CONGENITAL MALFORMATION AND ACQUIRED DEFORMITY OF THE ORAL AND FACIAL STRUCTURES.

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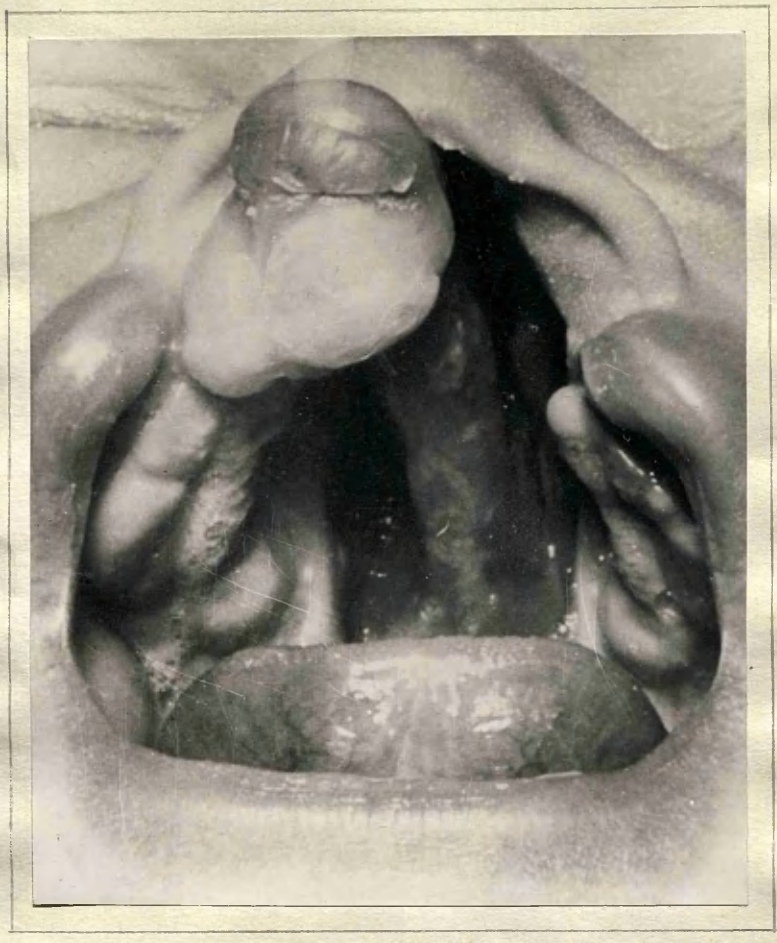

CONGENITAL MALFORMATION AND ACQUIRED DEFORMITY OF THE ORAL AND FACIAL STRUCTURES.

(A Survey of Oral and Facial Deformity with special reference to Closure of Palatal Defects by Non-surgical Methods).

C. KERR McNEIL, L.D.S.

CONTENTS.

INTRODUCTION

When considering congenital and acquired deformities of the oral and facial structures, hare-lip, congenital cleft palate and the results of accidental or war injuries are immediately brought to mind. Much excellent and painstaking work in the remedying of these conditions has been carried out in recent years, but it is a regrettable fact that many members of the community still suffer from the effects of these deformities, and are unaware that much may be done for them surgically, by prosthetic means, or by the combination of both methods. It is true that some have neglected to seek advice with regard to their abnormalities and disfigurement, but it is also true that there are others who, having done so, have been unfortunate in the advice which they have received, and in some cases, the inadequate or even harmful forms of treatment which they have undergone.

The restoration of function of mastication which has been impaired by the extraction of natural teeth is thought by many to be the sole object of prosthetic dentistry. There exists, however, a much wider field of dental prosthetics in which the dental operator may play a part of major importance. A branch of dental science which offers much scope is the application of dental/

/dental prosthetics in the treatment of oral deformities, both congenital and acquired.

With regard to the treatment of deformities of the oral and facial structures, there can be no doubt that the greatest advances in this aspect of medical and dental science took place during times when man had summoned his utmost powers of ingenuity towards the destruction of his fellow-beings, namely the two World Wars. The maxillo-facial injury, one of the most distressing types of war mutilation, called for a new outlook regarding treatment of these cases, methods which required the services of surgeon, oral surgeon and dental prosthetist. Circumstances thus brought into being a much closer liaison between these operators than had hitherto existed. This in itself marked an important advance in the remedying of deformity of the structures under consideration.

Whilst on service during the recent war, it fell to me to provide treatment for cases of maxillo-facial injury. As a result of experience gained when dealing with these acquired deformities, I formed the opinion that much might be done for those suffering from the effects of congenital malformations of the facial and oral structures. Since taking up my present whole time appointment in Glasgow Dental Hospital and School,

I/

/I have had ample opportunity to put into practice modes of treatment which I had previously considered might meet with success, particularly in cases where the severity of the condition presented complications with regard to the retention of appliances. I have thus been enabled to put to the test my earlier convictions, and to carry out searching investigations pertaining to the fitting of appliances of original design with a view to overcoming these complications.

The object, therefore, of the research which I have undertaken, the findings of which are embodied in this thesis, was based upon an earnest endeavour towards the betterment of modes of treatment of oral and facial deformity, and an attempt to make the lot of the afflicted a happier one by lessening the effects of the infirmity; replacing anatomical deficiencies; restoring physiological function; correction of impaired speech; the bringing about of improvement in aesthetic appearance. This latter factor is one of importance in that the mental outlook of the patient may be changed appreciably from one of inferiority to one of self-esteem, thus enhancing his chances of success in life.

Since the cessation of hostilities there has been, naturally, a decrease in the number of cases of acquired deformity./

/deformity. Nevertheless, one is still faced with cases where deformity has been brought about by accident, disease, or as the result of surgical removal of tissue. But the number of cases of congenital malformation presenting for treatment remains constant at all times. Hence, much of this research, both clinical and otherwise, has been concerned with congenital deformity, particularly cleft palate. In view of the frequency of occurrence of the condition, and the distressing effects associated with it, the bringing about of improved methods of treatment would appear to be of definite value. As Brophy (1923), (1) has stated :

> 'Congenital fissures of the palate, accompanied by cleft lip, are so conspicuous, of such frequent occurrence and their influence upon the patient so depressing, that measures looking toward their successful treatment have always been regarded by surgeons with deep interest. Cleft lip, with cleft palate, no doubt is one of the most distressing deformities which befalls mankind. The unfortunate sufferer, conscious of his deformity and his inability to speak distinctly enough to be understood by his associates, too frequently isolates himself and shuns the society of his fellow men'.

1. Brophy, T.W. (1923) "Cleft Lip and Palate."
11 : 73,
P.Blakiston's Sons & Co.

SCHEME OF STUDY

A series of 250 cases of congenital cleft palate was examined and treated.

Ages ranged from a few months to over seventy years.

Examination and treatment of all cases recorded in this treatise were undertaken in Glasgow Dental Hospital and the Royal Hospital for Sick Children, Glasgow.

A thorough examination was made of each case. This included visual, digital and X-ray investigation; the taking of preliminary impressions and construction of study models; the listing of 'associated conditions' and other abnormal features; obtaining of family histories; the noting of degrees of defective speech and deglutition.

A permanent record of features and modes of treatment of these cases was obtained by means of photography and the construction of acrylic resin models. Many of these models were used for photographic purposes in the illustrating of cases presented in this thesis. In numerous instances, duplicate appliances were constructed and preserved, particularly in cases where appliances of original design were utilised.

The methods of other investigators were studied. Their methods were put into practice, and note made of results/

/results obtained. In this way, a true comparison was made between the results achieved by these methods, and the original procedures which are described later. This resulted in patients benefitting from the fitting of appliances which had undergone clinical tests, and upon which research had been undertaken with regard to anatomical and physiological simulation.

Certain cases required special types of appliances, the method of fitting of which was such that the tolerance of the tissues was, at the time of insertion, undetermined. In these cases, tissue tolerance was ascertained by histological means, sections of tissue being prepared and examined microscopically at regular intervals extending over a period of several years.

Treatment, in many cases, consisted of a combination of surgical procedures and prosthetic measures. In many such cases, attendance in the operating theatre was necessary. This ensured the closest possible co-operation between surgeon and dental operator, resulting in a fuller understanding of each other's methods, and the problems which confront operators in both spheres of treatment.

Experiments were conducted in non-surgical methods of treatment of palatal defects. This entailed investigation into/

/into the osteogenic potentialities of the hard tissues of the defective palate, and methods of stimulation of the growth impulse. Progress made was ascertained by means of study models, X-ray examination and surgical investigation.

Investigation was made into the movements of the divided remnants of the defective soft palate during the functions of speech and deglutition. This was accomplished by using special appliances in conjunction with X-Ray examination.

Efforts were made to ensure that rehabilitation of all patients was completed in the shortest possible time. Extractions, fillings, orthodontic treatment, and the fitting of a prosthesis were all carried out as expeditiously as possible within the limitations of sound dental procedures. In cases where orthodontic treatment was provided, progress was noted by comparison with study models and photographic records.

Patients, on completion of treatment, were instructed to report for examination at regular intervals. In this way, results of treatment could be assessed - masticatory efficiency, speech effects, aesthetic appearance and psychological effects.

Statistics were prepared. These were based upon information/

/information received, and observations noted, in the examination and treatment of the series of 250 cases of congenital cleft palate, also from perusal of records pertaining to 31,953 infants born during a period of ten years.

From time to time, cases of acquired deformity of the facial and oral structures were treated. This entailed research into methods of prosthesis construction and retention. Materials were tested both clinically and in the laboratory. Tissue tolerance was kept under observation.

HISTORICAL NOTE

Down through the ages, man has been subject to disease and suffering. Nature, however, conferred upon him an inordinate urge to survive, and this, together with an inborn reasoning power, produced in him an instinctive desire to discover ways and means to assist in his self-preservation, the alleviation of pain, and the treatment of the maladies which beset him.

The beginnings of the art of healing must be, to a great extent, a matter of supposition and conjecture. In all probability the beginnings of the art of dentistry were the same as those of the art of medicine, beginnings which evolved through need, instinct, and, to a large extent, mere accidents of chance. Evidence of certain facts however, has endured. Much information has been supplied by relics of the past. Archeological surveys have revealed much that is of profound interest to both the medical and dental professions.

Amongst the relics which have yielded much valuable information must be numbered skeletal remains, ancient writings, votive offerings and early works of art. Undoubtedly, the skeletal and mummified remains of prehistoric and ancient man have yielded most information. Especially

/is this true when considering oral conditions, normal and pathological. Aitchison (1947), has pointed out (1) that 'the highly calcified and endurable teeth and jaws are the main findings upon which our anatomical knowledge of early man is founded.' Likewise, it may also be said that knowledge concerning the occurence of dental disease and oral deformities in ancient man has been gained from such relics. Nevertheless, a comprehensive enlightenment concerning the arts of medicine and dentistry in those far off days has been gained only by an exhaustive survey of all relics of the past. They provide evidence that diseases, to which modern man is subject, were active in remote times. They supply information regarding ancient modes of treatment as practiced by races in many parts of the world. There is definite proof that surgery was practiced; they show that, even in prehistoric times, the operation of trephining (2) was performed. From them, it has been learned that oral disease received attention; that the replacement of lost teeth, by the fitting of appliances, was practiced. Pieces of Etruscan workmanship (3) have been found, prosthetic pieces which were fashioned over three thousand years ago.

That congenital malformations occured has been established./

/established. There is evidence to show that these various deformities were as prevalent in early times as at present. Wright (1939), who investigated the anthropological aspect of dentofacial deformities, (4) has stated that the predisposing factors to oral and facial malformations were as active in primitive man as they are in man today. Furthermore, there is evidence, which would appear to be conclusive, that congenital oral malformation is not confined to the more highly civilized races. Campbell (1937-8), during field anthropological expeditions to Central Australia, found several cases of congenital cleft palate occurring in Australian aborigines. (5)

Although it was not until comparatively recently that congenital cleft palate found mention in literature, evidence exists which shows that the deformity made its appearance thousands of years ago. Smith and Dawson (1924), have described the presence of congenital cleft palate (6) in an early Egyptian mummy. Moreover, it is known that cleft palate is frequently associated with other congenital deformities, and there is definite proof that these various associated deformities did occur. The malformation most frequently associated with cleft palate is hare-lip, a condition which has been recognised since ancient times. Celsus,/

/Celsus, at the beginning of the first century, gives an account of the condition in his 'De re Medicina', and even describes its repair. During excavations in Egypt, Derry (1938), (7) found a skull which exhibited premaxillary agensia. Proof of the occurence of yet some other conditions associated with congenital cleft palate has been established. Mummies have been discovered which prove conclusively that hydrocephalus, inguinal hernia, (8) and club-foot (9) were not unknown in times remote.

This lack of early reference to congenital cleft palate may appear surprising on first consideration, and might readily give rise to the assumption in certain quarters that the deformity is one of comparatively recent origin. As shown already, however, there is ample indication to permit of the conclusive statement that the condition has in fact made its appearance since very early times. There must then, be reasons for its not having been referred to in early writings, and, as elicited from examination of skeletal and mummified human remains, the extremely rare occurrences of definite signs of its having existed. One explanation may be that, as a result of feeding difficulties and subsequent starvation, the mortality rate of infants born with the condition was extremely high;/

/high; it may even be that practically all who were afflicted died in infancy. Again, it may be that the afflicted were put to death at birth, and subsequent cremation destroyed all chance of the survival of relics which would have yielded information.

Assuming, however, that some children perchance, did survive, it seems reasonable to suppose that they were probably regarded as mental degenerates or weaklings on account of their abnormal speech and poor physical condition, and were put to death, or were ostracised by society, left to their own fate, and thus deprived of interment in recognised burial places when they died from want or disease. Sigerist (1944), states, when writing of the 5th century B.C., that disease was looked upon as a great curse: (10)

> 'The rich man, the cripple and the weakling could expect consideration from society only so long as their condition was capable of improvement. The most practical course to take with a weakling was to destroy him, and this was done frequently enough.'

Granted that the foregoing explanations are based mainly on conjecture, yet it lies within the realm of possibility that some of these theories may contain elements of fact. By accepting this hypothetical reasoning, however, it can be readily understood why the condition did not make its appearance in the literary works of early medical men.

What/

/What would appear to be the earliest description of congenital cleft palate is to be found in the diary of one, John Ward (1660): (11)

> 'A childe borne without the uvula or tonsillae but a great passage upp the nose from the mouth so that one might almost see out of one into the other: it could not suck but all came out of the nose againe, unless it lay backwards.'

By way of contrast, hare-lip and its repair have been described by many writers from the days of Celsus, down through the centuries, to the present time. Nevertheless, history has shown that the methods of repair changed but little during a period of many hundreds of years. In the Saxon Leechdoms (A.D.1000), is to be found an observation on the treatment of the condition: (12)

> 'For hair lip, pound mastic very small, add the white of an egg, and mingle as thou dost vermillion, cut with a knife the false edges of the lip, sew fast with silk, then smear without and within with the salve, ere the silk rot. If it draw together, arrange it with the hand; anoint again soon.'

Three hundred years later, the Flemish surgeon, Jean Yperman (1295-1351), (13) gave an account of the surgical treatment of hare-lip by means of freshened edges and special sutures. Even so, his technique was essentially the same as that described by Celsus.

Yet another three hundred years later, Peter Lowe (1550-1612),/

/(1550-1612), (14) Scottish surgeon, and founder of the Faculty in 1599, which was later to become the Royal Faculty of Physicians and Surgeons of Glasgow, writes of the condition in his 'Chyrurgerie':

> 'Of the Hare-Shaw or Cloven Lippe called the Hares Lippe.'
>
> 'The Hare-shaw is a defectuositie of nature, which happeneth either by nature or accident in the Lip, Eare or Nose; they or either of them are sometimes found cloven or they come into the world : it is sometime little otherwhiles so bigge, that you would imagine a peece taken out of it, such as are little cloven may be cured : if they be very much rent hardly do they receive any cure : such as are in old people of evill habitude, are very hardly cured.'

It is only in recent years that real progress has been made with regard to the surgical repair of lip clefts. Advances in plastic surgery have brought about the introduction of techniques which have proved particularly successful, both for malformation of the lip, and the nasal deformities which are so frequently associated with the condition. Paradoxically enough, much of this advancement in technique has developed as a result of experience gained in the surgical procedures used in the treatment of injuries sustained during the two World Wars.

In spite of the long history of treatment of hare-lip by surgical means, it was not until about the middle of the/

/the eighteenth century that surgical closure of congenital cleft palate was performed. According to Mettler, although the German surgeon, Heister, (15) described hare-lip and its repair in his 'Chirurgie' (1718), he acknowledged cleft palate to be irreparable. Nevertheless, it is known that closure of acquired perforations of the palate was contemplated, perhaps even carried out, by mechanical means during the latter half of the fifteenth century. Alexander Petronius was the first investigator to suggest the use of an appliance for closure of acquired lesions, but it was not until 1541 that Ambroise Paré published the first definite description (16) of such appliances, - obturators. He describes one of these in the quotation which follows :

> 'Many times it happeneth that a portion or part of the bone of the palate being broken with the shot of a gun, or corroded by the virulency of the Lues Venerea, falls away, which makes the patients to whom this happeneth that they cannot pronounce their words distinctly, but obscurely and snuffling; therefore I have thought it a thing worthy the labour to show how it may be helped by art. It must be done by filling the cavity of the palate with a plate of silver or gold a little bigger than the cavity itself. But it must be as big as a French crown, and made like unto a dish in figure; and on the upper side, which shall be towards the brain, a little sponge must be fastened, which, when it is moistened with the moisture distilling from the brain, will become more swollen and puffed up, so that it will fill the concavity of the palate, that the artificial palate cannot fall down, but stand fast and firm, as if it stood of itself.'

Paré/

/Paré also described another form of obturator which was in the nature of a stud. A disc was adapted to the roof of the mouth, covering the perforation. This disc was attached to a smaller oblong piece of metal by a revolving screw. The smaller disc was passed through the opening in the palate and was turned by means of the screw, in order that it would lie across the narrowest portion of the nasal aspect of the opening in the palate. The larger disc was thus held in position against the lingual aspect of the palate, and completely covered the perforation.

During a period of almost two hundred years following Paré's description of obturators, little change took place in the design of the simple appliances used for closure of acquired palatal defects. It was Fauchard who, in 1728, described and illustrated obturators (17) which were very much more complicated in design. Even so, in spite of the ingenuity displayed, the principle employed for the support of the appliances was much the same as that of the appliances designed by his predecessors. Examination of engravings, and a perusal of the description of these obturators brings to mind the words of Leonardo da Vinci :

> 'When you wish to produce a result by means of an instrument do not allow yourself to complicate it by introducing many subsidiary parts but follow the briefest way possible.... ....' (18)

Nevertheless,/

/Nevertheless, the methods of Fauchard were not improved upon until 1756, when Bourdet evolved a method of supporting an appliance by means of silk ligatures which were attached to the natural teeth.

Following the work of Bourdet, little of importance took place with regard to the prosthetic treatment of palatal defects until Delabarre published a treatise on mechanical dentistry in 1820.(19) Not only did he improve upon earlier obturators, but was the first to devise a method whereby deficiency of the soft palate, brought about by disease, was restored functionally by mechanical means.

What would appear to be the first attempt at remedying congenital cleft palate by prosthetic means was made by Snell in 1823. Prior to that time, only acquired defects had been treated by mechanical procedures, the fitting of appliances in congenital cases having been considered impossible.

From this time onwards, many investigators have made valuable contributions to the prosthetic treatment of the condition. Amongst those who have carried out work which has been of great importance in this field of dental science must be mentioned the names of Suerson and Kingsley. It was Dr. Wilhelm Suerson who, in 1867, pointed/

/pointed out that the important part played by the constrictor pharyngeus superioris muscle should be taken into account when constructing appliances. (20) He put his theories into practice, and designed his obturators accordingly. His work was rewarded with considerable success, and he thus established an original technique with regard to the mechanical treatment of the condition. Kingsley, on the other hand, carried out a vast amount of research work in various branches of dental science. (21) For the treatment of congenital cleft palate he developed appliances, the principles of which are frequently used in prostheses constructed even at the present time.

Despite the fact that the history of treatment of deformities of the palate by mechanical means had its beginning about five hundred years ago, it was not, as has already been stated, until the latter half of the eighteenth century that surgery, as a means of treatment, was recognised. The first successful surgical repair of a cleft of the soft palate was reported by Le Monnier, (22) a French dentist, in 1764. His success was followed by von Graefe of Germany in 1817, and by Roux of France in 1819. In the year 1828, Dieffenbach first suggested separation of the soft tissues from the underlying bone of the hard palate before closing the cleft in the soft palate.(23) For further relief of tension of the soft tissues, he used lateral incisions after closure of the soft palate cleft. It was also Dieffenbach who, in 1834, performed/

/performed the first successful closure of a cleft which involved both the hard and soft palates.

Dating from that time, many operators commenced the practice of cleft palate surgery, and many various techniques were developed, techniques which met with varying degrees of success. It is true that, in recent years, important advances have been made; that many of the earlier methods have fallen into disuse; that certain theories have been disproved; that many eminent surgeons have devised forms of treatment, the results of which show that real progress is being made. Nevertheless, with this branch of surgery certain names will always be associated, such names as Fergusson, von Langenbeck, Passavant, Billroth and Lane, some of the men who carried out pioneer work of the utmost importance, men who developed techniques upon which are based some of the methods employed in the operating theatre even of today.

The story is one of gradual progress. As knowledge of anatomical and physiological facts increased, so advancement was made in methods of treatment. To those who went before, those who have handed down the results of their labours, a debt of gratitude is owed by present day investigators. Without the hard work and laborious research which was undertaken by those early pioneers in surgical and mechanical procedures, the task of the present day investigator would be a formidable one/

/one indeed. Much existing knowledge has been gained from the experience of early operators; from their methods of approach and modes of treatment; their research findings; from their failures and successes.

It can be truthfully said: the findings of the enquiring mind of yesterday have proved to be but stepping stones to the achievements of today. So also can it be said that present day achievements are but the foundations upon which will be built the successes of the future.

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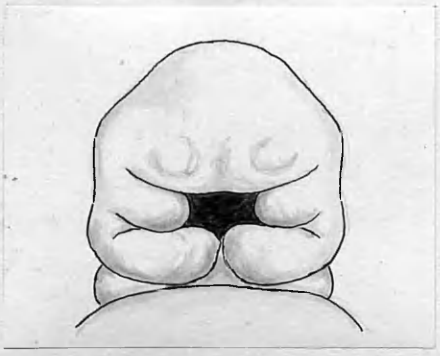
SURVEY OF NORMAL DEVELOPMENTAL PROCESSES.

During early embryonic life occur many of the abnormalities of the facial and oral structures which eventually necessitate treatment by the surgeon and dental surgeon. It is known that interference with normal development during prenatal life gives rise to malformations, and, when considering conditions such as hare-lip and cleft palate, a period of primary importance falls between the end of the fourth week and the beginning of the twelfth week of intra-uterine life. In order, therefore, that an understanding of the origin of these malformations is obtained, reference to the normal developmental processes of the parts concerned is necessary.

About the end of the third week of intra-uterine life the embryo begins to assume a definite shape. This is brought about by rapid growth in the long axis, and by the formation of the six branchial arches.

During the fourth week, the stomatodaeum or future mouth develops at the anterior end of the embryo, and this cavity is surrounded by processes which are developing from the base of the primitive cerebral capsule. These processes are five in number, and will ultimately unite to form the facial part of the head. That process which projects from beneath the fore-brain is the nasal or fronto-nasal process. The process is median, and/

/and is composed of symmetrical right and left halves. The remaining processes are lateral, a right and left maxillary process, and a right and left mandibular process.



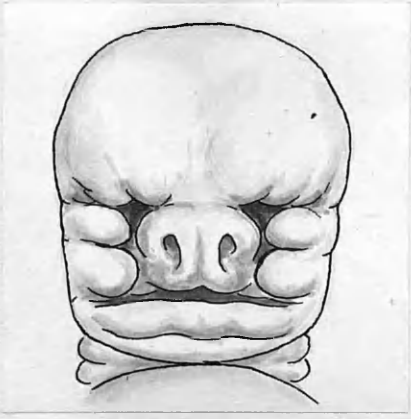
Head of human embryo. (End of 4th wk.)

Fig.1

About the end of the fourth week a thickening of the fronto-nasal process occurs, and a specialised plaque appears on each side of the process. With the appearance of these plaques the fronto-nasal process can now be subdivided into a median nasal process, and two lateral nasal processes. The plaques eventually become depressed by an upgrowth of the mesial and lateral nasal folds or processes to form the olfactory pits. At the same time, the two mandibular processes grow towards each other to meet in the median line.

Fusion of the mandibular processes with each other commences/

/commences about the end of the fourth week.



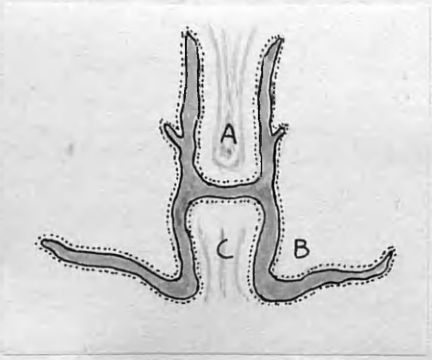
Head of human embryo. (End of 6th wk.)

Fig.2

The maxillary processes are derived from the mandibular arch. They are formed by extensions which develop from the cephalic aspect of the dorsal ends of the two mandibular processes. During the fifth and sixth weeks the maxillary processes grow forward towards the centre and thus separate the eyes from the buccal cavity. By the end of the sixth week the maxillary processes have grown forward to fuse with the lateral nasal folds. During the seventh week the maxillary processes come in contact with processes which have appeared on the median nasal process, the two globular processes which give rise to the primitive palate. The mesenchyme of the two maxillary processes invades this area of the median nasal process until the two processes meet to contribute largely to the formation of the philtrum of the lip at the/

/the point of fusion. The processes later form the cheeks, and the upper lip; contribute substantially to the formation of the philtrum; form the floor of the nose; the greater part of the upper jaw and palate, with the exception of the premaxilla.

During the sixth week a process appears on the inner aspect of each maxillary process. These are the two palatine processes which, at this stage, are separated from each other by the tongue. The developing tongue, besides being situated between the palatine processes, is almost in contact with the nasal septum which is developing from a deep portion of the fronto-nasal process, and from mesoderm from each maxillary process.

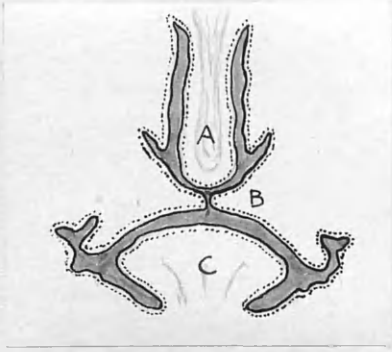


A - Nas. process.
B - Pal. process.
C - Tongue.

Fig.3

As the mandibular region grows in a ventral direction, the tongue flattens and drops downwards to take up a more adult position, while, at the same time, the palatine processes/

/processes commence to grow towards each other to coalesce in the space between the tongue and the free border of the nasal septum.



A - Nas. process.
B - Pal. process.
C - Tongue.

Fig.4

Fusion of the palatine processes proceeds from before backwards commencing at the primitive palate. As development progresses, membranous ossification extends into the palate to form the premaxillae in the primitive palate.

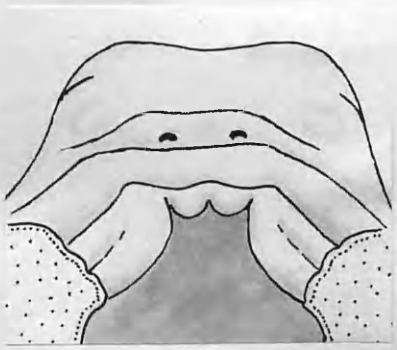


Fig.5

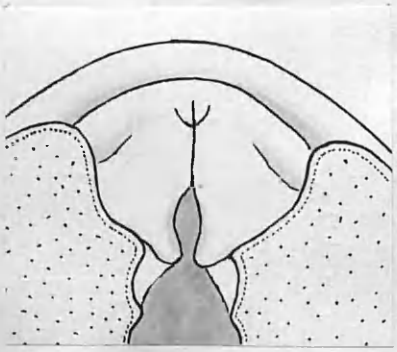


Fig.6

Diagrams illustrating development of palate.

The soft palate is constituted by backward growth of the palatine processes along the lateral walls of the pharynx. These backward prolongations meet and fuse with each other progressively from before backwards but not with the nasal septum, and there is no development of bone in this region.

Before the end of the third month of intra-uterine life the nasal and oral cavities are separated completely by the hard and soft palates.

The mandibular or first visceral arch is formed by union in the middle line of the two mandibular processes. These processes are in contact with each other in the fourth week of intra-uterine life, but it is not until the middle of the second month that the process of fusion is complete.

The mandibular arch gives rise to various structures besides the lower jaw. From it are derived the lower lip, muscles of mastication, and the anterior two thirds of the tongue. The arch also contributes to the formation of the sublingual and submaxillary glands, their other source of derivation being the floor of the primitive pharynx between the mandibular arch and the second or hyoid arch.

SUMMARY OF DEVELOPMENTAL MALFORMATIONS

Clearly defined grooves are present between the facial processes during the period when they are developing and fusing. These grooves normally disappear by the eighth week of intra-uterine life, but where, for some reason, certain processes fail to unite, or where union is incomplete, these grooves persist, giving rise to conditions such as hare-lip and congenital facial clefts.

Should there be faulty growth of the lower part of the fronto-nasal process, the comparatively rare condition of median hare-lip may result. This malformation can occur in varying degrees of severity.

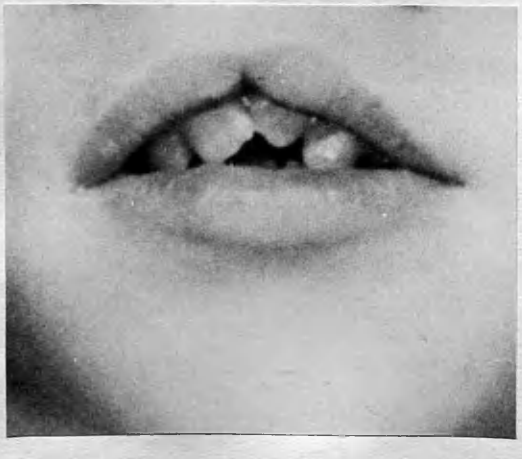


Fig. 1

Slight degree of
median hare-lip.

Unilateral hare-lip, which may appear on the left or right side, is brought about by failure of a maxillary process to fuse completely with the lower part of the fronto-nasal process.

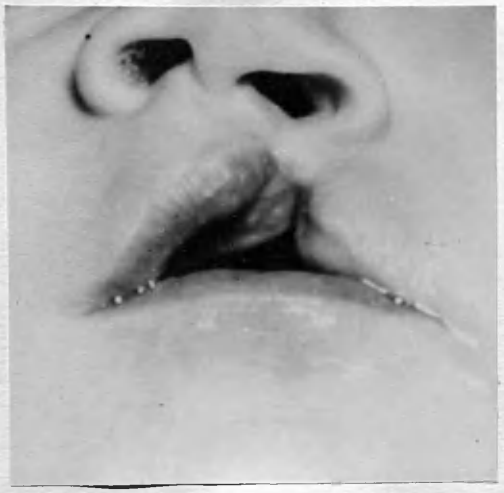


Fig. 2

Unilateral hare-lip.

In cases where failure of both maxillary processes to fuse with the median nasal process occurs, the hare-lip is of the bilateral type. Both lip clefts may be complete, or one or both may be partial. Where both lip clefts are complete, the result represents the greatest degree of hare-lip. The philtrum is absent, and the premaxilla/

/premaxilla usually projects forwards. This forward projection may cause the premaxilla to protrude beyond the nose which is usually flattened.

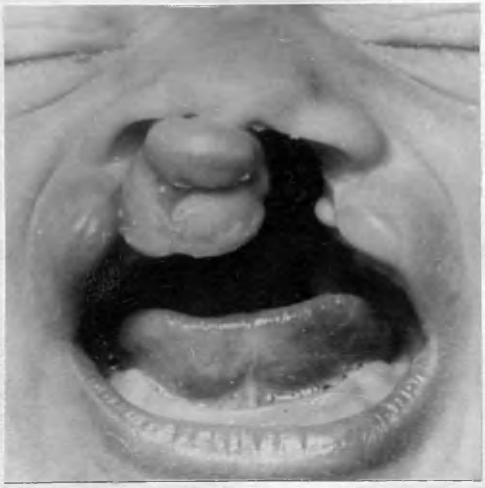


Fig. 3

Fig. 4

Bilateral hare-lip.

Failure of one of the maxillary processes to fuse completely with the lateral margin of the fronto-nasal process results in an oblique facial cleft.

Failure of the maxillary process on one side to fuse with the lateral nasal process, results in a rare condition in which the nasolacrimal duct forms a groove along the side of the nose. In such cases, hare-lip on the same side is usually present.

Incomplete fusion of the two mandibular processes results in a median cleft of the lower lip. The condition is rare, and may vary from a simple cleft of the lip to complete non-union of the two halves of the lower jaw.

Macrostoma, a condition in which the mouth is unduly

Fig. 5

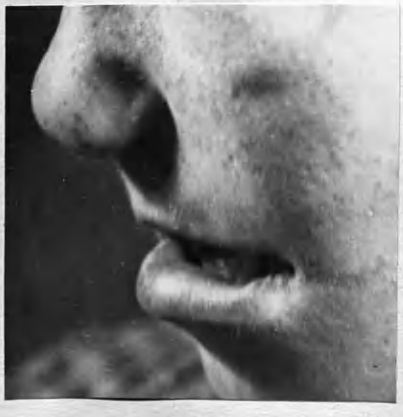


Fig. 6

large, is the result of incomplete fusion of the mandibular/

/mandibular and maxillary processes. Where the condition is slight, there may be only slight widening of the mouth, and a scar-like band extending across the cheek.

Excessive fusion of the mandibular and maxillary processes results in a very small mouth, - microstoma.

Astomia is a condition in which there is union of the upper and lower lips.

A cleft of the nose in the mid-line may appear in conjunction with median hare-lip. Faulty approximation of the mesial nasal processes of the fronto nasal process may bring about this condition.

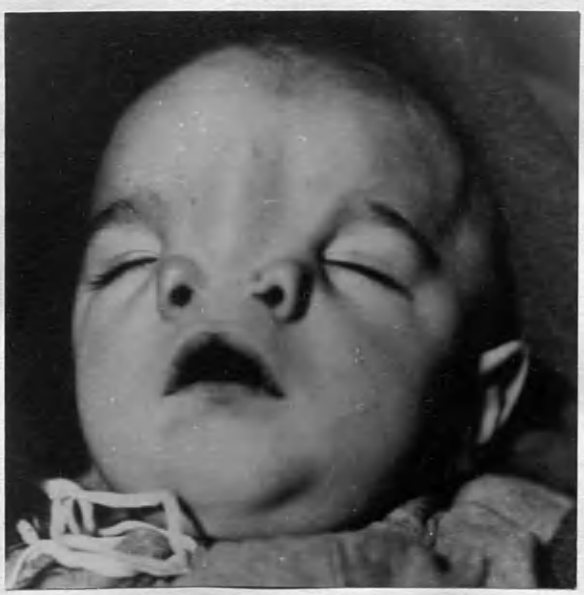


Fig. 7

Polypoid or irregular projections with intervening clefts/

/clefts may appear on the face as a result of the maxillary processes failing to fuse with the lateral or mesial parts of the fronto-nasal process.

Defective union, or complete lack of fusion of deeper processes, gives rise to developmental anomalies. A condition which is very frequently associated with hare-lip is congenital cleft palate. Various forms of the condition arise depending upon the degree of abnormal development occurring. Faulty union, or lack of fusion of the palatal processes of the maxillary process with each other, or with the primitive palate, results in some form of palatal cleft. During development, the process of fusion may be interrupted at any time. Orban, (1944) has stated that this explains the different types of cleft palate. (1)

The lesser degress of the deformity are bifid uvula, or where the cleft is limited to the soft palate only.

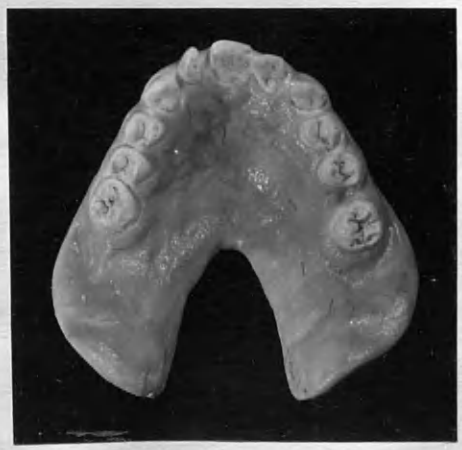


Fig. 8

In cases where one palatine process has fused with the primitive palate, whilst the other has failed to do so, the condition is unilateral, and the extent of the cleft is variable. The nasal septum may or may not be attached to the palatine process on one side.

Fig. 9

In the most severe degree of cleft palate there is complete lack of fusion of processes in the roof of the mouth.

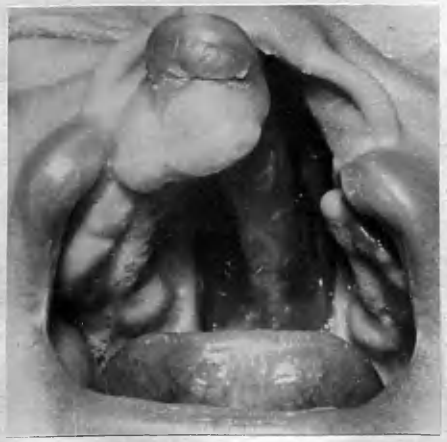


Fig. 10

A wide median fissure exists between the palatine processes. The lower border of the nasal septum is free. The premaxilla is separated from the palatine processes by a fissure on each side.

A congenital malformation which is rare, but would appear to be associated with hare-lip and cleft palate, is fistulae of the lips. They may appear in either the upper or lower lips, but more often in the lower. Four cases, three of which had complete palatal clefts, have been recorded by Matthews (1942). (2)

Stones (1948) states that the congenital fistula is bilateral in the upper lip, and usually bilateral in the lower lip, but may be unilateral. (3)

Agenesis, failure of a part to develop, sometimes occurs in the facial region. The first branchial arch may be absent, with resultant agnathia of the mandible. The condition can also occur in the maxillary region, and may be total, involving the entire upper jaw, or it may involve only the premaxilla. Failure of the fronto-nasal process to develop brings about the partial degree in which the premaxilla is absent.

A condition which is associated with failure of the fronto-nasal/

/fronto-nasal process to form, is cyclopia, a malformation in which the two eyes are fused into one. In such cases, the upper lip and palate are formed by the union of the maxillary processes.

A condition has been described in which the development of the face is so defective that it is almost absent. This condition is termed aprosopia.

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2. Matthews, E. (1942) "Congenital fistulae of the lips." Dental Record, 62 : 61.

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CLASSIFICATION

It is obvious that any attempt to classify acquired deformities of the facial and oral structures in other than a general way would present great difficulties in view of the many types of lesion, and various degrees of severity of mutilation which may occur. Congenital malformation of the oral structures, however, may be placed in various categories according to the extent or position of the deformity. For descriptive and diagnostic purposes, several classifications of congenital clefts of the lip, palate, and alveolar ridge have been evolved. One which is in general use by the surgeon is that which was drawn up by Davis and Ritchie (1). In it, the various types are classified under three groups, depending upon the position of the malformation relative to the alveolar ridge. These groups are termed as follows :-

Class 1. - Prealveolar cleft.

Class 11. - Postalveolar cleft.

Class 111.- Alveolar cleft.

Prealveolar cleft. - All degrees of hare-lip are grouped under this heading, ie., the deformity may be right or left unilateral; bilateral; or median. In each case, the hare-lip may be complete or incomplete.

Postalveolar cleft. - This denotes incomplete cleft of the palate./

/palate. The types which are classified under this heading are bifid uvula; soft palate clefts of greater degree; and clefts which involve the whole of the soft palate and part of the hard palate.

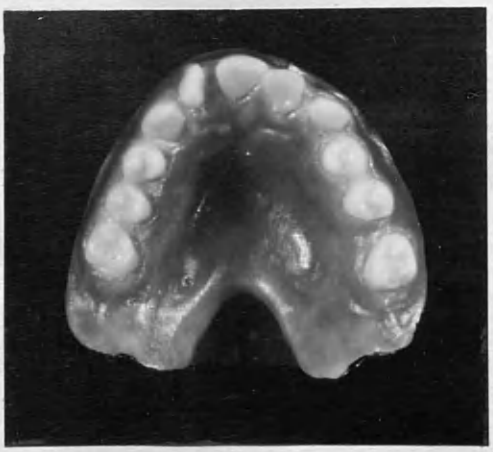
These clefts are median, being the result of an arrest of fusion after the palatine processes have been united with the premaxilla. That is, fusion has been arrested at some point between the premaxilla and the uvula. Hare-lip is sometimes associated with the palatal clefts which appear in this group.

Alveolar cleft. - In this group are placed the clefts which involve the alveolar ridge. The cleft may be unilateral; bilateral; or median; and in each case there is usually the associated condition of hare-lip.

Since the treatment of prealveolar clefts is surgical in character, the classification used in the presentation of cases in this thesis is one which would appear to be more applicable from the point of view of the dental operator, in that the lip clefts are regarded as associated conditions, and are not therefore placed in a separate class. In contrast to Ritchie's classification, which is based on the position of the malformation in relation to the alveolar ridge, this classification is based upon the degree of severity of the palatal deformity:-

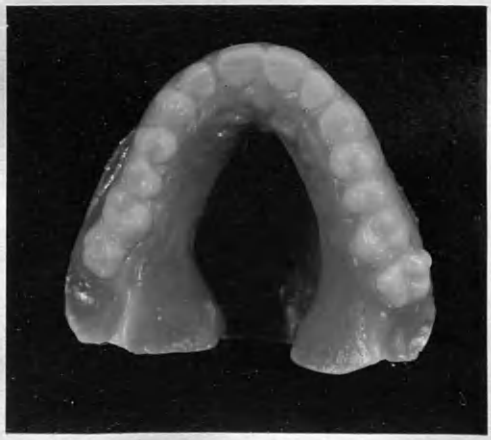
Class 1./

Class 1. - Cleft involves soft palate, varying from bifid uvula to complete division of the soft palate.



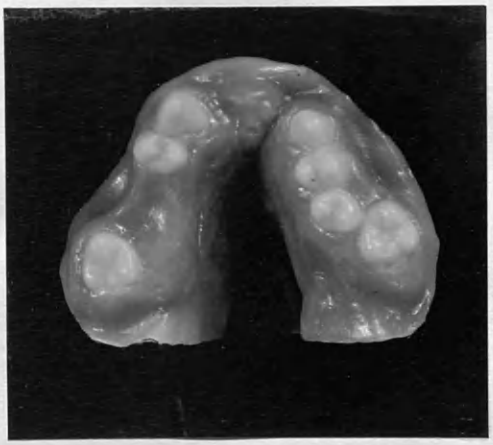
Class 1.

Class 11. - Cleft involves the whole of the soft palate and part of the hard palate. Hare-lip may be associated with clefts in this class.



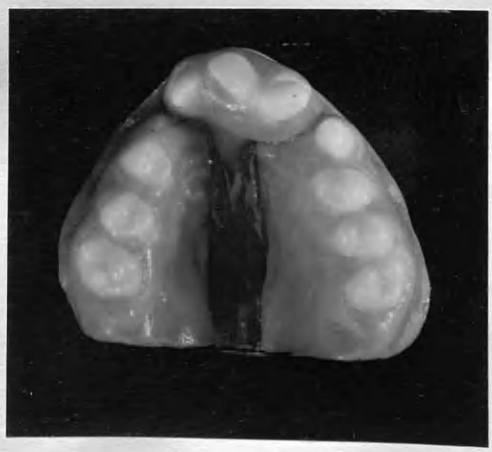
Class 11.

Class lll. - Clefts which extend through soft palate, hard palate, and alveolar ridge at one point, belong to this class. The lip is usually involved.



Class lll.

Class lV. - There is involvement of the soft palate, hard palate, and alveolar ridge at two points. As in Class lll, there is usually involvement of the lip, complete or incomplete.



Class lV.

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"Classification of Congenital Clefts of Lip and Palate."
J.A.M.A., 2 : 1323.

CASES

The cases which follow, serve to illustrate various aspects in the prosthetic and orthodontic treatment of congenital cleft palate.

It will be noted that, even in cases where the condition is severe, the complications which make for difficulties with regard to retention of appliances, may be overcome by means of original appliances which are mechanically operated.

Cases are presented in which palatal defects have been closed by methods which are non-surgical. These forms of treatment were evolved following investigation into the application of orthodontic procedures with regard to the cleft palate patient.

The prosthetic treatment of acquired deformity of the oral and facial tissues is illustrated. The cases of acquired deformity which are presented, serve to show that prosthetics may be an invaluable adjunct to surgical methods of treatment.

CASE 1.

Female, 11 years.

Case presented a small perforation of the soft palate as a result of break-down of tissue following surgical closure of the soft palate at the age of 2 years. It was found that further surgical treatment was contra-indicated in view of the poor general condition of the patient. The patient suffers from a congenital eye condition and has become blind in one eye recently.

Speech was defective, and, during swallowing, regurgitation of fluids through the nose was frequent.

Following the fitting of a small appliance, there was immediate improvement in speech, and defective deglutition was rectified.

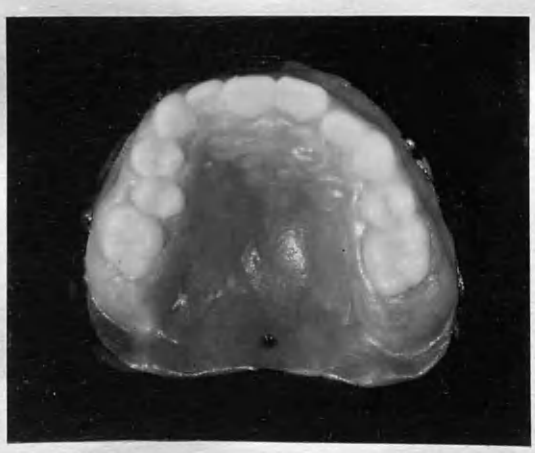


Fig. 1

Fig. 1 shows the palatal defect.

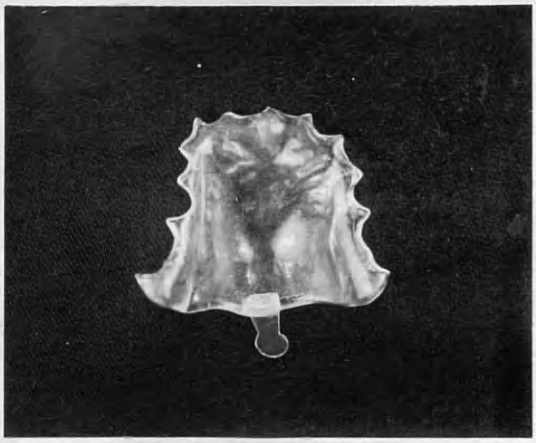


Fig.2

Fig.2 shows the appliance which was fitted. The small portion which covers the perforation was made of a soft plastic material. This allowed it to act in a valve-like manner, and permitted close adaptation to the soft tissues during movement of the soft palate in the functions of speech and deglutition.

CASE 2

Male, 4 years.

The case was of Class 11 type, soft and hard palates being involved.

Surgical closure of the soft palate cleft was carried out at the age of 2 years, 8 months.

The hard palate presented a large perforation which contributed largely to defective speech.

A small appliance was fitted, satisfactory retention being obtained by means of clasps round the two first deciduous molar teeth. Marked improvement in speech resulted from the fitting of the appliance.

An additional feature of the case was congenital deformity of the lower lid of the right eye. This is being treated by means of plastic surgery.

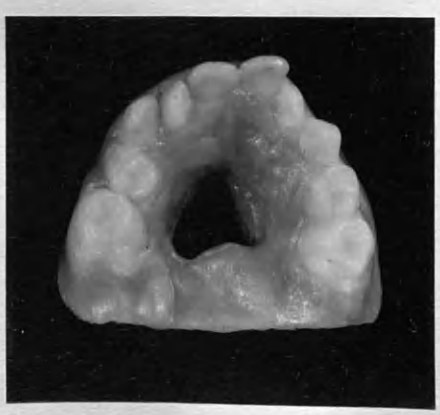


Fig. 1

Fig. 1 shows the unrepaired defect in the hard palate.

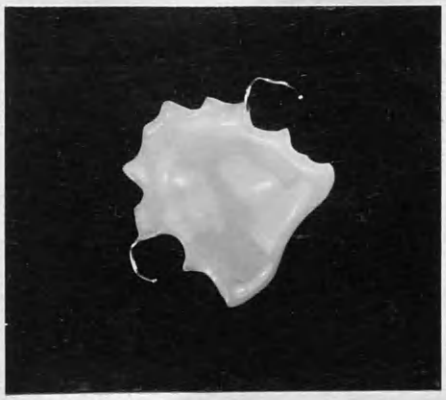


Fig. 2

Fig. 3

Fig. 2 shows the appliance which was constructed for this case. Fig. 3 shows the appliance in situ.

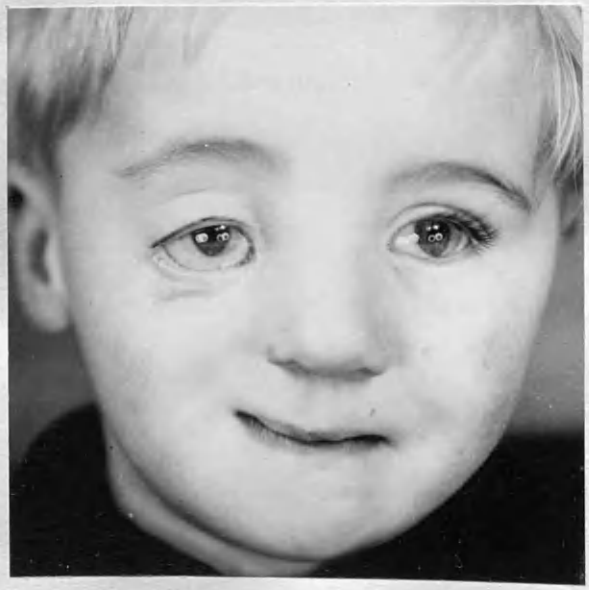


Fig. 4

Fig. 4 illustrates the present condition of the lower lid of the right eye. Skin grafting has already been performed.

CASE 3

Male, 63 years.

The malformation was of the Class 11 type, the cleft involving soft palate and hard palate. Both upper and lower jaws were edentulous. Dentures were worn, but speech was poor and there was impairment of function of deglutition.

A two-piece appliance was fitted, the artificial velum being attached by means of a universal hinge. There was immediate marked improvement in speech, and deglutition was restored to normal.

A feature of the case was the condition of syndactylism. The 2nd and 3rd toes of each foot were fused together throughout their entire length. This same condition was exhibited by three of his six children, the 1st, 3rd and 5th. There was, however, no malformation of the oral tissues.

The patient also suffered from a congenital heart condition. Death occurred suddenly some months after prosthetic treatment had been completed.

(Photographs illustrating features of this case are shown overleaf)

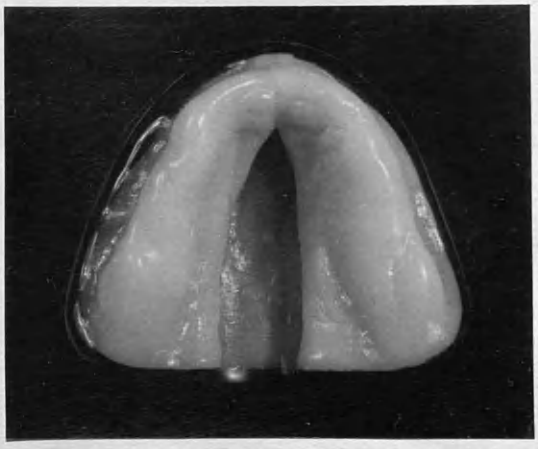


Fig. 1

Fig. 1 shows the extent of the malformation.

Fig. 2

Fig. 2 shows the appliance which was fitted.

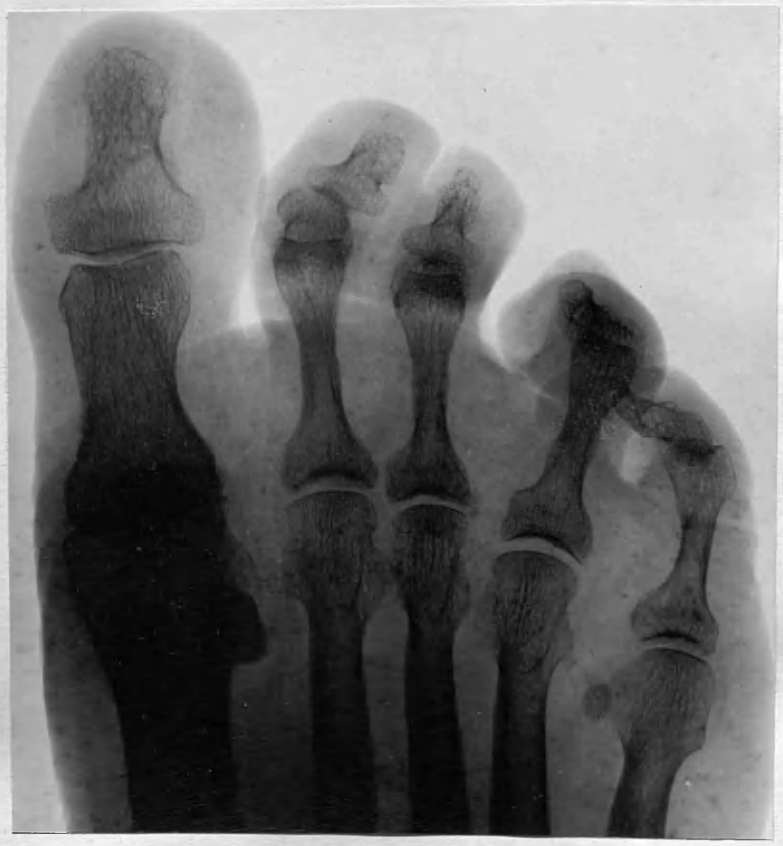


Fig. 3

Fig. 3 depicts a skiagram of part of the right foot. The condition of syndactylism is shown, the 2nd and 3rd toes being fused together.

CASE 4

Male, 23 years.

The case presented a congenital cleft of the palate of Class lll type. The upper jaw, in which seven sound teeth remained, was underdeveloped and malformed. This underdevelopment of the superior maxilla resulted in abnormal 'closure of the bite', and exaggeration of protrusion of the mandible. No appliance had been worn previously, and there was marked impairment of function of mastication. Aesthetic appearance was unfavourable.

The appliance which was fitted was constructed in such a way that the natural teeth were covered by the denture. This procedure necessitated 'opening the bite' in order to allow sufficient space for the denture material and artificial teeth. Alteration of the 'bite' resulted in correction of the abnormal vertical dimension. The artificial teeth were set in correct anatomical relationship with the natural teeth of the lower jaw. The artificial gum was thickened in order to give the upper lip as normal a contour as possible.

The appliance, which has been worn for three years, has proved to be entirely satisfactory. There has been marked improvement in speech, masticatory efficiency and aesthetic/

/aesthetic appearance. Soft tissues and teeth have not undergone any pathological changes in spite of the manner in which the appliance has been fitted.

Fig. 1

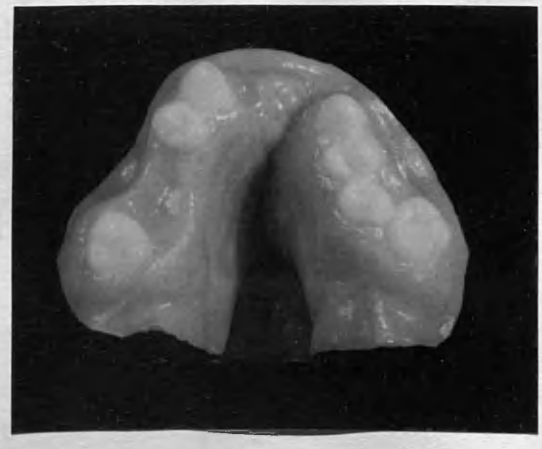
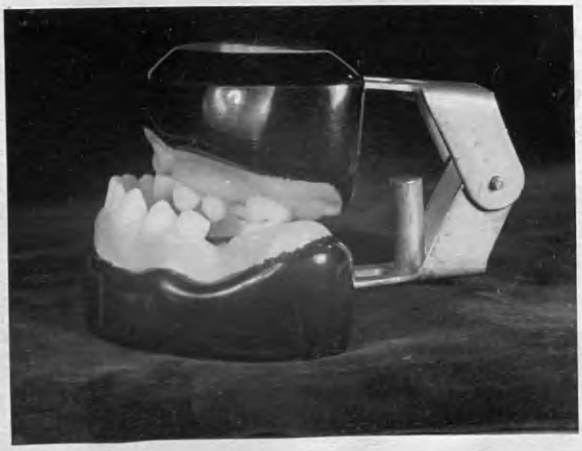


Fig. 2

Figs. 1 and 2 show the appearance of the upper jaw.

Anterior aspect.

Fig. 3



Lateral aspect showing marked malocclusion.

Fig. 4

Lateral aspect after fitting of appliance.

Fig. 5

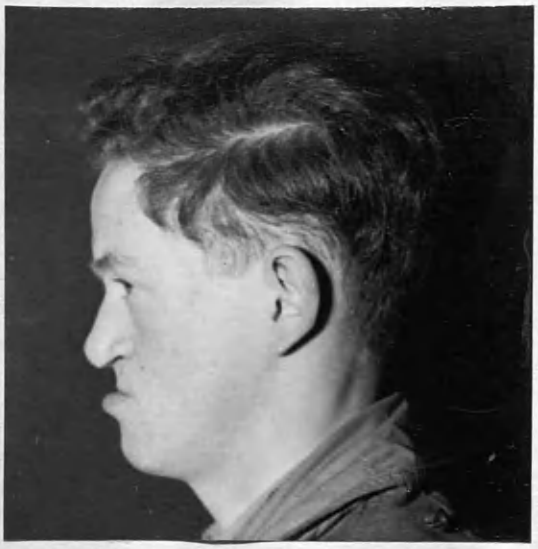


Fig. 6

Fig. 7

Fig. 6 shows the appearance of the patient prior to the fitting of a prosthesis. Fig. 7 illustrates the improved aesthetic appearance after the fitting of the appliance./

/appliance. The vertical dimension has been increased, and the upper lip brought forward by the thickened artificial gum.

Fig. 8

The appliance which was fitted is shown in Fig. 8. It was of the two-piece type, the artificial velum being attached by means of a hinge which was in the nature of a universal joint.

The extent to which the anterior artificial gum was thickened can be seen in the illustration.

CASE 5

Male, 25 years.

This case presented a Class lll malformation. Surgical closure of the cleft had been carried out during childhood, but subsequent break-down of tissue had resulted in a large perforation of the hard palate, and lateral collapse of the upper jaw. The mouth was edentulous, and previous appliances had proved unsatisfactory.

The 'bite was opened', and the appliance built out anteriorly in order that the artificial teeth could be placed in correct relationship with those in the lower denture. This building forward of the artificial gum of the appliance produced an upper lip contour which approximated to normal conditions.

The results were most gratifying in that speech was greatly improved, masticatory efficiency increased, and aesthetic appearance enhanced.

Fig. 1

The appliance which was fitted is depicted in Fig. 1. The illustration shows the extent to which the artificial gum has been built forward.

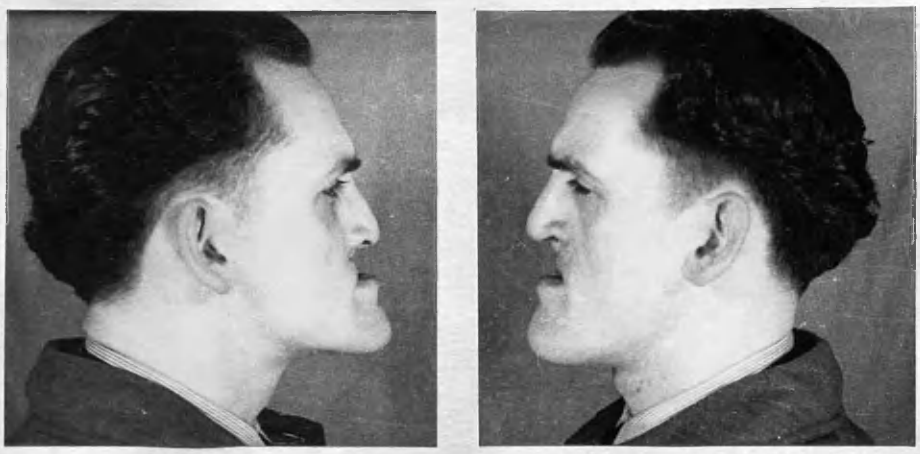


Fig.2

Fig.2 shows the appearance of the patient before commencement of prosthetic treatment.

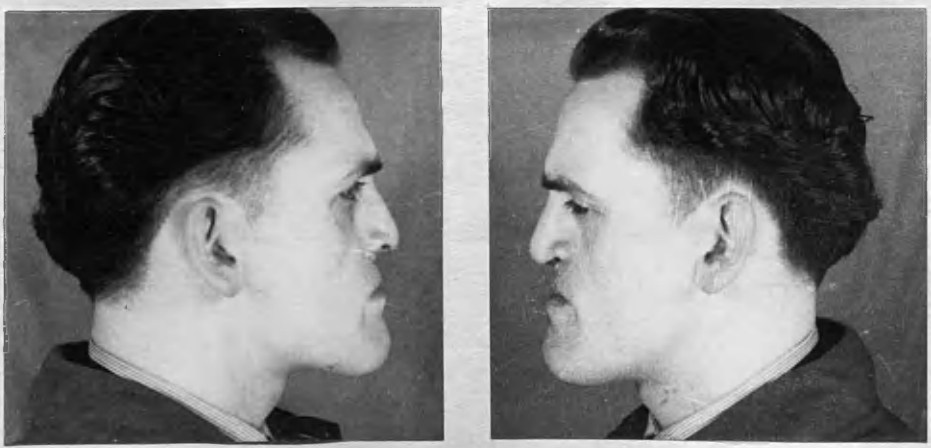


Fig.3

The improved appearance of the patient, following the fitting of a prosthesis, is shown in Fig.3.

CASE 6

Male, 27 years.

The case presented a wide cleft extending through soft palate and most of the hard palate. The malformation was atypical, and, as a result of questioning, the information was proffered that, at birth, one of the fingers of the right hand was in the patient's mouth. It would, therefore, be a matter of conjecture to arrive at any conclusion as to whether the presence of the finger in the mouth caused the malformation by bringing pressure to bear on the roof of the mouth, or whether the cleft condition had always existed, and the finger had produced the atypical appearance of the defect.

Xray examination of both hands revealed abnormal development of the second finger of the right hand.

In view of the abnormal distribution of the hard and soft tissues of the upper jaw, complications existed with regard to the retention of an appliance. The patient had never been able to wear any type of denture previously.

The appliance which was fitted consisted of a denture with a large obturator which passed well into the cleft. In order to reduce weight to a minimum, the obturator portion of the appliance was hollow.

Results/

/Results were most satisfactory. Retention was good. There was immediate improvement in speech. Previously, there had been regurgitation of fluids through the nose; this was overcome successfully.

Fig.1

Figure 1 illustrates the atypical appearance of the malformation, and the abnormal distribution of hard and soft tissues.

Fig.2

The appliance which was fitted is depicted in Fig.2. The unusually large obturator is also shown.

CASE 7 [x]

Male, 25 years.

"....The mouth, edentulous, presented a congenital cleft of the palate of Class 1V type with complete separation of the premaxilla. There had been involvement of the lip, and the patient had undergone surgical operations in infancy for bilateral hare-lip.

Fig.1

Fig.1 shows the extent of the abnormality. Prior to removal of several teeth in the upper jaw the patient had worn an appliance which covered the teeth.

Five years after the fitting of this appliance the teeth were extracted, and subsequent appliances were found to be unsatisfactory owing to there being an almost complete lack of retention.

(x McNeil, C. Kerr, (1948) "Congenital Cleft Palate", B.D.J. Vol. LXXX1V, No.7)

It was decided to construct an appliance which would gain its retention largely by the cleft itself.

Figs. 2,3 and 4 illustrate the completed appliance, the obturator of which is mechanical in action.

The simple mechanism of the obturator is easily operated by the patient by means of a finger control resembling a band or clasp. By means of this control the side pieces of the obturator are retracted for insertion and removal of the appliance....

Complete appliance with retractable side pieces, and velum attached by universal joint.

Fig.2

View of palatal aspect of appliance with side pieces in the locking position. Finger control can be seen on right side.

Fig.3

Appliance with side pieces retracted. Note position of finger control on right.

Fig.4

Notes on the technique employed in the construction of the appliance fcllow, and Fig.5 illustrates the components referred to below.

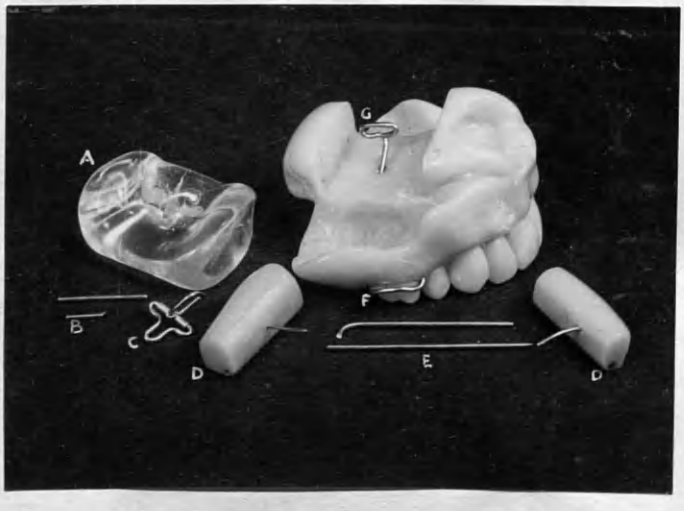


Fig.5

Components of the appliance. A, velum of acrylic resin; B, retaining pins for universal hinge; C, universal hinge; DD, side pieces of obturator with levers; E, shafts for side pieces; F, finger control end of control rod; G, loop on control to operate levers of side pieces.

The photograph shows the denture with side pieces of the obturator detached and control rod fitted; side pieces of the obturator with levers; shafts for side pieces; artificial velum; universal hinge and retaining pins....

...The impression was taken in Zelex, ... and a model was cast.... the denture with obturator constructed on this model.

A piece of stainless steel tube of 1mm. inside diameter was cut to fit the model as shown in Fig.6. A length of wire was fitted to this tube. The purpose of the wire was to retain the tube in position during flasking and packing. The tube formed the control rod guide in the finished appliance.

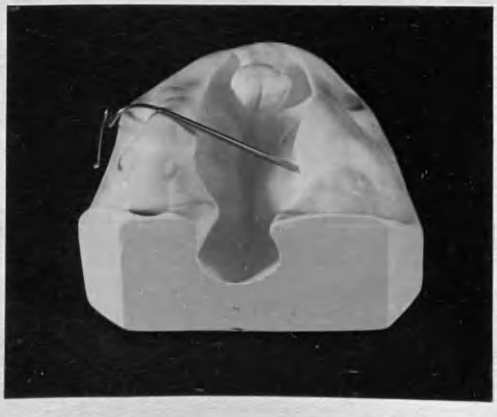


Fig.6

Stainless steel tube and wire fitted to model.

Following the registering of the occlusion the model was articulated. The steel tube and wires were waxed to the model in the position shown in Fig.6 and acrylic resin teeth set up.

The denture was flasked, packed and processed .... On deflasking, the denture with solid obturator was filed and polished.

Side pieces of obturator. - Plaster of Paris cores were now made on the fitting surface of the appliance. These were removed, and a block was cut out from the solid obturator. Holes were drilled in the appliance to take the shafts for the side pieces of the obturator(Fig.7.)

Fig. 7

Position of plaster of Paris cores. Wax block has been removed and control wire fitted.

Stainless steel bushes of 1 mm. tubing were placed in position on the shafts. The plaster cores were replaced and the 'cut out' filled with wax. The shafts were withdrawn leaving the steel tubing embedded in the wax. The wax block was carefully removed and the wires again inserted in it in readiness for flasking (Fig.8.)

Fig. 8

Wax block ready for flasking.

The block was now flasked and finished in acrylic resin. This block was divided antero-posteriorly and the two obturator side pieces constructed. With the control rod in position the side pieces were attached to the denture. The wire levers were waxed in position on the side pieces, the side pieces removed and the wire levers fixed permanently with acrylic resin.

The various figures show how the control rod was shaped and fitted.

The appliance was assembled and was now ready for trying in.

In cases where an appliance has not been worn previously it has been found advisable to allow the patient to wear the new denture for a week or ten days before attaching the artificial velum. This allows the patient to accustom himself to the wearing of the denture and also helps to make the construction of the velum less uncomfortable for the patient. The soft tissues having become accustomed to the presence of a denture, there is usually less tendency for the patient to gag and retch during the taking of the impression of the cleft in the soft palate....

Artificial velum and hinge. - A piece of composition was attached to the distal edge of the denture by a temporary wire. This composition conformed in shape approximately to what the finished velum would be. It was softened, and the appliance and composition inserted. The composition was then gently pushed into the cleft in the soft palate in order to obtain an impression of the border of the cleft. The appliance with impression was now removed. The composition was chilled and surplus cut away. This procedure was repeated until the composition/

/composition fitted the cleft exactly. The surface of the composition was softened, the appliance reinserted, and the patient instructed to close the mouth and swallow several times. This completed the final adjustment.

A model of the lingual surfaces of the denture and composition velum was cast. This was to retain the correct relationship between the denture and velum. The composition velum was now separated from the denture and flasked, packed and finished in clear acrylic resin.

The artificial velum was attached to the denture by means of a hinge which was universal in action. This type of hinge has proved to be entirely satisfactory as it allows the velum to take up any position required by the movement of the soft tissues. It is of simple design and constructed of 1mm. stainless steel wire and stainless steel tubing of 1mm. inside diameter.....

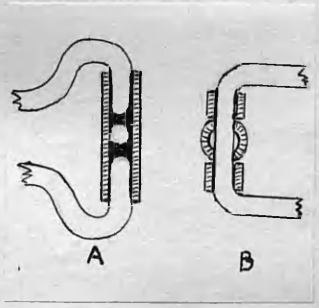


Fig.9

Details of universal hinge joint. A, front portion - plan ; B, rear portion - elevation.

Fig.10

The completed universal hinge joint.

In the case in question the hinge was not processed into the velum and denture. Instead, slots were cut in the denture and velum. The two links of the hinge fitted these slots, and stainless steel pins passed through the links and secured them in the acrylic resin (Fig.11).

The appliance was assembled and was now ready for insertion.

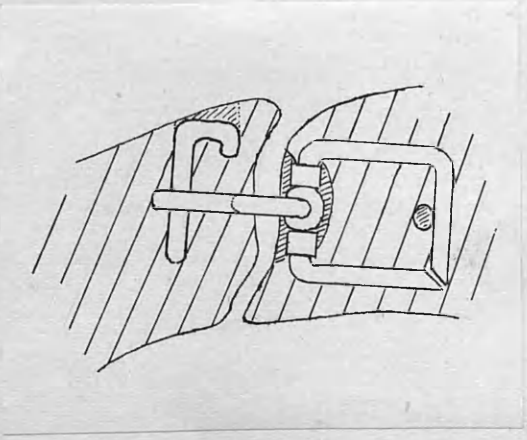


Diagram showing method of securing hinge in denture and velum with steel pins.

Fig.11

The appliance which has been worn for more than two years now, has proved itself to be even more satisfactory than was at first anticipated. It is perfectly stable, causes the patient no discomfort whatsoever, and has not brought about any pathological changes in the soft tissues. The masticatory efficiency has been greatly increased and there has been a marked improvement in speech...."

CASE 8

Female, 15 years.

The case presented a cleft which extended through the hard and soft palates. There had been surgical closure of the involved portion of the alveolar ridge. The hare-lip, which was median, had been repaired in infancy.

The case was of particular interest in that several 'associated conditions' were present. There was deformity of ears, hands and feet. The condition of ocular hypertelorism was present. The patient exhibited signs and symptoms of endocrine disturbance. Congenital heart and kidney conditions were present. There was a history of twins occurring several times on the patient's father's side.

Full upper and lower appliances were fitted, the upper being a two-piece appliance - denture with obturator, and artificial velum.

The case is considered in the section of this thesis headed 'Discussion' (p.170)

The photographs which follow, illustrate some of the features of the case.

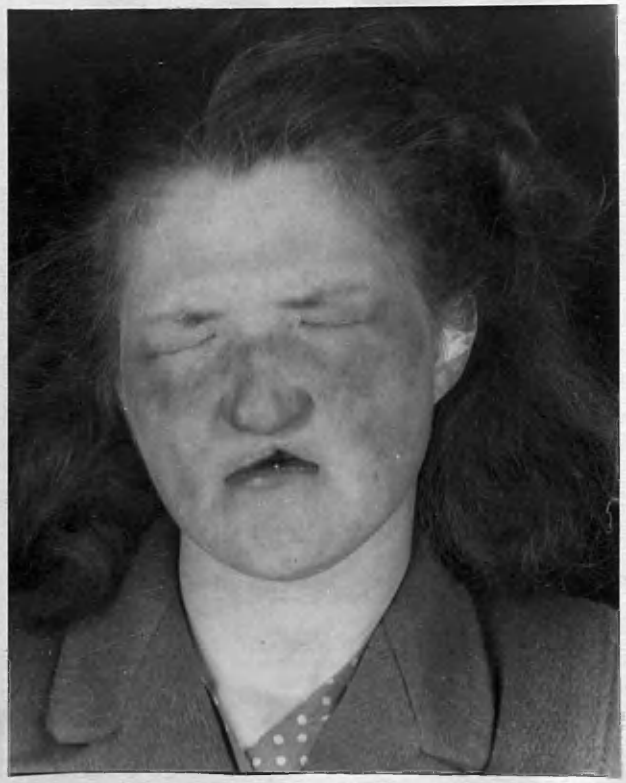


Fig.1

Note the excessive distance between the inner canthi of the eyes; thickening of tissues over eyebrows; median harelip.

Note deformity of the ear.

Fig.2

Oral condition of patient.

Fig.3

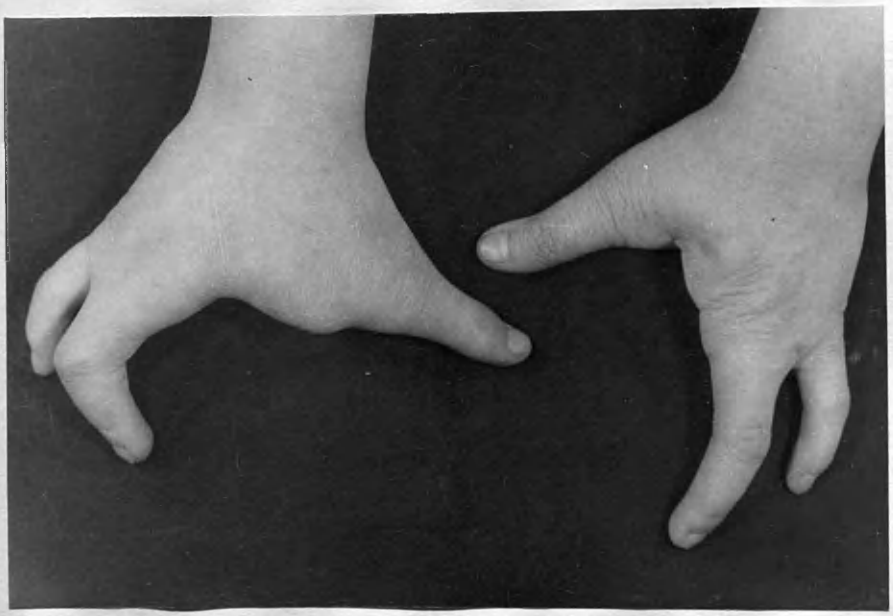


Fig.4

Fig.5

Figures 4 and 5 show photograph and skiagram of the deformity of the hands.

CASE 9

Male, 9 years.

The case was of Class 1V type. Several surgical operations had been performed previously. The first was undertaken when the patient was 5 weeks old. At that time the bilateral hare-lip was repaired, the soft palate closed, and an attempt made to push back the premaxilla which protruded. At the age of 5 years the hard palate cleft was closed. Break-down of tissue, however, resulted in a large perforation in the hard palate, and involvement of the tissue of the premaxilla. Further surgical treatment was undertaken at the age of 7 years, at which time the premaxilla was removed, and scar tissue in the upper lip eradicated.

A sister of the patient who died in infancy, also had congenital hare-lip and cleft palate.

The appliance which was fitted was constructed in such a way that it completely covered the palatal defect, and was thickened anteriorly in order that the lip would be made to take up a normal contour.

Besides there being a marked improvement in speech, the aesthetic result was most satisfactory.

(The case is illustrated overleaf).

Oral condition on presentation.

Fig.1

Appliance which was fitted.

Fig.2

Appearance of upper jaw following the fitting of appliance.

Fig.3

CASE 10[x]

Male, 63 years.

"The condition was one of congenital cleft palate and hare-lip. No surgical treatment had been carried out previously, and the untreated cleft in the lip involved the left nostril. Appliances which had been constructed previously were unsatisfactory aesthetically, and had brought about little improvement in speech.

Figure 1 shows the extent of the deformity.

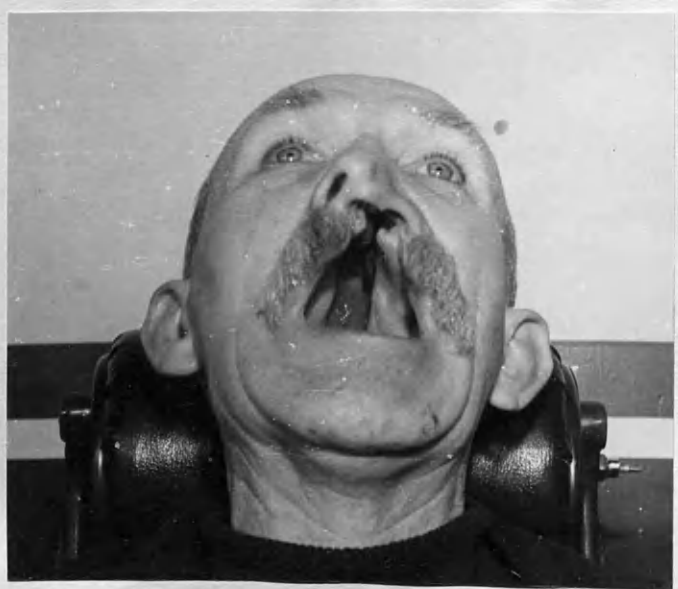


Fig.1

Appearance of patient before the fitting of the appliance.

(x McNeil, C.Kerr, (1948), "Die Offisiele Tydskrif van die T.V.S.A.", Vol.3, No.11.)

The appliance which was fitted was constructed in two pieces, a denture with obturator, and the lip restoration which was detachable.....

Fig.2

Denture with obturator and detachable lip restoration. Note tubes and pins for assembly of appliance.

Moustache restoration. - Horse hair which matched the natural moustache exactly was used for this part of the prosthesis.

The directions of the hairs of the natural moustache were carefully noted, and a series of fine holes were then drilled over the surface of the acrylic lip restoration at the required angles. These holes were used simply/

/simply for the fixation of the first hairs at the correct angles. The first hairs to be placed thus acted as guides for the positioning of the remaining hairs which formed the bulk of the artificial moustache. Hairs which required bending were shaped by holding at the correct curvature in contact with a very hot plate for approximately one second. The guiding hairs were cemented into the holes with acrylic resin dissolved in chloroform. The remainder were attached by dipping the end of each into the acrylic-chloroform cement and quickly placing on the surface of the acrylic in the correct position.

Using this method, it was found that the hairs gained adequate attachment to the surface of the acrylic.....

Lateral view of the appliance.

Fig.3

Fig.4

Lingual view of the
appliance.

The appliance has been in use continuously since its construction, and has brought about no irritation of the soft tissues. There have been marked improvements in speech, deglutition and aesthetic appearance.

The fact that the lip restoration is detachable enables the appliance to be easily and thoroughly cleansed."

Figures 5 and 6 show the aesthetic results which were achieved.

(Figs.5 and 6 appear overleaf).

Fig.5

Fig.6

Appearance of the patient after the fitting of the appliance is shown in Figs.5 and 6.

CASE 11

Female, 15 years.

The patient had a palatal cleft of Class lll type. Previous surgical treatment had been carried out, but there still existed a cleft in the anterior half of the hard palate and the alveolar ridge on the left side.

Radiological examination revealed the buried root. of the right central incisor tooth, and a solid irregular mass in the region of the cleft. This mass proved to be supernumerary tooth surrounded by a heavy deposit of salivary calculus. The tooth had erupted inside the cleft, and was lying on the nasal aspect of the hard palate in close proximity to the nasal septum.

The patient was of low mentality, exhibited considerable underdevelopment of the left side of the face, and had congenital deformity of the eyelids of the left eye. There was also present, congenital macrostoma on the left side.

Preliminary treatment consisted of the extraction of the right canine tooth, the buried root of the right central incisor, and removal of the supernumerary tooth and calculus.

A prosthesis, carrying four artificial teeth, was fitted. There was marked improvement in speech and in the function of deglutition.

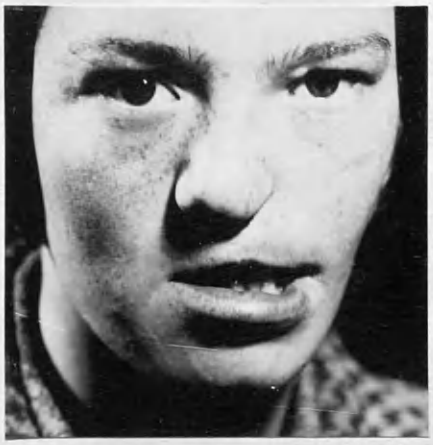


Fig.1

Fig.2

Figures 1 and 2 show the condition of macrostoma.

Fig.3

Fig.4

Figure 3 is a skiagram which shows the buried root and the position of the supernumerary tooth with deposit of calculus. Figure 4 shows this tooth after removal.

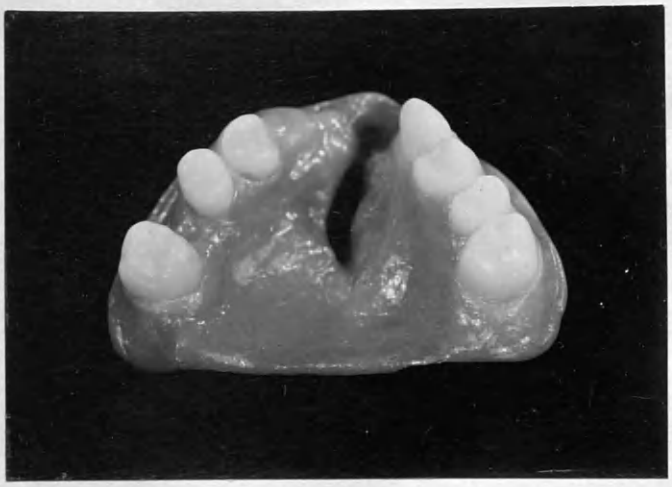


Fig.5

Condition of upper jaw
following preliminary
treatment.

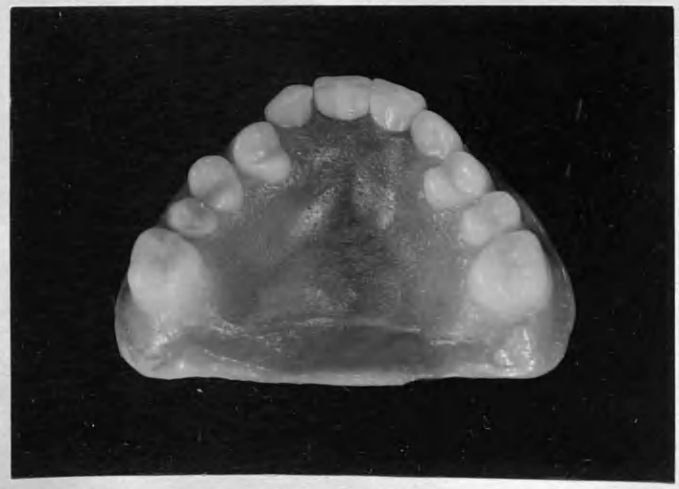


Fig.6

Appearance of upper jaw
with prosthesis.

CASE 12

Female, 10 years.

The case presented an upper jaw which had undergone previous surgical treatment, but in which the dentition was abnormal. Teeth were grossly malpositioned, and prognosis, with regard to a satisfactory result being obtained by orthodontic means, was poor.

The upper lip was firmly bound down to the alveolar ridge on the left hand side, the side on which hare-lip repair had been performed. It was therefore decided that certain teeth would be extracted, and, at the same time, the upper lip freed from the alveolar ridge.

These procedures were carried out, and an appliance, which had been constructed beforehand, was inserted immediately.

There has been marked improvement in speech, masticatory efficiency and aesthetic appearance.

The photographs which follow illustrate the progress of treatment.

Figures 1 and 2 show the oral condition prior to extraction of four anterior teeth, the freeing of the lip from the alveolar ridge, and the creating of a normal labial sulcus.

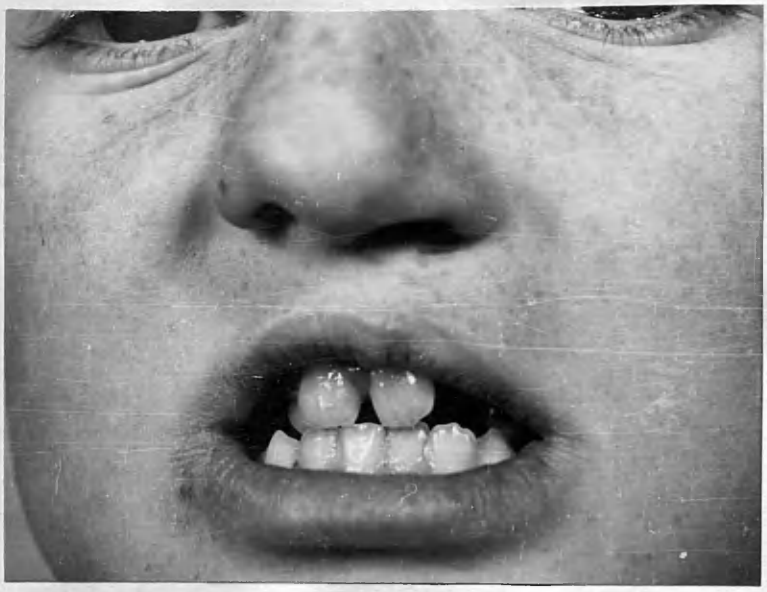


Fig.1

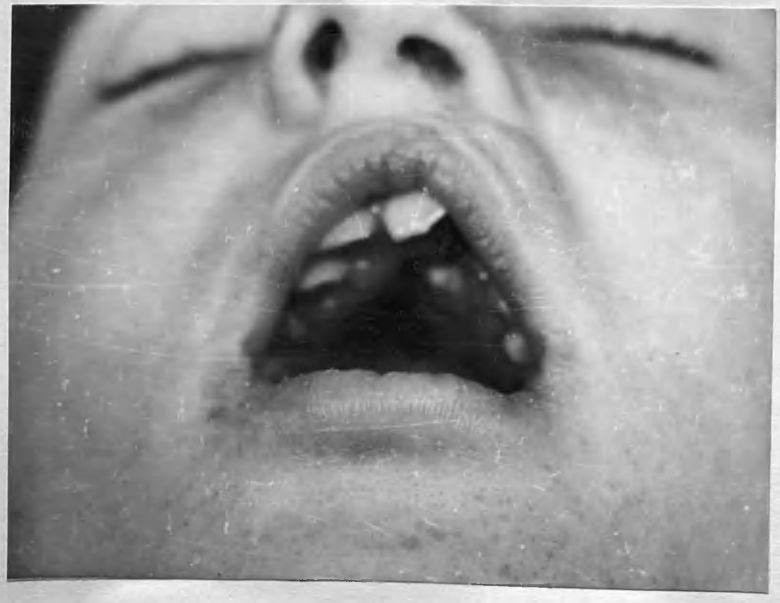
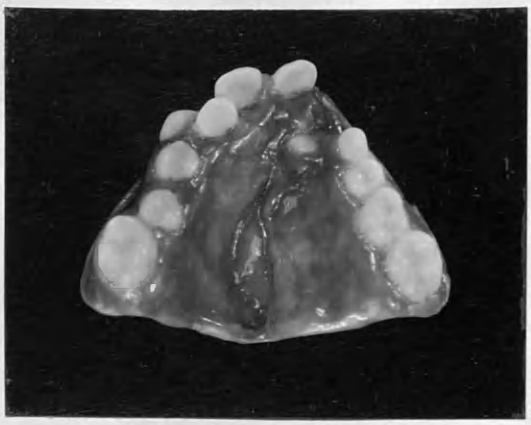


Fig.2



Before treatment.
Note the abnormal
dentition.

Fig.3

Condition after
extraction of four
anterior teeth.

Fig.4

Appearance of upper
jaw with prosthesis
in position.

Fig.5

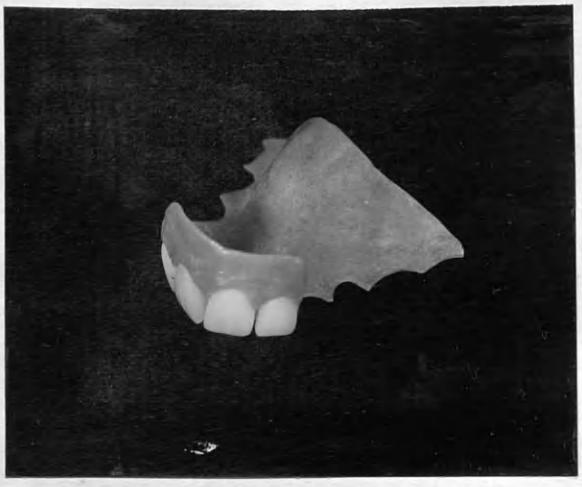


Fig.6

Prosthetic appliance.

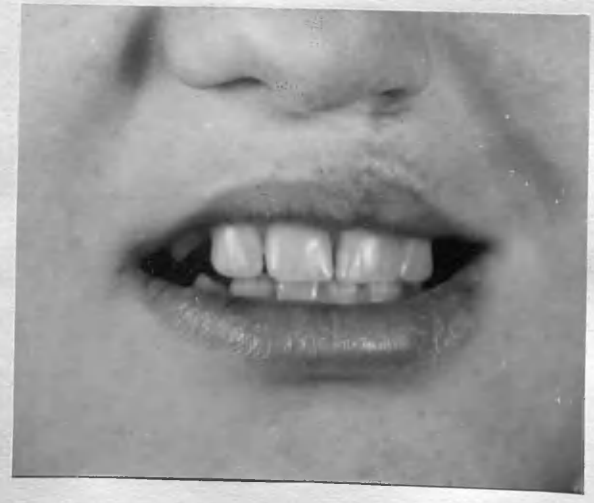


Fig.7

Appearance following completion of treatment.

CASE 13

Female, 13 years.

This case presented conditions which are frequently observed in the young patient following surgical treatment of the Class lll type of defect.

The soft palate was short and tense, and there was still a small perforation present. The hard palate tissues had broken down following surgical closure, resulting in a narrow perforation of the palate. There had been lateral collapse of the upper jaw, and dentition was abnormal.

Speech was bad, and it was decided to concentrate on this aspect of the case in the first instance.

The anterior upper teeth, and the right second premolar, were extracted. An appliance with artificial teeth, and which covered the perforations in the hard and soft palates, was fitted immediately following the extraction of the malpositioned teeth.

The fitting of this denture brought immediate marked improvement in speech.

The case is now undergoing non-surgical treatment for closure of the palatal defects. These methods of treatment are discussed later in this thesis.

(The case is illustrated overleaf).

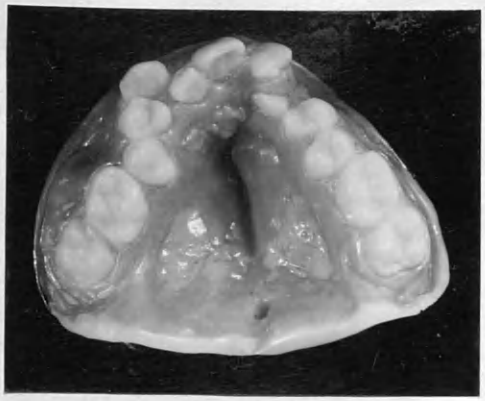


Fig.1

Oral condition prior to commencement of prosthetic treatment.

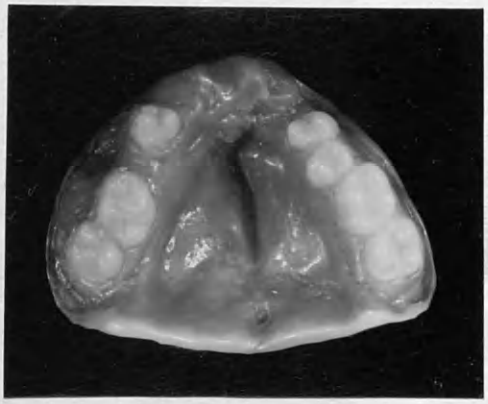


Fig.2

Condition following the extraction of teeth.

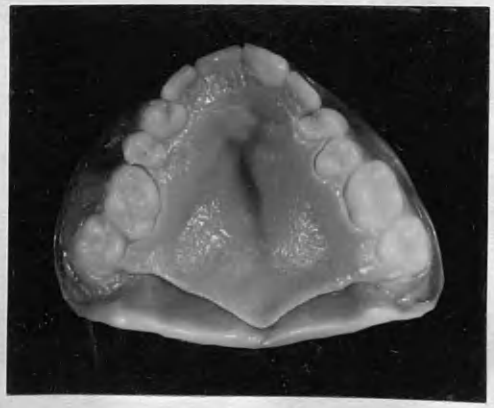


Fig.3

Upper jaw after the fitting of the prosthesis.

Original methods of non-surgical closure of palatal defects were applied in the treatment of the four cases which follow:-

Nos. 14 - 17.

CASE 14

Male, 17 years.

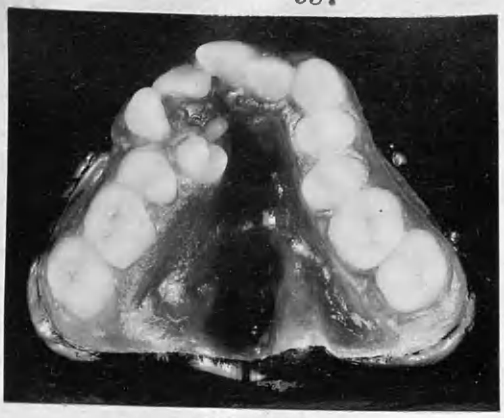
The case, Class lll type, presented an upper jaw which was deformed, and the teeth malpositioned.

Break-down of the tissue following surgical procedures resulted in a perforation through the anterior part of the hard palate, and a large perforation which involved the posterior part of the hard palate and most of the soft palate. The soft palate was merely a narrow band of tissue measuring $\frac{1}{4}$inch antero-posteriorly.

Treatment consisted of extraction of certain teeth; surgical removal of the soft palate remnants; expansion of the arch; closure of the palatal perforations by orthodontic means; and finally, the fitting of a prosthesis.

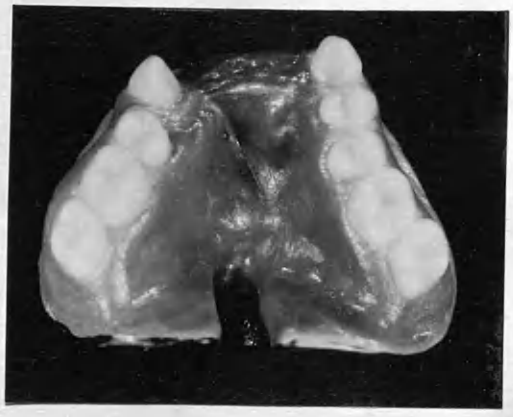
Fig.1

Figure 1 shows the narrow band of tissue which constituted the soft palate.



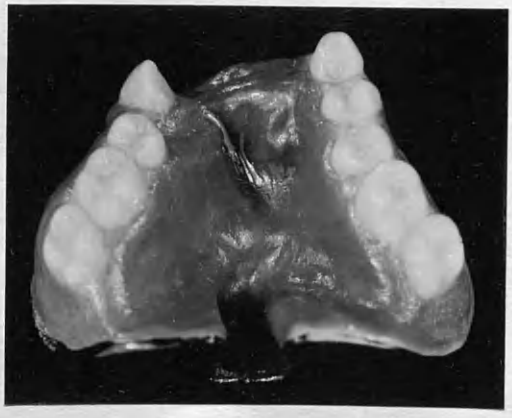
Appearance of upper jaw before commencement of treatment.

Fig.2.



Six months after treatment had been commenced.

Fig.3.



Appearance of maxilla ten months after the treatment had been commenced.

Fig.4.

Fig.5

Skiagram showing condition of upper jaw prior to the commencement of treatment.

Fig.6

Condition of jaw three months after commencement of orthodontic procedures. Note the formation of new bone.

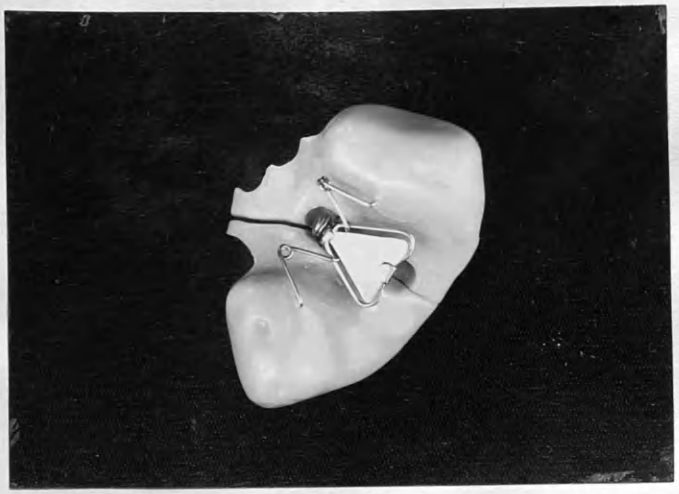


Fig.7

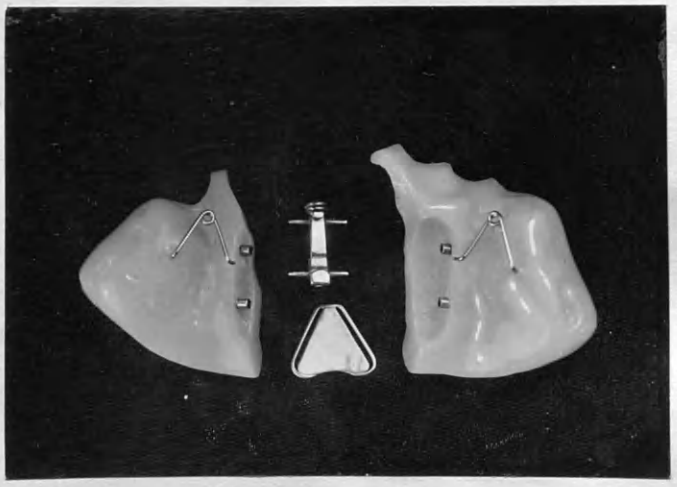


Fig.8

Figures 7 and 8 illustrate the appliance which was used for arch and palate correction. This appliance was of original design, and so constructed that con-controllable continuous gentle pressure was brought to bear upon the tissues, thus stimulating the growth impulse.

Fig.9

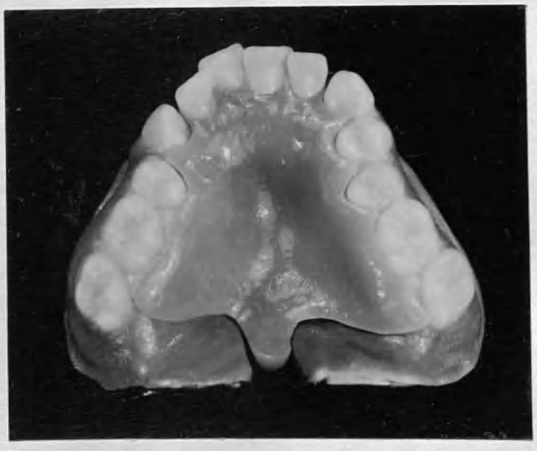


Fig.10

Figure 9 shows the prosthetic appliance which was fitted. It was of the two-piece type, the artificial velum being attached by means of a hinge having universal action.

Figure 10 shows the appearance of the upper jaw with prosthesis in position. (The velum was detached for the taking of this photograph).

CASE 15

Male, 7 years.

The case was of Class 1V type. The soft palate had undergone successful surgical treatment. The hard palate tissues had broken down following surgical procedures however, and the palate now presented a perforation. The premaxilla was malformed, and protruded abnormally. The upper jaw was extremely narrow, probably due to lateral collapse following surgical closure of the bilateral hare-lip, and attempt at closure of the hard palate cleft.

Treatment extended over a period of eighteen months. Expansion of the arch was commenced immediately. The appliance which was used also served to bring about closure of the defect in the hard palate. This type of appliance has been described in the presentation of Case (14).

When the necessary arch expansion had been obtained, the premaxilla was removed surgically, and a prosthesis, which had been constructed just prior to the commencement of surgical measures, was inserted immediately.

An interesting feature of this case is that the patient has two younger brothers who are identical twins.

The photographs which follow, illustrate the various features of the case.

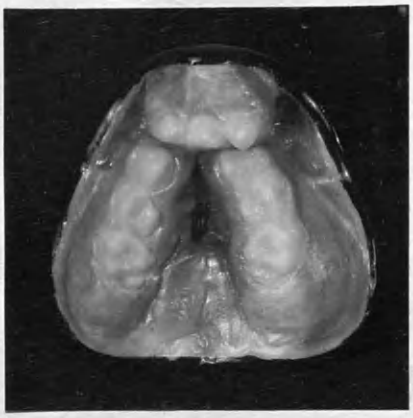


Fig.1

Condition of upper jaw before commencement of treatment.

Fig.2

Appearance of jaw twelve months after commencement of treatment.

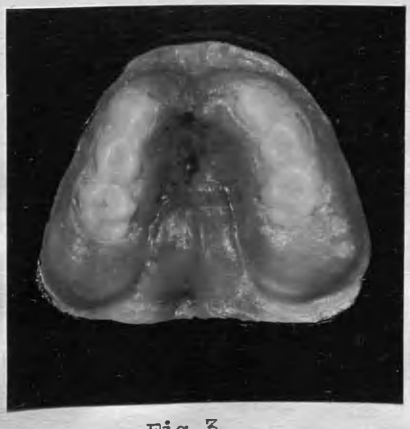


Fig.3

Appearance after eighteen months of treatment. Premaxilla was removed during the fifteenth month.

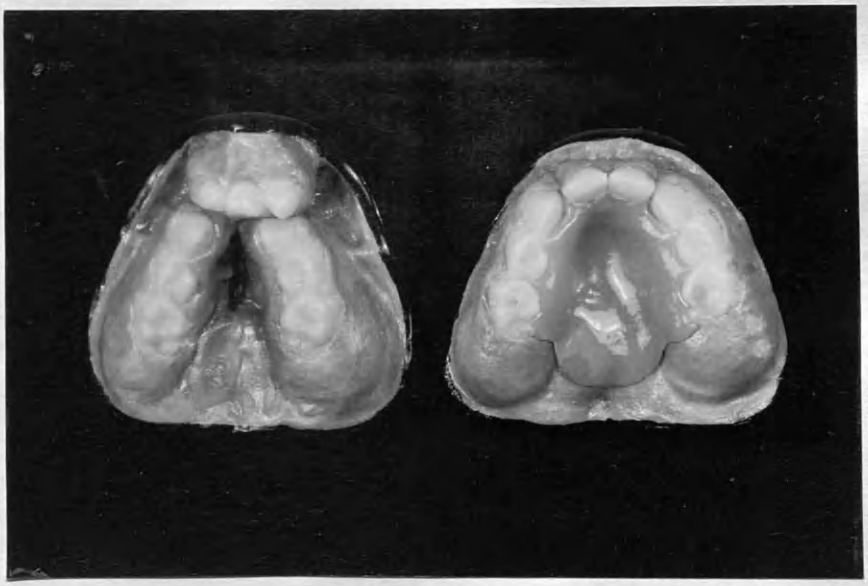


Fig.4

The appearance of the jaw before treatment had been commenced, and after orthodontic, surgical and prosthetic procedures had been carried out, is shown in Figure 4.

The degree of expansion which was required, and the symmetry of arch obtained, following orthodontic treatment, surgical removal of the premaxilla and the fitting of a prosthesis, are shown.

The two photographs which follow show lateral aspects of the oral condition before and after treatment.

Fig.5

Oral condition
before treatment.

Fig.6

Oral condition
after treatment.

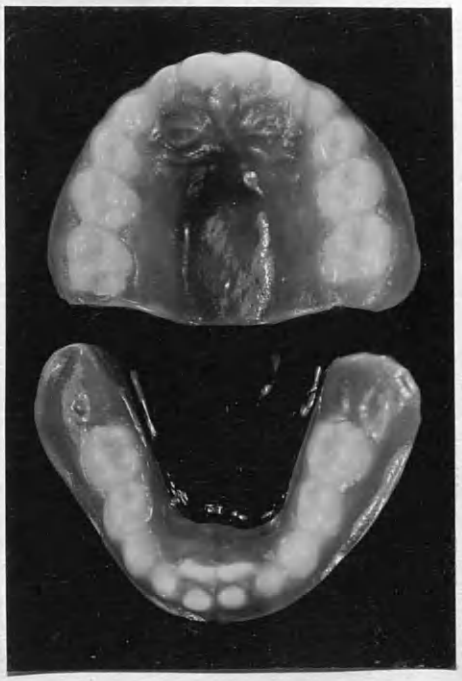


Fig.7

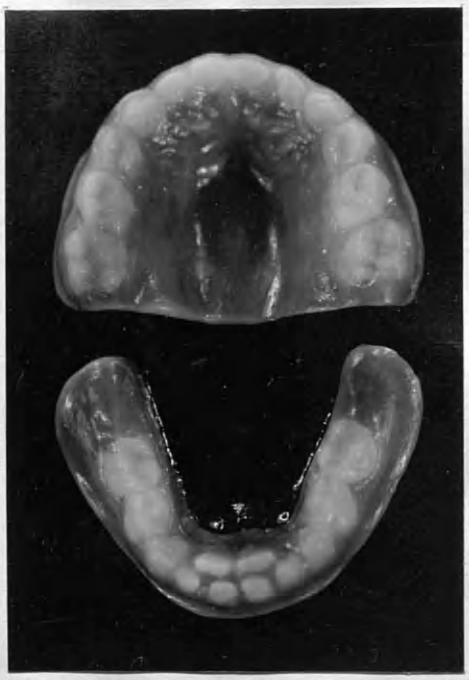


Fig.8

Figures 7 and 8 illustrate the oral conditions of the patient's two brothers who are 'identical' twins.

The marked similarity of the arches, and the almost identical dentition, are shown.

CASE 16

Female, 13 years.

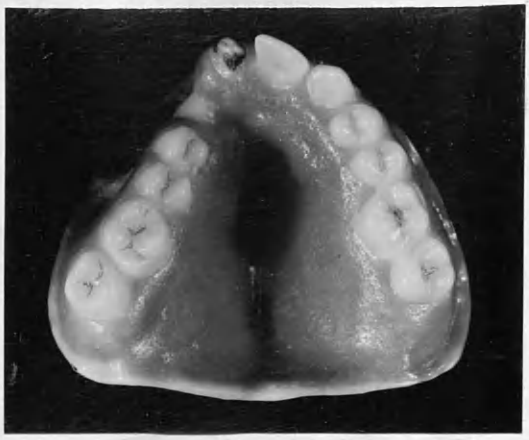
The case was of Class lll type. The hare-lip and cleft palate had undergone previous surgical treatment, but break-down of tissue resulted in a perforation of the hard palate. There was also lateral collapse of the right maxilla, and the teeth in the right side of the mouth were in malocclusion.

The right upper central incisor tooth was extracted. Measures were then taken to bring about correction of the right maxilla, and non-surgical closure of the palatal defect. When a certain amount of expansion had been obtained, the right canine tooth, which was in gross malposition, was extracted and corrective measures continued. On completion of these procedures, a prosthesis was fitted.

The results which were achieved are illustrated by the photographs which follow.

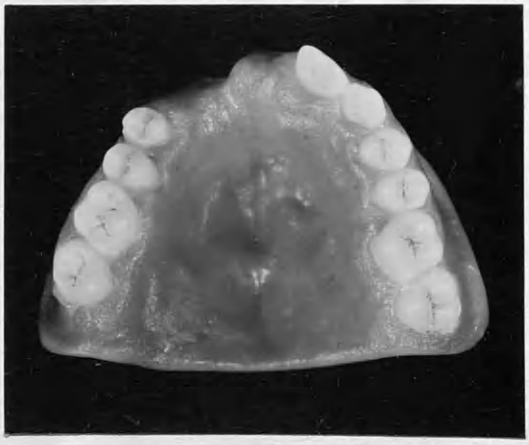
A feature of the case is that the patient has a brother, aged 7 years, who has a Class lll malformation of the same side.

(Illustrated overleaf).



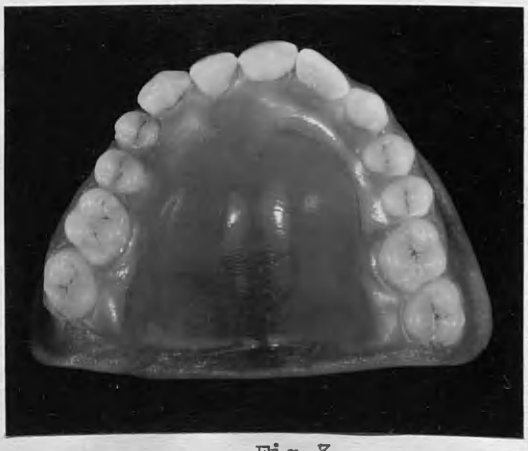
Condition of upper jaw on presentation.

Fig.1



Condition of jaw after treatment. (12 months)

Fig.2



Appearance of upper jaw with prosthesis in position.

Fig.3

CASE 17

Female, 17 years.

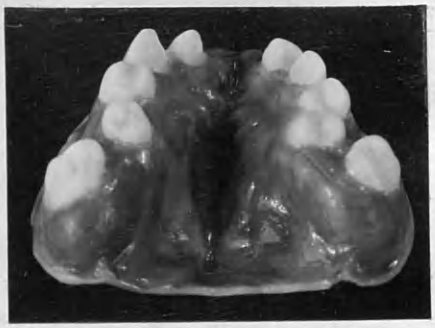
The case presented a large fissure in the hard palate as a result of break-down of tissue following attempt at surgical closure of the hard palate cleft. The soft palate had been repaired successfully. The two incisor teeth and the permanent first molars were missing.

Preliminary treatment consisted of the extraction of the right lateral incisor and the two second premolar teeth.

Expansion of the upper arch was then commenced. The appliance used for this procedure was of original design, and was constructed in such a way that it would serve to stimulate tissue growth in the region of the borders of the palatal defect.

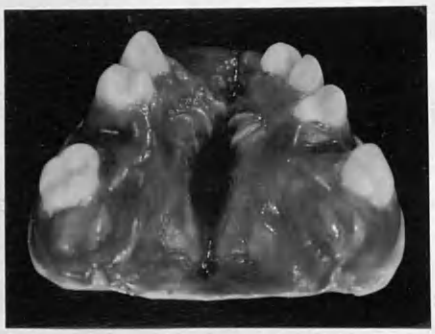
The results achieved were most gratifying, closure of the fissure being accomplished without the aid of surgical measures.

The photographs which follow illustrate the progress of treatment. Figure 1 shows the oral condition presented by the patient. Figures 2, 3 and 4 show the progress made at intervals of two months. The orthodontic appliance is shown in Figures 5 and 6; the prosthesis which was fitted is illustrated in Figures 7 and 8.



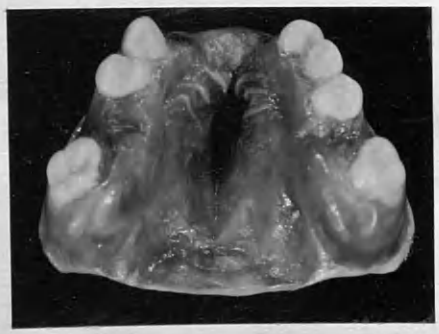
Condition before commencement of treatment.

Fig.1



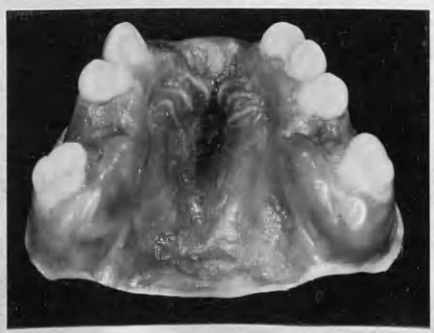
Two months after treatment had been commenced.

Fig.2



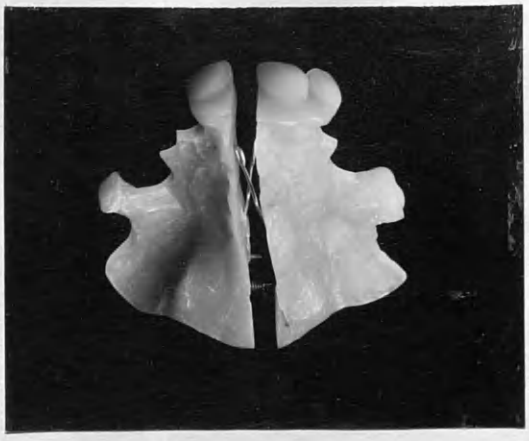
Four months after commencement of treatment.

Fig.3



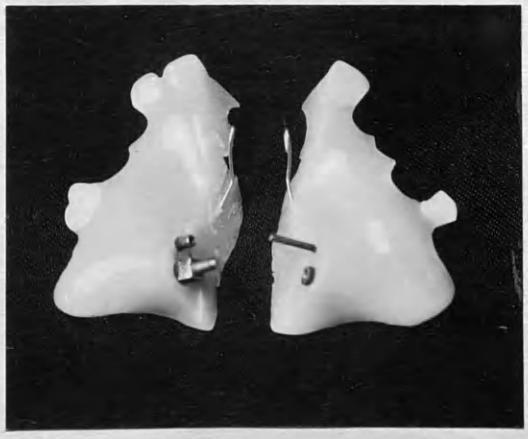
Appearance at the end of six months.

Fig.4



Fitting surface of appliance used for correction of arch and palate.

Fig.5



Lingual aspect of dismantled appliance showing expansion screw and springs.

Fig.6

The appliance shown in Figures 5 and 6 is of simple design, function being obtained by means of an expansion screw and finger springs. The thread of the screw was modified in order to introduce a certain amount of side-play. The anterior part of the appliance is thus activated by controllable spring pressure.

Fig.7

Prosthetic appliance.

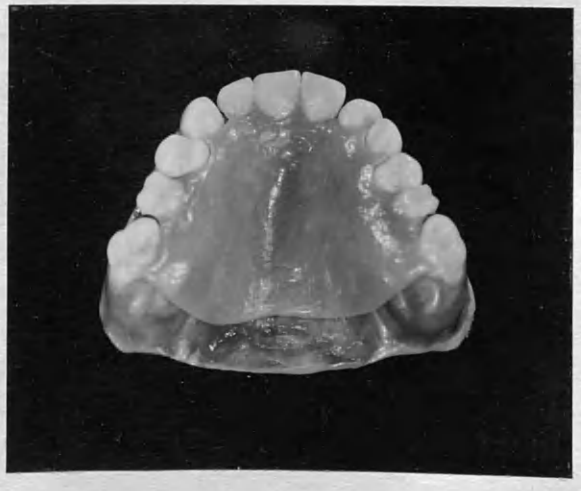


Fig.8

Appearance of upper jaw with prosthetic appliance fitted.

The cases which follow serve to illustrate the application of prosthetic procedures in the treatment of acquired deformity of the oral and facial tissues.

CASE 18

Male, 52 years.

The case was one of maxillo-facial injury sustained during the first World War.

A bullet made its entry below the left eye and passed obliquely downwards through the antrum, carrying away the left tuberosity of the maxilla. It then struck a mandibular molar tooth on the right side, was deflected upward and backward, and lodged below the right ear. The missile was removed a short time after the injury had been sustained.

The patient lost the sight of the left eye; an artificial eye is now worn.

The upper jaw presented a large perforation of the maxilla; and there was tissue loss involving the left tuberosity and part of the soft palate.

Prosthetic treatment consisted of the fitting of a denture with obturator. The obturator was hollow in order to cut down the weight of the appliance to a minimum.

The results obtained were very satisfactory. Speech improved immediately; the functions of mastication and deglutition were restored to normal; the aesthetic appearance was enhanced.

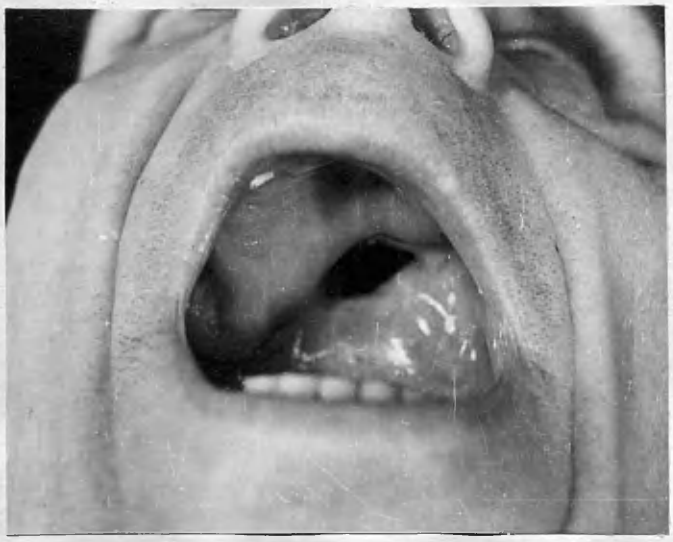


Fig.1

Oral condition.

Fig.2

Prosthetic appliance.

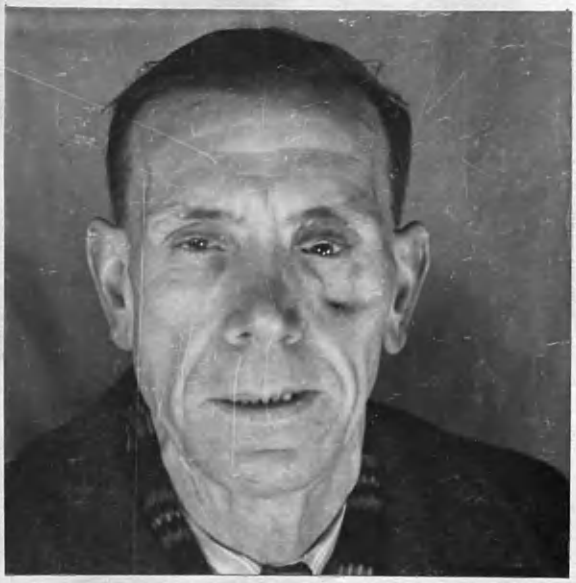


Fig.3

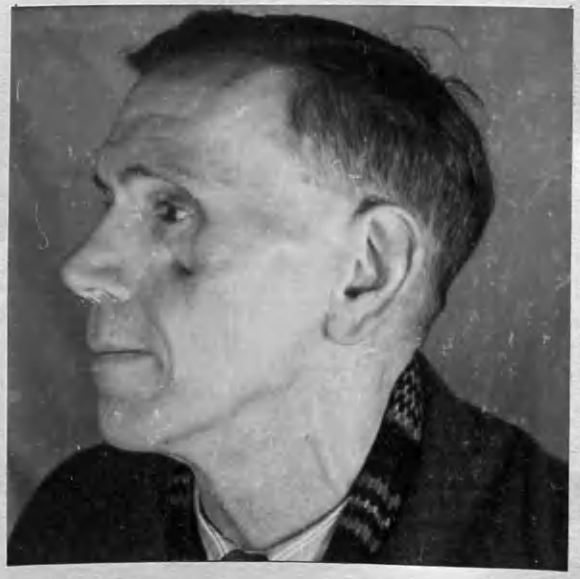


Fig.4

Figures 3 and 4 show the appearance of the patient after prosthetic treatment had been completed.

CASE 19 [x]

Male, 70 years.

"...Thirty years previously the patient had undergone an operation for the surgical removal of a tumour in the left maxilla, and the mouth now presented certain difficulties and complications.

Fig.1 shows the appearance of the upper jaw and the extent of the cavity resulting from operation.

Fig.1

During the course of many years, various appliances had been fitted but without any great degree of success. Lack of retention necessitated the use of buccal springs from the appliances to bands on the lower posterior natural teeth. In view of the patient's advanced age and the unsound condition of the teeth in the lower jaw, an alternative/

(x McNeil, C. Kerr (1947). "Three Mechanically Operated Obturators", B.D.J., Vol. LXXXlll, No.3.)

/alternative method of retention had to be found. It was thought that the cavity in the maxilla might be utilised for retentive purposes, thereby dispensing with the necessity for the fitting of buccal springs.

An appliance was designed, the obturator part of which almost filled the cavity. It was necessary to construct this appliance with a mechanical action permitting insertion and removal.

Fig.2 shows the appliance which was constructed. It will be seen that the 'end pieces' or projections of the obturator are movable.

Fig.2

Zelex was used as the impression material, great care being taken that an accurate impression of the floor of the cavity was obtained, thus ensuring a well fitting obturator.

Fig.3 illustrates the position of the end pieces for insertion and removal.

Fig.3

Fig.4 shows the components. Moving parts were bushed with stainless steel ribbon, viz. the end pieces, and the hole through which passes the control rod.

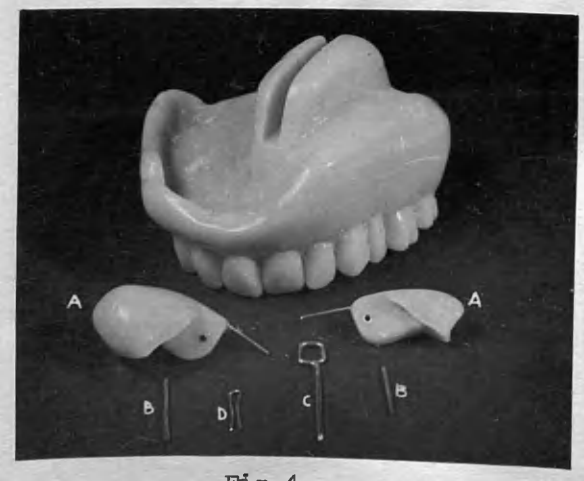


Fig.4

Fig.4. - A, End pieces. B, Shafts for end pieces.
C, Control rod. D, Locking device.

The control rod is actuated by the patient. The end of this wire is bent at right angles in an anterior direction. The piece which projects forward is $\frac{1}{8}$in. in length. This small projection lies in a shallow depression on the lingual surface of the palate of the appliance when in the locked position.

Fig.5 shows the finger control. It has been found that this causes no discomfort to the patient's tongue, and it is easily actuated by the patient merely slipping a finger-nail underneath the projection and easing in a downward direction.

Fig.5

A locking device is incorporated. This is a U-shaped piece of 0.6mm. stainless steel wire, the arms of which pass on each side of the control rod which has a groove cut at the correct level. In the locked position the wires slip into this groove....

An Alternative Method of Treating a Similar Condition.

An alternative method of actuating the end pieces is shown in Figs.6-8. This method would be used in cases where the roof of the cavity was such that insufficient height would limit the upward movement of the end pieces as in the previous appliance.

In the appliance illustrated only the anterior projection has been mobilised as this was found to be sufficient in the case in question, but the same principle may be applied to the posterior projection if required.

Fig.6

Fig.6 shows the appliance with the anterior projection in the locked position.

Fig.7 shows the projection retracted for insertion and removal of the appliance.

The components of the appliance are shown in Fig.8."

Fig.7

Fig.8

Fig.8.—A, Anterior projection. B, Crank.
C, Shaft for crank. D, Control rod.

CASE 20

Male, 55 years.

Case presented extensive deformity of the right maxilla as a result of injury sustained several years previously. Speech, and the functions of deglutition and mastication were impaired. Appliances which had been fitted previously were unsatisfactory, complications with regard to retention being present.

The appliance which was fitted was constructed in such a way that the obturator passed well into the cavity in the upper jaw, thereby gaining the maximum retention. In order to achieve this, it was necessary to permit the impression material to pass well into the cavity, thus allowing the construction of a model of the upper jaw with the entire cavity. The appliance was constructed on this model.

Results obtained were entirely satisfactory, the patient being enabled to overcome the effects of the deformity.

The photographs which follow illustrate features of the case.

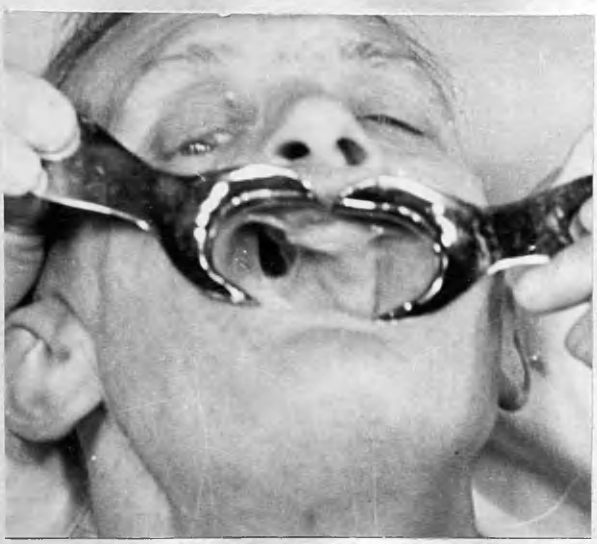


Fig.1

Fig.2

Figures 1 and 2 show the position and extent of the deformity.

Fig.3

Figure 3 illustrates the palatal aspect of the appliance. The obturator portion of the appliance is shown. In order to reduce weight to a minimum, the obturator was hollow.

CASE 21

Female, 54 years.

The case presented severe oral and facial deformity as a result of loss of tissue following acute osteomyelitis. Several surgical operations had been performed some years previously, and the right side of the mandible had been removed. There had been involvement of the soft tissues of the face which now presents a deep indentation and large areas of scar tissue. The oral condition presented acute complications with regard to the fitting of dentures.

The appliance which was fitted was of original design, and consisted of full upper and lower dentures which were connected by a system of spring levers. Chafing and irritation of the soft tissues by the springs was prevented by the fitting of stainless steel buccal plates or guards. These plates were attached to the spring levers in such a way that they would remain stationary even when the springs were functioning during mastication.

This appliance has proved to be completely satisfactory.

The aesthetic appearance of the patient was enhanced by the fitting of a facial prosthesis. This was constructed in hard acrylic resin tinted to match the natural tissues.

Features/

/Features of the case are illustrated below.

Fig.1

Appearance of lower jaw.

Fig.2

Fitting surface of
lower denture.

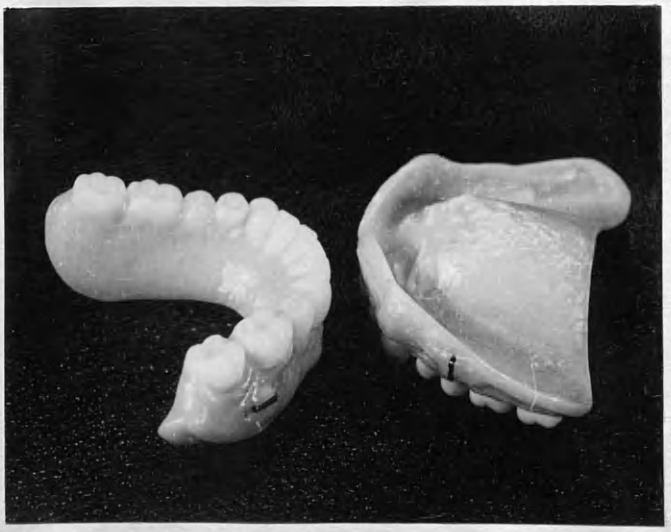
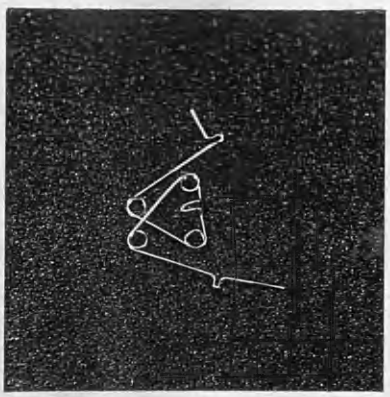


Fig.3

Upper and lower dentures before the spring levers and buccal guards have been fitted. Note the small stainless steel tubes for the attachment of springs and guards.



Spring levers.

Fig.4

Buccal plate.

Fig.5

Spring with buccal plate attached.

Fig.6

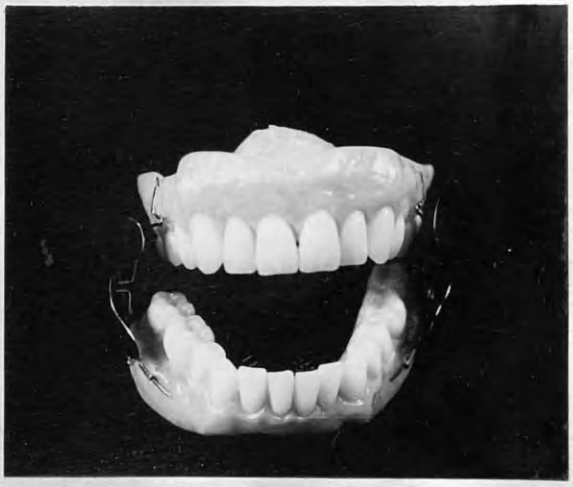


Fig.7

Fig.8

Figures 7 and 8 show
appliance assembled.

Fig.9

Fig.10

Figures 9 and 10 show the facial prosthesis.

Fig.11

Fig.12

Figures 11 and 12 show the patient before and after the fitting of the facial prosthesis.

THE YOUNG PATIENT.

Although much can be done to assist the adult patient in overcoming the effects of his disability by prosthetic means, there can be no doubt that treatment afforded to the young patient may be of great value. The bringing about of conditions which tend towards the attainment of normal speech and deglutition is one aspect of treatment which is of paramount importance, and one which should be undertaken before harmful habits with regard to speech and deglutition have become established.

Cases have already been described in which closure of palatal defects has been obtained by means of orthodontic measures. These methods are now being applied to some of the cases illustrated below, the patients having already benefited, with regard to speech and deglutition, by the fitting of prostheses at an earlier age.

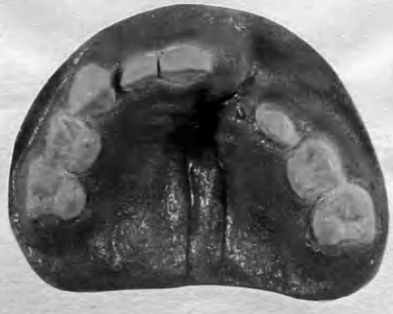


Fig.1

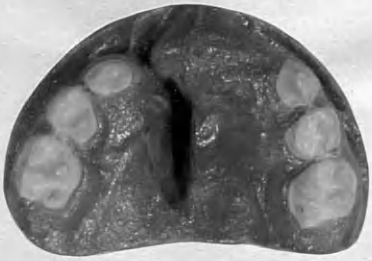


Fig.2

Fig.3

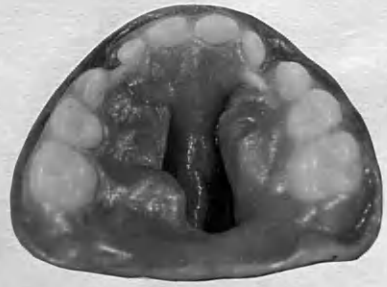


Fig.4

Fig.5

Premaxillary Retraction:

The obtaining of a normal dental arch at an early age is of importance. It frequently happens that a certain amount of deformity of the upper jaw results from surgical closure of palatal clefts. Moreover, in severe cases where the malformation is of Class lV type, protrusion of the premaxilla may be so pronounced that surgical procedures alone may prove inadequate for the correction of the condition.

The photographs which follow illustrate cases in which there is abnormal protrusion of the premaxilla.

Fig.1

Fig.2

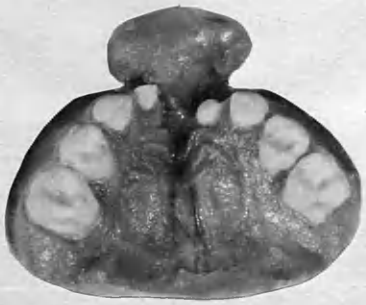


Fig.3

Fig.4

Methods have been employed for the correction of malpositioned premaxillae. As will be seen from the photographs which follow, this is achieved by extra-oral procedures. It must be pointed out, however, that it may be necessary, in some cases, to fit temporary intra-oral retaining appliances following the positional correction of the premaxilla.

These methods of premaxillary retraction may be combined with arch expansion procedures. Indeed, in some cases combined/

/combined treatment is actually indicated, as in cases where there is lateral collapse of the upper jaw with resultant narrowing of the alveolar gap which should be occupied by the premaxilla.

Figure 5 illustrates the appliance which is used for premaxillary retraction.

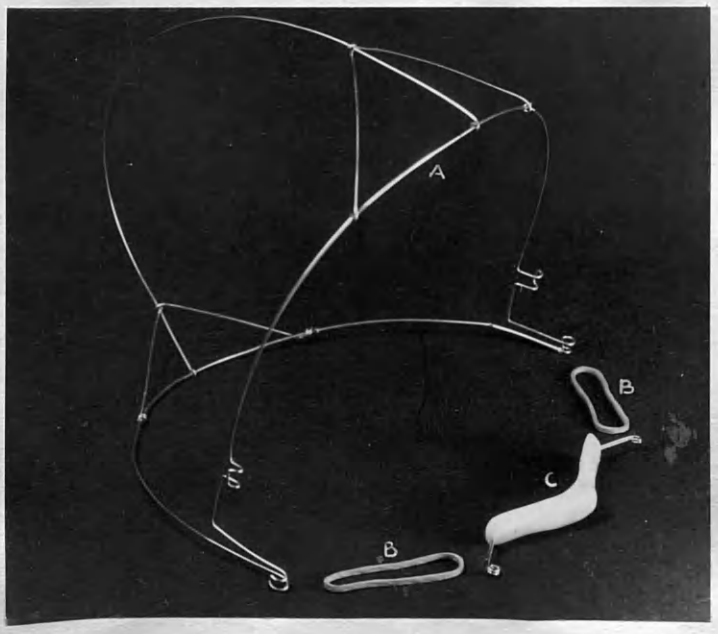


Fig.5

Components of the appliance. A, stainless steel head harness; B, rubber bands; C, labial attachment.

Practical application of the premaxillary retraction appliance is shown in the illustrations which follow. It has been found that this appliance is tolerated well, even by the very young child.

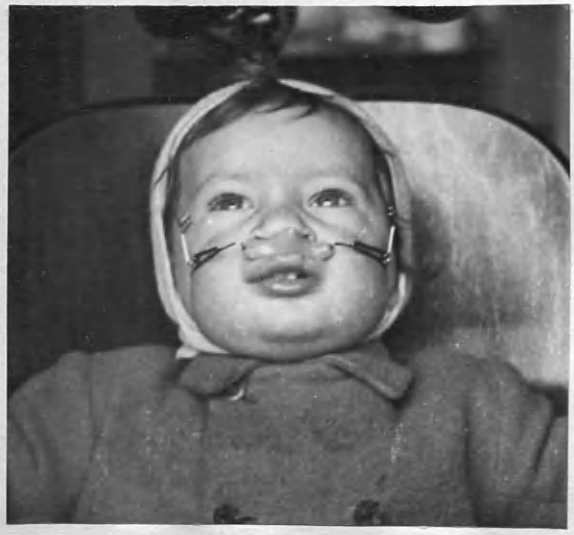


Fig.6

Fig.7

Age, 10 months.

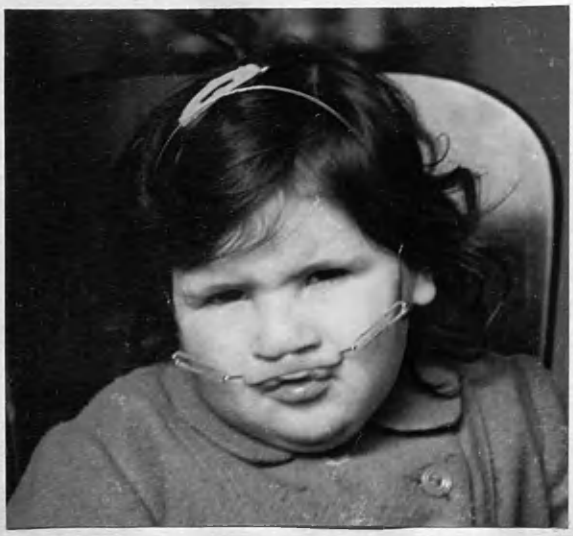


Fig.8

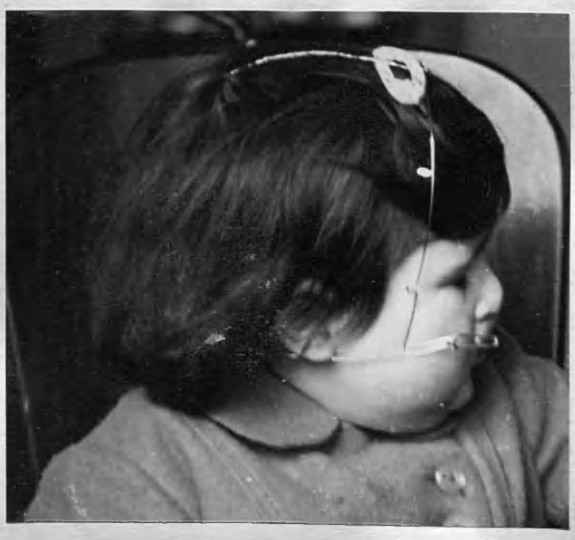


Fig.9

Age, 1 year, 10 months.

Fig.10

Fig.11

Age, 2 years, 6 months.

TECHNICAL PROCEDURES.

Universal Hinges :-

In the presentation of Cases in which two-piece appliances have been utilised, mention has been made of hinges which are in the nature of universal joints. The hinges which have been used in these Cases are of original design, and are of three main types.

The construction of Type 'A' has already been described in Case 7 (p.71.)

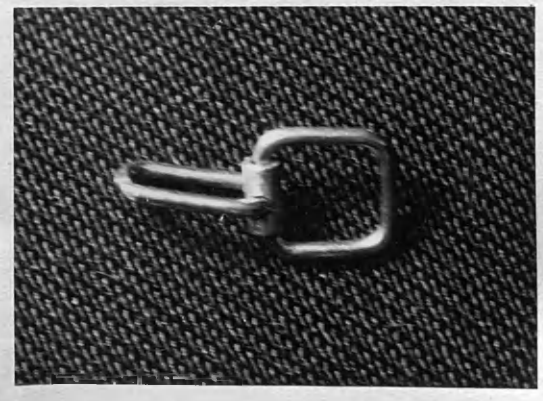


Fig.1

Universal hinge
Type 'A'

Type 'B' universal hinge is of different construction but has the same function as Type 'A'. The illustrations which follow show its construction. It consists of two pieces/

/pieces of stainless steel tubing which are welded or soldered together at right angles to each other, the links of the hinge being made by passing stainless steel wire through the tubes, and bending into the required shape. It will be seen that these links interlock. This is a safety measure to ensure that no harm may result in the event of fracture taking place at the welded joint.

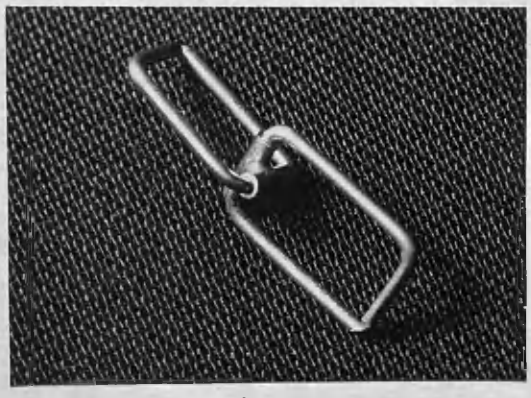


Fig.2

Universal hinge
Type 'B'.

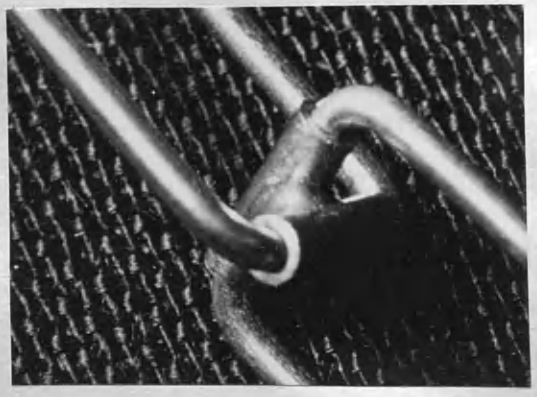
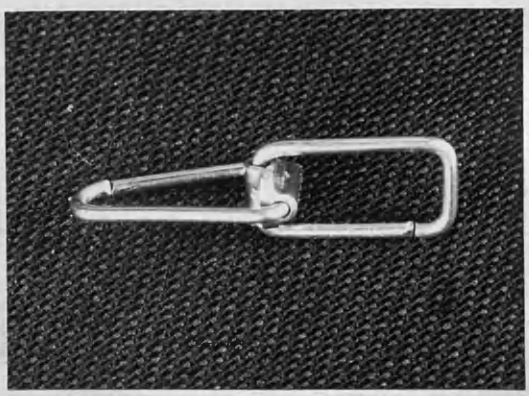


Fig.3

Detail of welded
or soldered joint.

The hinge which has superceded previous patterns is Type 'C' universal hinge. It is a modification of Type 'B', the difference being that the tubing which is used for the joint is flanged. This allows a greater area for welding, and thus ensures a stronger joint.

The photographs which follow illustrate the hinge and its construction.



Universal hinge
Type 'C'.

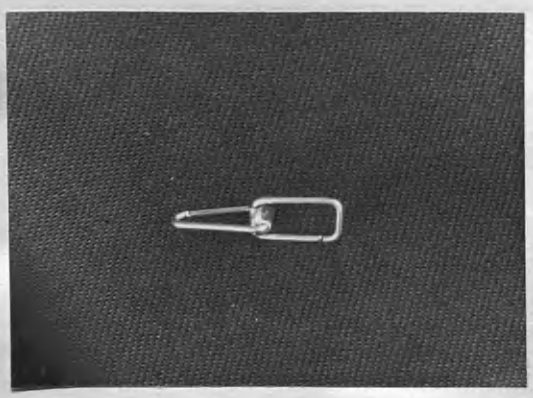


Fig.5

Type 'C'.
(actual size).

Figures 6 and 7 show steps in the construction of Type 'C' universal hinge.

Fig.6

Two sections of flanged tubing.

Fig.7

The two sections have been welded together, and the joint shaped by grinding.

The links of the hinge are then constructed of stainless steel wire as described for Type 'B' hinge.

Artificial Velum:-

The achieving of satisfactory results from the fitting of a movable artificial velum depends upon its method of construction conforming to certain requirements:

It must be attached in such a way that it is free to follow the movements of the soft tissues.

There must be no escape of air between velum and denture.

The first requirement is obtained by attaching the velum to the denture by means of a universal hinge. The method of attachment is as follows:

During the construction of the denture - ie. the fixed portion of the appliance, - the denture is extended distally into the soft palate cleft for a short distance. This extension is shaped in such a way that the major portion of it becomes part of a sphere, whilst the remaining portion forms a lip which projects backward and downward. (see Fig.3. p.144.)

A socket is now cut in the extension. This socket is utilised for attachment of the hinge. Wax is built round one link of the hinge, and an impression taken of the socket, thus obtaining a block of wax which fits the socket/

/socket exactly. Wax is also moulded round the free link, and a small regularly shaped block carved. The hinge is now flasked, and the blocks finished in acrylic resin.

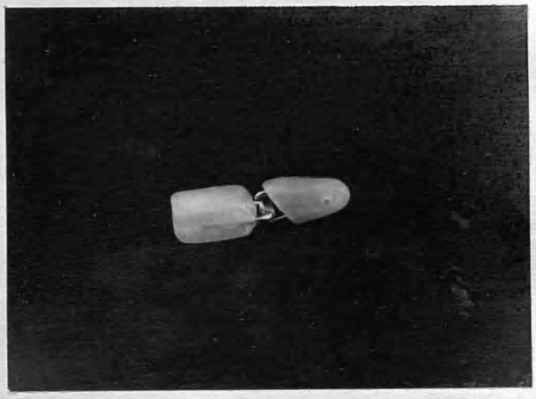


Fig.1

Hinge with acrylic blocks attached.

The hinge is attached to the denture by inserting the acrylic block into the socket. It is then locked in position by drilling a hole through the denture extension and block, and inserting a stainless steel retaining pin.

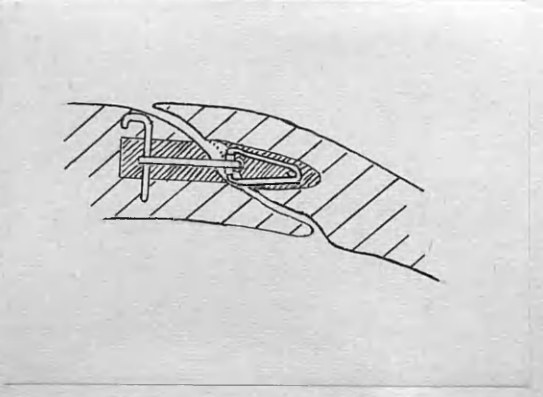


Fig.2

Method of attachment.

The composition velum is then conformed over the acrylic block on the free link. Its method of construction has been described previously in Case 7 (p.70.)

The finished acrylic resin velum is attached to the hinge in exactly the same manner as that described for attaching the hinge to the denture.

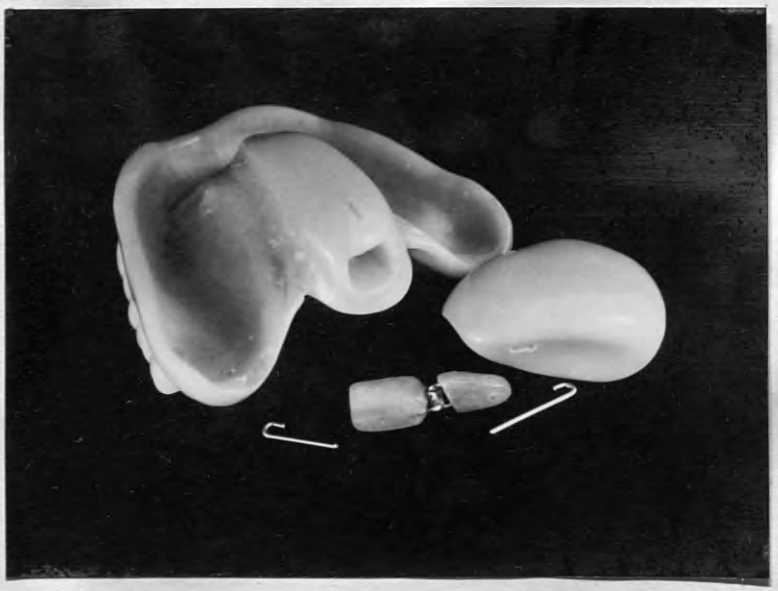


Fig.3

Denture with obturator, artificial velum, hinge and retaining pins.

The second important requirement which the two-piece appliance must possess is that no air must pass between artificial velum and denture.

When the artificial velum has been conformed in impression compound by the soft tissues, and trimming by hand has been completed, a final adjustment is made prior to its removal from the denture for completion in acrylic resin.

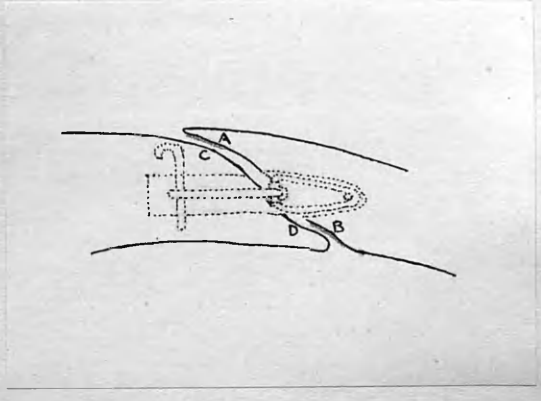


Fig.4

Explanatory diagram.
(elevation)

Wax is added to portions A and B of the velum. While the wax is still soft, the appliance is inserted, and the patient instructed to close the mouth and swallow several times. In this way, impressions of the portions C and D of the denture extension are taken up by the wax at A and B. The appliance is then removed from the mouth, and the velum detached for finishing in acrylic resin.

These/

/These procedures result in an artificial velum which, when at rest, will form an airtight contact at point BD, and in the elevated position, at AC. The spherical shape of the extension allows this valve-like action to take place no matter how much the velum may move in lateral directions.

FINDINGS.

Examination of records of 31,953 infants born during a period of ten years showed the incidence of congenital cleft palate to be one case in approximately 1,600 births.

The statistics which follow, have been compiled from a series of 250 cases which were examined and treated.

Sex.	Cases treated.
Male.	125
Female.	125

The following table illustrates the incidence of the various types of malformation observed in the series of cases :

Class.	Male.	Female.
Class 1.	5	13
Class 11.	22	36
Class 111.	65	60
Class 1V.	27	8
Alveolar ridge only.	6	8

The foregoing table would appear to point to the fact that males are less subject to the lesser degrees of malformation/

/malformation, but more subject to conditions where soft palate, hard palate, alveolar ridge and lip are involved.

The series presented 125 cases in which the condition was of Class lll type, - involvement of soft palate, hard palate and alveolar ridge.

Class lll type malformation.		
Position of alveolar involvement.	Male.	Female.
Left side.	49	41
Right side.	16	18
Median.	—	1

The deductions to be drawn from this table are that the condition occurs more often on the left than on the right side, and that median malformations are rare.

Although it was established that a family history of congenital cleft palate and 'associated conditions' existed with regard to many of the cases, no figure, sufficiently accurate for statistical purposes, could be arrived at with any degree of certainty. This was due to reticence on the part of patient or parent to divulge facts which, in many cases, might have been of the utmost importance.

It was found that twins, or a history of twinning, existed in many of the families in which the 250 cases occurred. It was also found that, where a family history of both twinning and congenital oral deformity existed, these two conditions occurred invariably on the same parental side of that family.

In the series of 250 cases concerned, twins, or a history of twinning, existed, as far as could be ascertained, in 160 instances. This represented an incidence of 64%.

It was observed that the condition of ocular hypertelorism occurred, not only in many of the cases, but frequently in members of their families or in one of the parents, despite the fact that they themselves did not suffer from oral malformation.

Some patients were found to exhibit abnormal endocrine effects. It was also observed, in some instances, that blood relations, although exhibiting no oral deformity, showed signs and symptoms of endocrine disturbance.

Clinical tests, and radiological examination of patients fitted with special appliances, revealed that the/

/the soft palate remnants in cleft palate cases are capable of simulating the movements of a normally functioning soft palate. It was also noticed, in many instances, that the tissues on one side of the soft palate cleft had a greater degree of mobility than those of the opposite side.

Practical application, and clinical observation showed that the two-piece appliance was the most satisfactory type of prosthesis in the great majority of cases.

Tests carried out on hinges for the attachment of artificial vela showed that these, to obtain successful results, had to be universal in action. It was also further proved that these hinges had to be constructed in the same metal throughout. In experimental cases where hinges were constructed in two different metals, rapid wear took place, due, in all probability to electrolytic action. In some cases it was noticed that the greater amount of wear occurred in the harder of the two metals, not the softer as would be expected. The metal which proved to be entirely successful was stainless steel.

A/

/A mode of treatment, which proved successful, was the application of orthodontic principles in the non-surgical closure of palatal defects. It was found that stimulation of the growth impulse was possible, and that the most favourable results were obtained when osteogenic potentiality was high — during the eruption of certain teeth. It was also observed that the correction of mal-positioned teeth could be accomplished successfully, even when these teeth were in close proximity to the defect in the alveolar ridge.

A series of 100 cases, drawn at random from the main series of 250 cases, appears below in summarised form. These cases serve to illustrate and emphasise the main features and characteristics which were found to occur in such patients. These various features are discussed later in this discourse.

SUMMARY OF 100 CASES.

Case 5. Male, 18 years. Mother had severe fall during 4th month pregnancy. History of twins on mother's side.

Case 7. Female, 15 years. Mentally deficient. Has macrostomia. History of twins on mother's side.

Case 9. Male, 9 years. Father's sister has cleft palate. Father's other sister has congenital nasal deformity. Father's brother went blind at age of 12. History of twins on father's side.

Case 12. Male, 37 years. Brother has twins. History of twins on mother's side.

Case 13. Male, 7½ years. Has younger brothers who are twins.

Case 16. Female, 43 years. History of twins on mother's side.

Case 17. Male, 8½ years. 7th in family of 7. Upper lateral incisor teeth missing. Mother had fall during 4th month of pregnancy.

Case 21. Male, 2½ years. Grandfather's brother (father's side) had hare-lip.

Case 23. Female, 24 years. Deaf. Brother has hare-lip. Father was a twin. Grandmother's brother (father's side) had twins.

Case 24. Male, 63 years. Congenital heart condition. Has webbed toes. Had 6 children, 1st, 3rd and 5th have webbed toes but no oral condition.

Case 25. Male, 4 years. Has congenital eye condition. History of cleft palate (mother's side). History of twins (mother's side).

Case 27. Male, 9 years. Sister has cleft palate. History of twins on mother's side.

Case 29. Female, 19 years. Mother's sister had twins.

Case 35. Female, 47 years. Patient's two sisters had twins.

Case 37. Female, 38 years. Congenital kidney condition. History of cleft palate on mother's side. History of twins on mother's side.

Case 39. Male, 41 years. 6th in family of 8. Brother is paralysed. History of twins on mother's side.

Case 43. Male, 3 years. Mother had fright during 2nd month of pregnancy.

Case 49. Female, 51 years. Epileptic.

Case 51. Male, 29 years. Sister's child is deaf and dumb. Aunt (mother's side) had twins.

Case 53. Male, 8 years. Suffers from convulsions. Has no lateral incisor teeth in upper jaw. History of cleft palate and hare-lip on father's side. History of twins on father's side.

Case 57. Male, 29 years. History of twins on father's side.

Case 61. Female, 52 years. Patient's mother was subject to fits. Patient's son has extra finger on left hand.

Case 65. Female, 49 years. 7th in family of 7. History of large families.

Case 73. Female, 25 years. 6th in family of 6. Mother has congenital heart condition and is deaf.

Case 75. Female, 28 years. 7th in family of 12. One sister has bifid uvula. History of twins on mother's side.

Case 81. Male, 35 years. Mentally deficient. Mother suffers from fits.

Case 83. Female, 14 years. Mother has hare-lip. History of cleft palate on mother's side.

Case 93. Male, 73 years. History of large families. 7th in family of 9.

Case 103. Male, 41 years. 12th in family of 14.

Case 107. Male, 5 years. Deformity of ears. History of congenital heart condition on mother's side - four sudden deaths in one family. Mother had one stillborn child. History of twins on mother's side.

Case 113. Female, 14 years. Bad eyesight. Congenital deformity of hands, feet and ears. Signs of endocrine disturbance. History of twins on father's side.

Case 121. Female, 33 years. Has had several stillborn children. Patient's father was a twin.

Case 123. Male, 10 months. Mother's brother had spina bifida. History of twins on mother's side.

Case 133. Female, 46 years. Patient's mother had stillborn twins twice.

Case 139. Male, 10 years. History of twins on father's side.

Case 141. Female, 48 years. Deaf. Has bad eyesight.

Case 145. Female, 10 years. Has recently become blind in one eye. Another child in same family had nasal and oral deformity - lived 6 hours. Brother and sister are twins. History of twins on mother's side.

Case 147. Female, 2 years. Mother had fall during 3rd month of pregnancy. History of twins on both sides of family.

Case 151. Male, 39 years. History of large families. 7th in family of 8.

Case 159. Female, 37 years. Sister had twins twice. History of twins on mother's side.

Case 163. Female, 29 years. Youngest in family of 5. History of large families. Mother 43 years when patient born.

Case 175. Male, 44 years. Father has congenital heart condition.

Case 175. Male, 39 years. Deaf. Eldest in family of 12. Has two brothers who are twins.

Case 176. Male, 2½ years. History of hare-lip and cleft palate on mother's side. History of twins on mother's side.

Case 178. Male, 10 years. Patient's cousin (mother's side) has hare-lip and cleft palate. Mother is epileptic. History of twins on mother's side.

Case 180. Male, 5 years. Brother has hare-lip and cleft palate.

Case 181. Male, 2½ years. Brother has hare-lip and cleft palate. (see case 180).

Case 182. Male, 3 years. Has twin sister - no lip nor palatal deformity.

Case 184. Male, 3 years. History of cleft palate, mental degeneracy and large families on mother's side.

Case 190. Female, 10 years. History of hare-lip and cleft palate on father's side.

Case 191. Female, 55 years. Sister had spina bifida.

Case 194. Female, 41 years. Sister has hare-lip and cleft palate.

Case 195. Female, 15 years. Youngest in family of 10. Two brothers are twins. History of miscarriages and twins on mother's side. History of large families on mother's side.

Case 196. Male, 7 years. Sister has hare-lip and cleft palate. History of these conditions on mother's side.

Case 197. Female, 13 years. Brother has cleft palate and hare-lip. (see case 196).

Case 201. Male, 6 years. Has congenital inguinal hernia. Father has clubfoot. History of twins on father's side.

Case 202. Male, 15 years. 7th in family of 9. Brother has hare-lip.

Case 203. Male, 25 years. Youngest in family of 5. Deaf. History of twins on mother's side.

Case 205. Male, 14 years. Patient and brother have congenital foot deformity. Father has hare-lip and cleft palate. Mother's brother was epileptic. Mother has sisters who are twins.

Case 207. Female, 21 years. Youngest in family of 5. One sister is epileptic. Other two are twins. Patient's cousin (mother's side) has webbed toes.

Case 208. Male, 3 years. Youngest in family of 5. Mother has hare-lip.

Case 211. Male, 4½ years. Youngest in family of 4. Eldest has hare-lip and cleft palate. Mother has thyroid condition and congenital heart condition. History of twins on both sides of family.

Case 212. Male, 52 years. Deaf and dumb. Daughter is epileptic.

Case 213. Male, 43 years. Patient's grandmother (father's side) had hare-lip and cleft palate. Patient's brother was father of twins.

Case 214. Male, 4½ years. Patient is left handed. History of left handedness on father's side. History of twins on father's side.

Case 215. Male, 14 months. Father's brother and sister are twins.

Case 216. Female, 1½ years. Aunt's child (mother's side) has congenital foot deformity. History of twins on mother's side.

Case 217. Male, 2½ years. One aunt (mother's side) had several miscarriages. Other aunt (mother's side) had two children - one died in infancy, the other has congenital spinal deformity. History of twins on mother's side.

Case 218. Male, 14 years. Youngest in family of 5. (two were stillborn). Has no upper lateral incisor teeth. Aunt (father's sister) is deaf and dumb.

Case 220. Female, 14 years. Father is subject to fits. Patient has brother and sister who are twins. History of twins on father's side.

Case 221. Male, 39 years. 9th in family of 10. Mother is subject to fits.

Case 224. Female, 40 years. 2nd in family of 6. Patient's daughter has congenital foot deformity.

Case 225. Female, 32 years. Patient's mother has congenital heart condition. History of miscarriages - patient and patient's mother. History of twins on mother's side.

Case 226. Female, 9 months. Mother subject to fits. History of strabismus on mother's side.

Case 227. Female, 2½ years. Aunt (father's sister) has clubfoot. History of twins on both sides.

Case 228. Male, 7 years. Mother had severe burning accident during 3rd month of pregnancy.

Case 229. Female, 10 years. Has brothers who are identical twins. History of epilepsy on father's side.

Case 230. Female, 23 years. History of cleft palate, deafness and visual disturbance on father's side. Mother suffered from goitre.

Case 231. Female, 10 years. Mother subject to fits. History of twins on mother's side.

Case 232. Female, 40 years. Deaf. Excessive growth of hair on upper lip and chin. Has brother and sister who are twins.

Case 233. Female, 22 years. Youngest in family of 6. Mother had fall during early pregnancy.

Case 234. Female, 29 years. Mother subject to fits.

Case 236. Male, 40 years. 2nd in family of 7. Has congenital inguinal hernia. Sister was epileptic.

Case 238. Female, 19 years. Youngest in family of 8. Father has supernumerary finger on one hand.

Case 240. Male, 7 years. Aunt (father's sister) is epileptic and has congenital leg deformity. History of deafness on father's side.

Case 242. Male, 15 years. Deformity of ears. History of congenital heart condition on mother's side. History of twins on mother's side.

Case 243. Male, 7½ years. Left hand underdeveloped. History of congenital foot deformity on father's side. History of twins on father's side.

Case 245. Female, 7 years. Mother has congenital deformity of legs. History of twins on mother's side.

Case 246. Female, 28 years. Brother has congenital foot condition. History of twins on mother's side.

Case 247. Male, 14 years. Sister has spina bifida. One of father's brothers has cleft palate. Another of father's brothers has spinal deformity. Third brother has epileptic son.

Case 249. Female, 28 years. Eldest in family of 3. Brother has congenital foot deformity. History of twins on mother's side.

Case 250. Male, 8½ years. Only child. Deformity of ears. History of cleft palate on mother's side. History of twins on mother's side.

Case 251. Female, 6 years. Youngest in family of 7. History of cleft palate on mother's side. History of twins on mother's side.

Case 252. Male, 10 years. Mother suffers from fits. History of anodotia on mother's side. History of twins and triplets on mother's side.

Case 254. Female, 30 years. Excessive growth of hair on upper lip. Suffers from 'fainting fits'. Mother suffers from same. History of twins on mother's side.

Case 255. Male, 7½ years. Eldest in family of 4. Fright during 3rd month of pregnancy. Granduncle (mother's side) has cleft palate.

Case 256. Male, 38 years. Had brother with hare-lip and cleft palate. History of twins on father's side.

Case 257. Male, 49 years. Sister has congenital spinal deformity. History of twins on mother's side.

Case 258. Female, 3½ years. Youngest in family of 3. Mother has marked ocular hypertelorism. Patient's aunts (mother's sisters) were twins. Patient's grandmother (mother's mother) was a twin.

Case 260. Female, 3 years. Patient's granduncle (father's side) had hare-lip and cleft palate. Patient's cousin (father's side) has congenital skin condition. History of twins on father's side.

DISCUSSION.

The dissertation which follows is presented in two sections.

The first deals with the etiology of congenital oral deformities.

Modes of treatment of the conditions are considered in the second section.

DISCUSSION.

Section 1. -- Etiology :

Streeter, (1930), has described certain pathological processes which may occur in the developing human foetus. He has thrown light on the nature of certain pathological bands of connective tissue passing from the foetus to the amnion. He has also described how limbs and digits are 'amputated' within the uterus.(1) Keith, (1940), collected cases exemplifying and extending the findings of Streeter, and to these pathological processes of development he gave the name 'Streeter's foetal dysplasia'. From his investigations, Keith has drawn the conclusion that these lesions are caused by temporary or permanent failure in the circulatory system of the foetus. When discussing this foetal disorder with regard to dysplastic lesions of the face and oral tissues, he has drawn the conclusion that they 'are caused by local necrosis probably due to a circulatory failure which may be placental in origin'.(2) When he further describes how this circulatory failure occurs along marginal areas where capillary formation is in progress, and how some foetal tissues, such as the fibroblasts of the skin and deep fascia, respond in a particularly vigorous manner when cut off from their/

/their blood supply, it seems reasonable to believe that hare-lip and cleft palate are manifestations of this foetal plastic disorder. Particularly does this seem probable when the developmental factors which go to the formation of the normal palate are taken into account; its bilateral origin; the approximation and ultimate fusion of the palatine processes, structures which, during their development, have definite 'marginal areas where capillary formation is in progress'.

The fact that cleft palate may be present in two or more members of the same family, or that there exists a definite family history of the condition, may give rise to the suggestion that heredity is the sole factor concerned in the manifestation of the deformity. Now, heredity implies the transmission of certain characteristics from the parents or ancestors to their offspring. This means that the embryo receives certain characteristics which predetermine the development of the individual as a whole, or of any one part of the individual. In view of the fact that the condition of cleft palate may occur in forms varying in degree from a mere notch of the uvula, to the severe types where soft palate, hard palate and alveolar border are involved, and that lip clefts also vary in degrees of severity, it seems more/

/more logical to assume that a certain hereditary susceptibility is transmitted to the embryo, rather than to accept heredity, as defined, to be the cause. It has been pointed out by Hamilton, Boyd and Mossman, (1945) (3) that the different parts of the embryonic morphogenetic field can be regarded as unstable during the earlier stages of development. Moreover, Oppenheimer, (1940) (4) quotes Brachet , (1935) as saying that 'the germ layers, like the blastomeres, have an actual potentiality and a total potentiality; the former is what they normally become, the latter what they are capable of forming in addition under diverse natural or experimental influences'. That is, the fate of the various parts of the embryo is in a plastic state; it is undetermined. It follows, then, that influences brought to bear upon the embryo during this stage of development may result in various developmental anomalies.

It is known that various congenital malformations and derangements are associated with hare-lip and cleft palate. An apparently more accurate statement would appear to be that lip and palatal clefts, together with these other congenital conditions, bear a definite relationship to each other, a genic relationship in which environmental influences may play a considerable part in the etiology of the conditions. This assumption is based on the fact that/

/that an individual suffering from congenital cleft palate may also exhibit one or more of the associated conditions. Moreover, it frequently happens in families in which there is a definite history of the occurrence of palatal clefts, some members may exhibit one or more of the associated conditions and yet not be afflicted by any oral deformity. This would appear to point to the transmission to the embryo of a certain susceptibility which predisposes, not only to oral deformities, but likewise, to the various associated conditions.

It is generally considered that most abnormalities of development are due to genetic causes; either by processes which are in the nature of mutations, or by the effects of genes acting adversely on normal development. The nature in which genes act during development has not been definitely established, but it is considered that they 'act by elaborating chemical substances affecting differentiation and, in particular, the rate of developmental change'.(5) Thus, disturbance of the timing of the processes of developmental change results in abnormal development. It is known that certain genes influence the development of the tissue in which they are situated, whilst others act upon developing tissues which are remote from the site in which these genes are situated. Further,/

/Further, it has been pointed out (6) that the effect produced by any gene depends on other genes with which it happens to be co-operating, and that the environment of a gene may be provided, to a certain extent, by the action of other genes, directly or indirectly.

Much research work has been undertaken by investigators regarding the etiology of congenital malformations, and a 'perplexing feature of all these investigations is the variety of malformations apparently due to the same cause as well as the variety of causes leading to similar end-results'. (7)

Might it not be, then, that these various congenital malformations are but features of a complex syndrome in which the manifestation of each developmental abnormality is dependent upon some specific factor? It seems reasonable to suppose that the effects of the interaction of genes are capable of widespread functional and structural alteration of parts arising from a particular germ layer. Since it is known that the germ layers have actual and total potentialities, and that the congenital malformations under consideration occur in tissues of mesodermal origin, there would appear to be evidence to support the hypothesis that a syndrome does indeed exist. It may be that the embryo, to which has been transmitted genes, some of which predispose towards malformations, is/

/is influenced in its subsequent development by the particular genetic pattern present, that is, by the particular interaction and co-operation of the genes in that pattern. The occurrence of one, or a combination of some of the various congenital malformations and abnormalities would thus be solely dependent upon the particular co-operative and inhibitory effects of the interaction of the genes present. On the other hand, it may be that environmental influences play a considerable part. The fact that malformations may occur separately or in varying combinations in members of the same family would appear to indicate that environmental as well as genetic factors contribute to their etiology. It seems reasonable to suppose that, where there exists a predisposition to abnormal development, additional factors may seal the fate of a developing part by exerting their influences during the early stages of intra-uterine life. Thus, the seeming haphazard occurrence of these various conditions in members of the same families may be due to the various environmental conditions in which the genes may operate. Moreover, the apparent absence of some or all of the conditions in some members of these families need not necessarily mean that the predisposition to these particular abnormalities does not/

/not exist, it may merely mean that the predisposition is influenced or inhibited by genic or environmental factors in such a way that it is suppressed, or its effects are so slight that they may not be readily recognised as forms of abnormal development.

In addition to conditions such as hydrocephalus, spina bifida, inguinal hernia, clubfoot, syndactylism and polydactylism, it would appear that an abnormal endocrine pattern may be one of the features of the syndrome. Fergusson, 1857, (8) stated, when discussing hare-lip and cleft palate :

> 'In most of these cases, every kind of absurd reason is given by the mother and others to account for the deformity. The common one is, that the mother, during her pregnancy, has either seen or heard of a case of the kind, and has possibly been much alarmed or disgusted. For my part, I put no faith in such views, and I imagine that in most of such cases, there is a partial defect in the upper lip and jaw of one or both of the parents. I have noticed this so frequently, that I fancy I can in general detect the parent of a child thus born by the appearance of the face, and often whilst listening to a mother's story about some conjectural cause for her infant's deformity of face, I have thought that a glance at her own features in a looking-glass might have given her a more plausible reason for the condition of her offspring'.

Contrary to Fergusson's assumption, in the many cases of hare-lip and cleft palate which I have examined and treated, instances of defect of the upper lip or jaw of one/

/one or both of the parents have been comparatively rare. I have, however, been struck by the fact that, in families in which there is a case of hare-lip or cleft palate, or in which there is a definite history of the conditions, the facial structures very frequently conform to a characteristic pattern. It was probably this characteristic facial pattern which Fergusson observed in many of the parents of affected children.

Now, investigators have shown the relationship between the internal secretions and the individual. That certain physical and phychic characteristics are determined by their influence has been established. Endocrinologists have enabled us to recognise certain types of individual in whom a particular gland is dominant in his endocrine system. Some of these endocrine types are easily recognised by physical and mental features of the individual. There are, however, many individuals who may be placed in definite categories according to their physical and mental make-up, but cannot be recognised as being dominated by one particular gland. This can be readily understood considering the complexity of the endocrine system, the interrelationships of the different glands, and the probability (9) that most body tissues are capable of producing secretions which may act in a way similar to that of the ductless glands. Could it not be then,/

/then, that the characteristic facies observed in families with a history of lip and palatal clefts are the results of an abnormal endocrine pattern, a pattern inherited by those who have a predisposition to congenital malformations?

Certain findings would appear to support this theory. Greig, (10) in 1924, first described a condition which was given the descriptive term ocular hypertelorism. This craniofacial deformity is associated with undue separation of the orbits, and Greig believed that the condition was primarily due to abnormal development of the sphenoid bone during early foetal life. It has been found that deformities elsewhere in the body are sometimes present in cases exhibiting hypertelorism. Some of these abnormalities are syndactylism, polydactylism, clubfoot, hernia, congenital heart disease, deformity of the ears, deafness and affections of the higher nervous and mental functions. It will be noted that all of these are conditions which are also associated with hare-lip and cleft palate. Further, Brown and Harper, 1946, (11) have shown that cases occur in which lip and palatal clefts are present. A case of encephalocele associated with hypertelorism and cleft palate was described by Oldfield (12) in 1938.

If, as Greig suggests, hypertelorism is primarily the result of abnormal development of the sphenoid bone during/

/during early foetal life, it may be argued that interference of normal growth of the pituitary gland could occur as a result of malformation of the sella turcica. It is known, however, that the pituitary gland influences the growth of the cranial bones. It is obvious therefore, that disturbance in the function of the pituitary gland may result in abnormal development of these bones. Could it not be then, that the action of heteronomous genes on the developing pituitary gland is such that the gland undergoes abnormal change with resultant dysfunction. It may even be that an abnormal endocrine pattern is transmitted to the embryo, a pattern in which the action of the pituitary gland is such that its abnormal products result in malformation of the bones of the skull. That is to say, hypertelorism may be the direct result of an abnormally functioning pituitary gland influencing development and growth of the sphenoid bone before and after birth.

A patient, to whom I afforded prosthetic treatment for the correction of cleft palate, exhibited a series of abnormalities which merit special mention. In addition to the oral deformity, ocular hypertelorism and other anatomical malformations were present. (Case 8, p.73.) Various conditions, usually associated with endocrine disturbance,/

/disturbance, were also observed. There was marked thickening of the bones of the skull; the soft tissues of the face and nose were hypertrophied; the tongue enlarged; micturation was frequent. It will be noted that all of these conditions are characteristic of pituitary disturbance. Conditions usually associated with abnormal function of the thyroid gland were also observed. The intellect was dimmed; memory poor; there was a latent period before questions were answered; speech was slow, thick and indistinct; the whole attitude of the patient was apathetic and lethargic. There was impaired vision; deafness; malar flush; thinning of the hair of the outer half of the eyebrows; the skin of the hands and feet was dry and rough. Furthermore, there appeared to be abnormal function of the adrenal glands. There was excessive growth of hair on the upper lip and chin; scattered cutaneous pigmented spots appeared on the face and body.

It would appear then that this patient exhibited a syndrome of conditions, some of which were the result of an abnormal endocrine system.

Now, in the course of examining parents and other blood relations of children affected by hare-lip and cleft palate, I/

/I have observed that ocular hypertelorism and combinations of signs and symptoms of endocrine disturbance occur in a large proportion of these individuals. Consequently, I am inclinced to believe that the presence of a combination of these conditions accounts for the characteristic facies noticeable in so many of these individuals. Fergusson obviously observed these same characteristics, and was prompted to say '...I fancy I can in general detect the parent of a child thus born by the appearance of the face,....'. (13) He was apparently in error, however, when he assumed that '...there is a partial defect in the upper lip and jaw of one or both of the parents'. (14) His assumption would appear to be disproved by the fact that hypertelorism and combinations of these selfsame endocrine effects have been recognised in members of families in which there exists a history of congenital malformations other than lip and palatal clefts.

Herein, then, appears further evidence in support of the theory that a syndrome does exist, a syndrome in which an abnormal endocrine pattern in one of the hereditary features.

The occurrence of yet another 'associated condition' is worthy of mention. It has been observed (see page 149) that there is a particularly high incidence of twinning in families/

/families with a history of hare-lip and cleft palate. Normally, twins occur about once in every ninety births (15) and there is evidence that monozygotic and dizygotic twinning are both hereditary characters. Now, it has been shown previously that, of 250 cases of cleft palate examined, there was a definite history of twins in the families of 160 of the cases. This points, then, to the existence of a predisposition to twinning in such families.

Twinning in monovular species is regarded by some as an 'atavistic' reversal to a more primitive condition. Huxley, (1942), (16) has stated however, that 'atavism' is, in all probability, but the result of new combinations of old genes. He goes on to quote Haldane as saying 'modern genetics deals not only with inheritance, but with recombination'. It may be, then, that the genetic pattern present in families in which occur congenital malformations, is one in which genic combination is such that a predisposition to twinning results.

It has been shown previously (see pp.152-159) that epilepsy may be regarded as one of the conditions associated with hare-lip and cleft palate. It is outwith the scope of this thesis to discuss the etiology of a condition so problematical and so provocative of speculation and controversy/

/controversy as is epilepsy. Nevertheless, despite the assumption and conjecture which surround the etiology of epilepsy, mention must be made of this obscure condition in its relation to congenital deformity.

Lennox (7) suggests that epilepsy has a primary and a secondary cause. The fundamental cause he suggests as being an inherent instability of the brain, whilst the contributing cause may be one of many. It may be, then, that defective germ plasm is responsible for a predisposition to the condition, whilst one, or a combination of other factors, induced the actual manifestation of the disorder. Hypothetically, then, this predisposition to epilepsy in individuals who are members of families in which exists a history of congenital malformation may be a feature of the syndrome under discussion. The manifestation of the condition in these individuals may thus be the direct result of the influence of other abnormal features of the syndrome acting in conjunction with this predisposition.

Many theories regarding the causation of lip and palatal clefts have been advanced by investigators from time to time. In my opinion, however, many of the features and conditions mentioned in these theories must be regarded as merely contributing to the oral defects, and not as primary causes. It has been suggested previously that environmental influences may play a considerable part in the/

/the production of the malformations, and that 'additional factors may seal the fate of a developing part by exerting their influences during the early stages of intra-uterine life'. (see p.166).

Vaughan, (1940), has stated :

> 'The influence of maternal impressions as a cause of congenital deformities must be regarded as a superstition without foundation. The supposed shock has always occurred long after foetal development has progressed beyond the point where lip or palate union could be influenced'. (18)

It is probably true that these statements are factual in many cases, but to regard the influences of maternal impressions to be foundationless in all cases would appear to be dismissing an aspect of causation which might possibly have some bearing on the etiology of lip and palate deformation. It has been said : 'There is no result in nature without cause ....' (19) It might, then, be wise to investigate an aspect of causation, no matter how remotely connected it may appear, especially when considering a subject in which, to use Vaughan's own words, '....there is much speculation, but very little definite knowledge'.

Assuming that a hereditary predisposition to malformations does exist, and it having been pointed out previously that the embryonic morphogenetic field can be regarded as unstable/

/unstable during the early stages of development, it would appear that certain influences, acting upon the embryo during early intra-uterine life, may result in malformation.

The hypothesis is, then, that the hereditary factor, a hereditary predisposition, together with one, or a combination of several additional factors, whether environmental changes, pathological conditions, deficiences or even external influences, may bring about the conditions of hare-lip and cleft palate. Amongst these additional factors, the internal secretions of the body merit investigation. It is known that the secretions of the endocrine glands have a widespread influence on various parts and functions of the body. It is also known that shock, sudden fright or mental strain are capable of upsetting the endocrine balance in an individual. That exophthalmic goitre may be produced by violent emotional upheaval has been established. That is, the endocrine system may be disturbed considerably by the effects of emotions. Likewise, disorders of the endocrine system may occur in an apparently lesser degree following emotional disturbance. Some of these disorders may even pass unrecognised in view of a seeming lack of obvious signs and symptoms. Nevertheless, it is reasonable to suppose that far-reaching effects may be produced, giving rise to conditions, the cause of which would appear to be obscure, but are, in effect, the result of endocrine/

/endocrine disturbance. It would appear feasible, then, that some upset of functional perfection and correlation of the maternal endocrine system during early pregnancy could lead to conditions which would have an adverse effect upon the developing embryo. Thus, mental disturbance, influencing the endocrine balance of the parent, may produce conditions which, acting upon the embryo to which has already been transmitted a susceptibility to oral deformity, could result in the birth of an abnormal child, a child exhibiting some degree of hare-lip or cleft palate.

From time to time, theories of causation, based on malnutrition of the pregnant mother, have been advanced by certain investigators. No doubt, these theories have been suggested by the fact that hare-lip and cleft palate are found in members of the poorer classes more often than in those of a higher social status, the inference being that proverty results in undernourishment. According to my experience, however, there is little evidence to suggest that malnutrition played any major part as a causative factor of the conditions in the many cases examined. Since it is known that these deformities have occurred in certain families for generations, I am inclined to believe that they are conditions which must be considered as having contributed to a lowering of the social status of the afflicted and their descendants, rather/

/rather than that they are the indirect results of poverty. In other words, lip and palatal clefts are found most frequently in members of families which have suffered socially as a result of the occurrence of these conditions in former generations of these families. That is, genic factors have influenced social status. Sigerist, (1944), (20) has stated :

> 'Disease, all forms of disease, invariably affect the individual's social life. ..... Society always reacts very strongly to the physical appearance of a sick man'.

It can be readily understood, then, that the distressing effects of oral deformity, such as cleft palate, would tend to isolate the unfortunate victims, with a resultant lessening of his chances of success.

> 'In a competitive society the ever so slightly disabled worker cannot keep up with the worker in full health, and thus may easily become permanently unemployable'. (21)

Nevertheless, it must be admitted that maternal malnutrition might readily play some role as a contributary factor in the production of oral deformity. McCarrison, (1921), (22) has pointed out that there is sufficient evidence to show that normal functioning of the endocrine system is dependent upon a properly balanced and vitamin-containing food supply;'.....dietetic deficiency means endocrine insufficiency'.

Thus,/

/Thus, undernourishment or malnutrition of the mother, with resultant endocrine disturbance, may produce conditions, which, acting upon the embryo already possessing a predisposition to oral malformations, could result in the birth of a child exhibiting these congenital deformities.

The foregoing discourse would appear to lend support to the hypothesis that one, or a combination of several factors, whether or not they be external influences, acting in conjunction with a hereditary predisposition to developmental abnormality, may bring about dysplastic lesions, one of which is congenital cleft palate.

Section 2. -- Treatment.

Fox, (1803), when discussing palatal clefts, stated :

> '... These extensive natural imperfections can rarely be assisted by artificial palates. It is certainly very desirable to cover the opening, and thus contribute to the comfort of the patient, by preventing the passage of food into the cavity of the nose, and also by rendering the sound of the voice more articulate. But the irritation is so great in those cases where the soft palate is deficient, that in general all artificial means are inadmissable; and whenever the experiment is made, it should be accompanied with expectations of failure'....(23)

How much in error was Fox, has been demonstrated, times without number, by operators dating, it is interesting to note, from a few years subsequent to his statement. It is true that many of the appliances of the past proved only partially successful, and that, even at the present time, certain mechanical methods of treatment employed by some operators do not fulfill all the necessary requirements. There can be no doubt, however, that the application of dental prosthetics in the treatment of the condition is a branch of dental science which is of the ustmost importance.

Satisfactory treatment of congenital cleft palate can be said to have been attained only if the end results are such that the patient is enabled to overcome the distressing effects of the condition. That is, Nature should be simulated/

/simulated in that physiological function and aesthetic appearance must be restored despite anatomical abnormalities and deficiencies. Although the criterion by which the success of the treatment of the condition is usually judged by the degree of restoration of the physiological speech mechanism attained, there is another aspect which is also of paramount importance. It is the correction of disfigurement, improvement of the aesthetic appearance of the patient. Certainly, the most obvious disfigurement is brought about by the condition of hare-lip, but even in cases where there is no involvement of the lip, there may be facial deformity due to underdevelopment and malformation of the maxilla. In such cases there may be marked protrusion of the mandible due, in many instances, to closure of the 'bite' as a result of malocclusion of teeth. More frequently, conditions are such that the mandible merely appears to be protruded. When it is taken into account that the mandible is usually almost normally developed due to functional exercise and resultant stimulation, it can be readily understood that it will appear to be abnormally positioned in its relationship with an upper jaw which is underdeveloped. Moreover, cases, in which there is involvement of the alveolar ridge, present abnormalities of dentition which almost invariably necessitate/

/necessitate removal of natural teeth and the provision of some type of prosthesis, unless, in some cases, where orthodontic procedures may bring about correction of these abnormalities. It seems obvious, then, that the successful treatment of congenital cleft palate depends, not only on the skill of the surgeon and plastic surgeon, but to a great extent, on the application of oral prosthetics.

Generally speaking, the cases which fall into the hands of the dental operator are those where surgical treatment has not been attempted, or where it has met only with partial success or even failure. As shown in some of the cases presented however, results have been extremely gratifying where treatment has consisted of a combination of both surgical and prosthetic procedures.

In the series of patients to whom I afforded treatment, cases of most frequent occurrence amongst adults and adolscents were those which presented cleft of the soft palate; cleft of the soft palate and part of the hard palate and alveolar ridge. It must be pointed out that these types of cases are usually found where no surgical treatment has been attempted. Nevertheless, a considerable number of patients may exhibit deformities of severe degree even after surgical intervention, break down of tissue being the cause of such end results.

It is generally accepted that the objectives of any appliance utilised in cases of this type should be complete closure of the cleft, and the creating of contact between the appliance itself and the posterior wall of the pharynx during speech and deglutition. This latter important function is in order that separation between oropharynx and nasopharynx will take place, thus simulating the normal series of events which take place during deglutition and in the course of normal speech. That is, during swallowing and speech, the appliance can make contact with Passavant's ridge or cushion, - that bulging upwards and forwards of the posterior wall of the pharynx brought about by the action of the uppermost section of the Constrictor pharyngis superior muscle.

Perusal of literature dealing with the treatment of congenital cleft palate serves to show that there are two distinct schools of thought regarding the series of events which take place during deglutition and speech in the afflicted. It is believed by many that the divided remnants of the natural soft palate are no longer capable of simulating natural movements of the soft palate. This point of view, being held by many operators, is responsible for their particular choice of appliance in the prosthetic treatment of the condition. They favour a rigid one piece appliance/

/appliance, one which will close the cleft, and against which Passavant's ridge will make contact during deglutition and in the course of speech. Landa, (1947) an advocate of the rigid type of appliance, gives reasons for his preference :

> 'Even with the most expertly and scientifically constructed restoration, the living tissues will still have to adjust themselves to new environmental conditions'.

He goes on to say :

> '...the rigid appliance will serve better during the process of deglutition when the tongue presses itself against the palate and directs the food into the pharynx. Also in pronouncing K, G, Ng and C (hard, as in cat or carrot) the base of the tongue is raised upward and directed backward, until it comes into contact with the soft palate. In both instances cited here it is preferable that either the bolus of food or the tongue itself come into contact with a rigid rather than a movable appliance'. (24)

Landa then states :

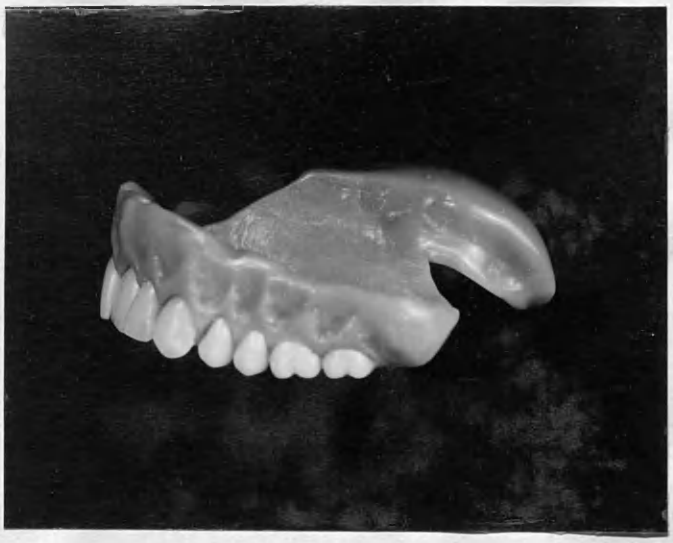
> 'The advocates of the rigid type ....believe that the divided remnants of the natural soft palate muscles are no longer capable of simulating natural movements of the soft palate'.

He would then appear to contradict his statement when he says that these operators construct their rigid appliance 'in such a manner that the remaining portions of/

/of the soft palate muscles and adjacent tissues will grip it and press themselves against it ...' (25)

It is difficult to comprehend how this may be accomplished in a satisfactory manner when, as they believe, the remnants of the soft palate do not function! It has even been pointed out that, during its construction, that part of the rigid appliance which closes the soft palate cleft should be 'muscle trimmed'. Here again would appear to be advice based on phenomena which they believe to be non-existent!

It is my conviction that, in the great majority of cases, the appliance which will give the most satisfactory results in every respect is one which is constructed in two pieces, that is, a rigid-movable appliance. It must, however, conform to certain important requirements. From clinical observations and research findings, proof exists that the remaining portions of the soft palate muscles do function in much the same way as if they were part of a normally functioning soft palate. That is, the soft palate remnants are capable of carrying the movable portion of the appliance, the artificial velum, upwards and backwards. Furthermore, it has been observed that there may be lateral movement of the soft palate remnants; sometimes this is more pronounced on one side of the cleft than/



Rigid appliance.

Rigid-movable appliance.

/than on the other. The artificial velum must therefore be attached in such a way that it is allowed to take up any position required by the movements of the soft tissues. That is, it must be attached to the denture part of the appliance by means of a hinge which is in the nature of a universal joint. (p.138-141)

Morley, (1945) states :

> '....m, n, and ng are the only sounds in the English language in which air may pass through the nose, and then in the form of vibrations and not in a continuous stream as in breathing'.(26)

It follows, then, that passage of air from oral cavity to nasal cavity between denture and artificial velum would produce marked speech defects. A point of the utmost importance in the construction of the two piece appliance is, therefore, that this undesirable feature must be prevented. How this is accomplished has been described elsewhere.(p.145-6)

Finally, the upward movement of the artificial velum must be limited, and this limitation of upward movement of the velum should coincide with its making contact with Passavant's ridge. Landa stated that '... it is preferable that either the bolus of food or the tongue itself come into contact with a rigid rather than a movable appliance'. (27) Following clinical observation and tests, however, it is my/

/my firm belief that Nature is simulated to a much greater degree if either the bolus of food or the dorsum of the tongue impinge upon a surface which is at first yielding and eventually unyielding, that is, upon the surface of an artificial velum which is free to follow all movements of the soft tissues with the exception of upward movement which is limited mechanically.

It having been observed that the angle formed by the soft palate at its junction with the hard palate varies considerably in different individuals, it seems obvious that the one piece appliance could only bring about successful results in a small proportion of cases. Taking into consideration the cases in which the remnants of the soft palate lie in an almost vertical position in their relation to the hard palate, it is easy to understand that, in order that these remnants may continue to make contact with the rigid appliance during their functional periods, the backward prolongation of the appliance would, of necessity, require to have considerable depth. This would make for a bulky restoration, thereby introducing complete disregard for anatomical simulation. It seems obvious, then, that an artificial velum which, during its construction, is allowed freedom of movement while it is being conformed by the soft tissues, (p.70) will approximate to normal anatomical and physiological requirements/

/requirements as closely as is possible to achieve in mechanical treatment of the condition. No matter in what position the soft palate remnants may lie, the adaptability of the two piece appliance, and the close simulation of anatomical function achieved by the movable artificial velum, produce entirely satisfactory results in the great majority of cases. It must be pointed out, however, that some cases are such that there is a complete lack of soft palate remnants. At first sight, the prosthetic treatment of a case such as this would appear to present extreme difficulties with regard to the choice of appliance. Nature appears to compensate, however, in that there is usually exaggerated function of the lateral pharyngeal walls as well as a marked hyperfunctioning cushion of Passavant. It is in a case such as this that a certain degree of success may be achieved by the fitting of a one piece appliance.

It must be assumed that certain operators have been, until recently, influenced in their choice of appliance by the abnormal distribution of hard and soft tissues. In many cases it would seem that certain appliances have been utilised merely because problems of retention have presented themselves. This probably explains why cases have been observed where rigid appliances have been fitted when much more successful results could have been attained by the fitting/

/fitting of two piece appliances. Problems of retention need no longer bring their influence to bear upon the choice of appliance however. It has been shown that, even in the most severe cases, these problems may now be overcome by the fitting of special mechanically operated obturators. (see Case 7, p.64)

When considering restorative treatment, it must be borne in mind that orthodontic measures cannot be entirely divorced from prosthetic procedures. Indeed, the science of orthodontics may play a part of the utmost importance and necessity during the treatment of some cases. Congenital cleft palate, however, brings its own peculiar problems with regard to orthodontic treatment.

Selmer-Olsen (1937), when discussing forces which act on the teeth of the mandible, states that the effect of pressure exercised by the action of the external soft tissues and muscles inward and backward against the anterior teeth, plays an important role.(28) It is frequently noticed, when dealing with the cleft palate patient, there may be protrusion of the mandible. It seems highly probable that an important contributing cause of this feature is the direct result of surgical closure of the cleft of the upper lip. The surgical freeing of tissues from the upper jaw, and the approximating of the free edges/

/edges of the lip cleft, with resultant forward displacement of the facial soft tissues, are factors which are almost certain to produce an abnormal relaxation of the tissues of the lower lip. This, in conjunction with the intra-oral pressure of an enlarged tongue, a condition frequently observed in cases presenting a wide palatal cleft, will result in abnormal forward growth of the anterior part of the mandible. At a later state, however, the looseness of the lower lip tissues may be eliminated, either by the forward growing mandible, or by the soft tissues themselves regaining normal function, or even by a combination of both processess. This may result in a backward tilting of the lower anterior teeth. These conditions, together with underdevelopment or marked deformity and asymmetry of the maxilla, contribute towards the problems which confront the prosthetist. Difficulties such as these can be overcome however, and successful results with regard to speech, masticatory efficiency and aesthetic appearance have been achieved by means of combined prosthetic and orthodontic methods. (see Case 4, p.55)

Cases, which at birth, present clefts involving the palate, alveolar process and lip, may, at a later stage, undergo drastic changes. Following surgical closure of the lip cleft, the resultant pressure of the soft tissues of/

/of the upper lip upon the malformed maxillae may produce lateral collapse of the upper jaw. This collapse of the upper jaw may be further accentuated at a later stage by undue tension of the palatal tissues following surgical closure of the palatal cleft. It is obvious, then, that the dentition of these patients will be abnormal, and orthodontic treatment may be indicated.

During mechanical correction of the abnormal upper arch, clinical observation and radiological examination have revealed that deposition of new bone occurs in the region of the free edges of the alveolar lesion. In certain cases, this new bone has provided suitable sites for teeth which have been in malposition but which are made to take up natural position by orthodontic means. In view of these findings, it would appear that indiscriminant extraction of teeth which erupt in the region of the cleft is contra-indicated, and should only be carried out after due consideration. It is my view, however, that prolonged orthodontic treatment for the correction of anomalies of dentition is undesirable when dealing with the young cleft palate patient. It has been pointed out previously that one of the most important end results aimed at is the attainment of normal speech. In spite of a satisfactorily functioning soft palate having/

/having been provided by surgical procedures, the patient may still be incapable of normal speech because of the presence of malpositioned teeth. These, together with the orthodontic appliances required for their movement, will tend to inhibit normal functioning of the tongue and lips. Should the conditions exist over a prolonged period, as is usual in orthodontic practice, then it may be that permanent impairment of speech will result. White, (1944), when discussing the treatment of the young patient, has stated :

> '...If a series of abnormal reflexes is established - in other words, if faulty speech habits are formed - it will prove extremely difficult to replace them with normal reflexes and speech training becomes almost impossible...' (29)

It is obvious then, that any condition or series of conditions tending towards impairment of speech, should be eliminated as soon as possible. That is, conditions approaching anatomical and physiological perfection should be attained at the earliest possible age.

In the type of case under consideration, conditions may be further complicated by the presence of perforations or persistent fissures in the hard palate even after surgical intervention, break down of tissue having resulted in the formation of these deformities. It is generally accepted that closure of these defects, or the elimination/

/elimination of their harmful effects, can be achieved only by surgical means or by the fitting of obturators. During my researches, however, I have succeeded in obtaining closure of these palatal defects by using methods other than surgical and prosthetic procedures. Even in cases where expansion of the upper arch has been indicated, results have shown that closure of the palatal deformity and expansion of the arch are processes which may be carried out conjointly.

The reaction of bone to traction or pressure is deposition and resorption. It is known that resorption of bone takes place at a greater pace than that of the formation of new bone. I am of the opinion, therefore, that intermittent forces are contra-indicated in orthodontic treatment. Where rest periods occur, it follows that the bone reaction will cease, that is, the deposition of new bone will cease. In view of this, the appliance utilised for arch and palatal orthodontic treatment must be one in which the forces exerted on the tissues are continuous but very delicate. Results have shown that appliances having such an action satisfy the requirements for the attaining of a favourable end result. The continuous gentle pressure provides the necessary stimulus for bone reaction, that is, the deposition of new bone.

It/

/It might appear that the age of the patient must be, of necessity, an important factor with regard to the optimum time for commencement of this type of treatment. Age, however, is too indefinite a factor on which to base any definite line of treatment when considering the cleft palate patient, the patient whose oral malformation is usually associated with abnormal dentition. It seems, therefore, that the optimum time for initiating treatment should be governed by factors which are more determinate.

Hellman (30) has found that marked acceleration in growth of the jaws occurs, in girls, at the time of shedding of the deciduous canine and molar teeth and eruption of their permanent successors. He has also found that this spurt in growth of maxilla and mandible occurs, in boys, at the time of eruption of the permanent second molar teeth. From these observations it would seem that these are the ideal periods in which to commence general orthodontic treatment. When dealing with the child with a palatal defect, however, the speech factor must be borne in mind, and it seems logical that treatment should be commenced at an earlier age. Smith, (1947), has pointed out that a period, in which there is acceleration in vertical and horizontal jaw growth, occurs from the third to the seventh year. (31) It is highly probable that the time of greatest/

/greatest acceleration of growth during this period will occur during eruption of the first permanent molar teeth. Nevertheless, I feel that, in cases in which the dentition is such that the fitting of a permanent denture may never become necessary, treatment of the palatal defects should be attempted as early as possible. In this way, closure of the perforation or fissure may be attained before harmful speech habits have become permanently established.

It must be pointed out that clinical and radiological examination have revealed that the most satisfactory results have been obtained during the periods of greatest acceleration of jaw growth, that is, during eruption of permanent canine, bicuspid and second molar teeth. Nevertheless, cases have responded favourably even when treatment has been commenced during, or just following, eruption of the deciduous teeth on the one hand, and just previous to eruption of the permanent third molar teeth on the other. It would appear, then, that the optimum time for initiating mechanical treatment of palatal defects should be dictated by the periods of greatest acceleration of growth of the jaws, bearing in mind, of course, the important speech factor which, in many cases will be the chief determining feature.

When/

/When considering orthodontic measures as applied to the treatment of congenital malformation of the oral structures, mention must be made of cases in which clefts extend through the alveolar ridge in two places with resultant separation of the premaxilla. It frequently happens, in these cases, following surgical closure of the lip condition, the premaxilla still protrudes abnormally. In many instances the tension of the tissues of the repaired lip is sufficient to push the premaxilla into a normal position, or retain it in that position in cases where it has been placed in correct alignment by surgical means. Sometimes, however, the tension of the lip tissues brings about further deformity of the upper jaw by exerting pressure on the buccal aspect of the maxillae, thus causing lateral collapse of the upper jaw towards the median line. This collapse can occur rapidly, as can be readily understood when the cleft condition of the palate is taken into account. The result may be, then, an approximating of the free ends of the maxillae, thereby bringing about a diminishing of the alveolar gap, thus preventing the premaxilla taking up a normal position.

It seems obvious, then, that the application of measures which will prevent the occurrence of this series of undesirable events, will be of definite value towards the/

/the attaining of satisfactory end-results. Following clinical investigation, it has been found that orthodontic procedures may be utilised to advantage. (p.132) It is essential, of course, that these mechanical measures be introduced at an early age. Since it is known that the first period of acceleration in growth of the jaws takes place from birth to seven months, it would seem desirable that commencement of these methods be made during this period. It has been found, however, that favourable results may be achieved at a later age, so long as the alveolar gap is still sufficiently wide to accommodate the premaxilla. That these procedures form an important contribution towards obtaining satisfactory end-results, seems certain. The chances of the upper arch growing to normal size and shape are greatly increased. This will tend to lessen problems of dentition; will make for conditions favouring better speech; contribute largely to a successful aesthetic result; and will eliminate the necessity, as is sometimes indicated, for surgical removal of the premaxilla, an operation which may result in conditions which make for complications and problems with regard to subsequent prosthetic procedures.

Now, it has been shown that the cleft palate patient may present various anomalies of dentition. Eruption may be delayed; teeth malpositioned; supernumerary teeth may be/

/be present; teeth are frequently found in close proximity to the cleft; teeth may even erupt in the cleft. It follows then, that some patients may require extraction of certain teeth and the fitting of some form of prosthesis, whilst others may have to undergo orthodontic treatment for the correction of malpositioned teeth. Since it is known that surgical closure of hard palate clefts frequently produces further abnormalities of dentition, and since it has been shown that closure of hard palate defects may be achieved by mechanical stimulation of the growth impulse, it would appear that there exists a strong argument in favour of the surgeon concentrating, in many cases, mainly upon the obtaining of a satisfactorily functioning soft palate, thus leaving the restoration of the hard palate deformity to the dental operator. Moreover, when the various problems and complications associated with cleft palate work are considered in all their aspects, an even stronger argument would appear to be in favour of the closest possible co-operation between surgeon, plastic surgeon and dental specialist. Only in this way can real service be rendered, service which is amply repayed by the gratitude of the afflicted, in that they are enabled to overcome the distressing effects of their deformities; service which brings/

/brings its reward in the knowledge that the young patient may be enabled to look forward to a future unhampered by the effects of his disability.

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CONCLUSIONS.

Certain conclusions have been arrived at following the researches and clinical investigations which have been undertaken :

The conditions of hare-lip and cleft palate are malformations which have made their appearance from early times, and are not solely confined to the more highly civilized races.

The incidence of congenital cleft palate is one case in approximately 1600 births. The condition occurs more often on the left side than on the right, and median clefts are rare. Males are less subject to slight degrees of cleft palate, but more subject to the condition when soft palate, hard palate, alveolar ridge and lip are involved.

Although there exists much speculation with regard to the etiology of congenital cleft palate, evidence goes to show that it is a dysplastic lesion which bears a certain relationship to other abnormalities. The conclusion arrived at is that a hereditary predisposition to developmental abnormality influenced by, or acting in conjunction/

/conjunction with other factors, brings about the manifestation of one or a combination of certain abnormalities and dysplastic lesions, one of which is congenital cleft palate.

The condition of ocular hypertelorism bears a relationship to oral and other congenital abnormalities.

The incidence of twinning, and a family history of twinning, is high amongst families in which exists a history of congenital abnormalities, especially congenital oral deformity.

In the cleft palate patient, the divided remnants of the defective soft palate are capable of simulating movement of a normally functioning soft palate. In many cases, there is more movement of the tissues on one side of the cleft than the other. The angle formed by the soft palate remnants at their junction with the hard palate varies in different individuals. The remnants may lie in any position between horizontal and perpendicular.

Prosthetic dentistry and orthodontic measures play important parts in the overcoming of the effects of the condition. The most satisfactory type of prosthetic appliance/

/appliance, in the great majority of cases, is the two-piece or rigid-movable prosthesis. The movable part of this type of appliance, that is, the artificial velum, must be attached in such a way that it is free to follow the movements of the soft tissues - it must be attached by means of a hinge which is universal in action. This hinge should be constructed of the same metal throughout.

There must be no escape of air between artificial velum and denture. That is, the velum must make a valve-like contact with the denture part of the appliance during the functions of deglutition and speech.

Cases which, hitherto, have presented complications with regard to the retention of appliances, can be treated satisfactorily by the fitting of special obturators which are mechanically operated. These obturators, although passing well into the 'under-cuts' of the palatal clefts, produce no pathological changes in the soft tissues upon which they bear.

Non-surgical closure of palatal defects can be accomplished by means of the application of certain orthodontic procedures. The growth impulse can be stimulated/

/stimulated by mechanical means, and this is best achieved when osteogenic potentiality is high, - during the eruption of certain teeth. There can be no doubt that these procedures can play a part of the utmost importance in the treatment of palatal defects, especially with regard to correction of palatal malformation in the young patient.

Rehabilitation of young patients should be accomplished in the shortest possible time within the limitations of sound dental procedures; if possible, before permanent harmful habits become established with regard to speech and deglutition.

The psychological effects, resulting from the bringing about of improved aesthetic appearance, are frequently very marked. Acquired complexes may be entirely eliminated following the completion of prosthetic measures.

Successful treatment of congenital and acquired deformities of the oral and facial structures depends upon the closest co-operation between surgeon, plastic surgeon and dental specialist.

SUMMARY.

An introductory note is followed by a short discourse on the history of the conditions which come under discussion in the treatise.

Normal development of the oral and facial structures is reviewed and illustrated diagramatically.

A summary of developmental malformations is given, and, in some instances, photographs serve to illustrate the conditions mentioned.

Lip and palatal clefts are classified. Photographs of the various types of these malformations are included.

A series of selected cases is presented. This series includes cases of congenital and acquired oral deformity. Modes of treatment are described and illustrated. Results, following the application of original procedures in the non-surgical closure of palatal defects, are shown. Methods of overcoming retention difficulties, by means of original appliances, are demonstrated in cases of both congenital and acquired oral deformity. Orthodontic measures, as applied to the correction of premaxillary protrusion in the young patient, are described and illustrated.

Technical procedures in the construction of original appliances are described. Photographs and diagrams are utilised/

/utilised in the presentation of these various procedures.

Findings are given. These are based upon examination of records of 31,953 infants born during a period of ten years, together with observations noted during the examination and treatment of a series of 250 cases of congenital cleft palate. The main features and characteristics exhibited by those suffering from congenital oral deformity are illustrated in a series of 100 cases drawn at random from the main series. The 100 cases are presented in summarised form.

A discussion is included. This part of the thesis is presented in two sections. The first section deals with the etiology of congenital malformations. A theory, based upon hereditary predisposition to oral malformation, is advanced and discussed. Existing theories, relating to 'maternal impressions' and 'maternal malnutrition' are investigated, in an attempt to determine whether or not these conditions play any major part in the etiology of congenital deformity. The high incidence of twinning, or history of twinning, observed in families in which occurs oral deformity, is considered. Mention is made of endocrine disturbance, epilepsy and ocular hypertelorism in their relation to congenital malformation.

The second section of the discussion is devoted to the treatment of oral deformity. Arguments are put forward

in/

/in favour of various corrective measures which have proved efficacious during the researches which have been pursued. Consideration is given to prosthetic measures in relation to the functions of speech, deglutition and aesthetic appearance. Non-surgical methods of closure of palatal defects, by the application of original orthodontic measures, are discussed. Surgical procedures are considered, both as independant modes of treatment, and in conjunction with prosthetic and orthodontic measures.

The conclusions arrived at, as a result of the researches which have been undertaken, are enumerated.

A bibliography appears at the end of each main section of the treatise.

NOTE.

Since the compilation of this thesis, a further 43 cases of congenital cleft palate have been examined and treated. Findings noted in this series of cases are in complete agreement with those already presented.

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