transmitted: ^{determination} this is largely based on the numerical ratios in which the variations occur in successive generations.

Finally, the following statement by Professor J. C. Brash will not be unavailing if it but serves to indicate why the scope of the present inquiries is necessarily within narrow limits: "The subject is clearly of fundamental importance; one of the most urgent needs is to have data collected and analysed; and it is really remarkable that this, so far as I am aware, has not been done on any scale. No doubt the difficulties are very great and such as to daunt any individual who cannot make it his chief business. It is not very surprising, therefore, that the busy practitioner has not been able to do very much towards the elucidation of these problems;