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SEPTAL DEFORMITY, MALOCCLUSION AND RAPID PALATAL EXPANSION*

LINDSAY P GRAY, M.B., B.S., D.L.O.†
and W. F. BROGAN, D.D.O.R.F.P.S., F.A.C.D.S,‡

PART 1:

The Relationship between Septal Deformity and Dental Malocclusion

This article describes some observations supporting the Birth Moulding Theory (Gray 1965) of the Aetiology of Septal Deformity and demonstrates not only that this same aetiology can, but also usually does produce typical dental malocclusion. These observations give a firm rationale to the procedure of Rapid Palate Expansion.

There are two basic types of septal deformity which have different aetiologies and may occur independently or in association.

1. Anterior Cartilage Dislocation: This is a bend or buckle localised to the anterior quadrilateral septal cartilage, with or without dislocation from the anterior nasal spine. This is due to direct pressure at any age, and there is often malalignment of the external nose.

2. Combined Septal Deformity: This involves all the septal components—vomer bone, perpendicular plate of the ethmoid and anterior septal cartilage. There may be a spur or S shaped deformity. There are always associated abnormalities, as irregular hypertrophy of the lateral walls of the nose, and at times deformities of cheek, external nares, palate and malocclusion of the teeth. This is due to birth moulding pressures and is an acquired congenital deformity. There is no external malalignment of the nose.

Varying degrees of nasal obstruction due to the combined septal deformity have been demonstrated at birth by the passage of polythene testing struts (Gray 1969). The incidence of frank obstruction is about 21% of normal vaginal deliveries but only about 5% in cases of Caesarean Section. The incidence of septal deformity in adult skulls is about 77% (McKenzie 1884). This deformity is present at birth and becomes more apparent with age.

The basis of the Birth Moulding Theory is that during pregnancy, before or during parturition, the foetus receives varying degrees of pressure which can be localised or generalised. These are called Posture and Parturition Pressures, i.e. distinguishing those occurring before and during parturition. Bilateral pressure occurring across the transmalar plane (the widest part of the face) will be transmitted across each arch of the maxilla, and the resultant force will be directed cranially up the septum, tending to compress the septum against the firm base of the skull. If this resultant force is great enough, then splaying out of the vomer-ethmoid junction, or a gentle C or S shaped bend of the septum may occur.

Considerable torsion strains occur during parturition, as readily shown by the unequal moulding of the head of a new-born baby. If the compressing force acts on the front of the septum, the septum will tend to bend in an AP direction. If the compressing forces on each side are unequal and strong enough (see Fig. 1) then one side of the maxilla will tend to be compressed medially, and the arch of the palate to be raised cranially on that side. This will cause tilting of the vomer bone to the opposite side, thus causing kinking of the vomero-cartilage articulation. This kinking causes loss of the controlling growth pressures of direct apposition of the bone and cartilage, and thus the deformity tends to increase with ensuing growth. This compression of the maxilla will cause altered bony contour, with change in direction of the growing teeth, and will tend to produce crowding. For the first 3 years the growth of the septum is by growth of the cartilage and after that by absorption of bone above and deposition of bone below the palate (Scott and Symonds).

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† Senior E.N.T. Surgeon, Princess Margaret Hospital for Children, W.A. 6000.

‡ Consultant Orthodontist, Princess Margaret Hospital for Children, W.A. 6000.

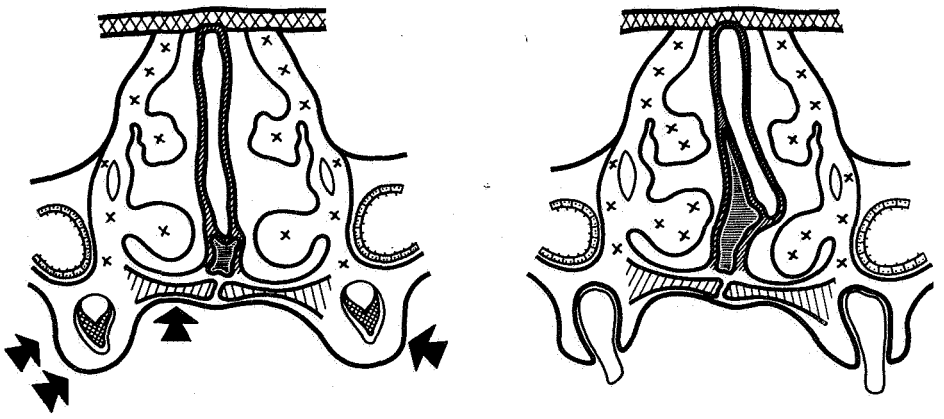


Fig. 1: Diagrammatic Representation of Growth of Septum due to Unequal Pressures. Note compression of *maxilla, elevation of palate, tilting of vomer* to opposite side, giving unequal growth of the vomer irregular hypertrophy of the lateral nasal wall and changed alignment of teeth.

The normal septum is straight and symmetrical and meets a normal arched palate at right angles in the mid line (Figs. 2 and 3). The following illustrations demonstrate the development of these palatal and septal deformities. Figs. 4 and 5 demonstrate posture pressures in a 5 month foetus. Fig. 6 demonstrates parturition pressures at birth, and Fig. 7 demonstrates the growth of the deformity in a 6 month old child. Fig. 7 also demonstrates the irregular compensatory hypertrophy of the lateral wall of the nose that occurs to fill up any concavities of the septum.

These sections demonstrate obvious changes in the arch of the palate and the contour of one maxilla.

As these bony structures are not elastic, there is no tendency for spontaneous reduction. Once deformity has occurred, then with growth of the child certain abnormalities will ensue, varying with the strength of the pressures, their site of application and the strength of the tissues. Some of the abnormalities can be readily observed at birth, but all become more pronounced with the growth of the child. These are dental and palatal changes, changes in cheek contour, soft tissue and bony changes of the external nares, septal changes and changes in the lateral wall of the nose.

Dental Changes: Deformities are evident in the milk dentition and are carried on into, and may be more marked in the permanent dentition.

The site and direction of the compressing forces can usually be readily seen and cause the following main types of dental deformities.

1. **Bilateral Pressure:** (a) Symmetrical pressure (see Fig. 8) produces angulation of the anterior palate with narrowing. The palatal rugae are even. The incisors are usually angled, with overlapping, and the mandibular articulation is normal. The nares are normal. The septal deformity is usually a simple bend or deviation, although spurs, composed of kinking of the vomer and ethmoid plate, may occur.

(b) Asymmetrical pressure may cause compression, for example over the molars on one side and the canine area on the other, producing narrowing and elevation of the palate on one side and cheek changes on the other. The septal deformity is the spur type.

2. **Local Compression:** of the Central Incisors. The central incisors are pushed backward, the lateral incisors tend to be rotated and the canines splay out (Fig. 9). The lower incisors are crowded and incline backwards. The remaining teeth and mandible are in normal occlusion. The palate is normal. The septum may show some splaying out of the vomero-cartilage junction or be deviated.

3. **Local Compression along one side:** This is the commonest deformity. The teeth on the other side characteristically have normal alignment unless there has been swing of the mandible. The mandible may swing to the same or opposite side to make the occlusion of the teeth more comfortable, and this appears to be influenced mainly by the degree of deformity of the upper canine. The palate, depending on the site of compression, may become narrowed, distorted and elevated, with unevenness of the rugae. The septum has a spur deformity to the opposite side to the compression. The nares are often deformed and narrowed on the side

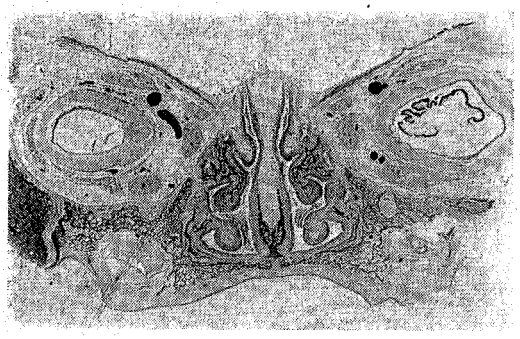


Fig. 2

of the compression with flattening of the cheek. The sites of compression, which may be quite localised are:

1. centred over the lateral incisors—partly affecting the central incisors and canine;
2. centred over the canine—partly affecting the adjacent bicuspid or molar and tending to push forward or twist the lateral incisors (Fig. 10);
3. centred over the molars and partly affecting the canine.

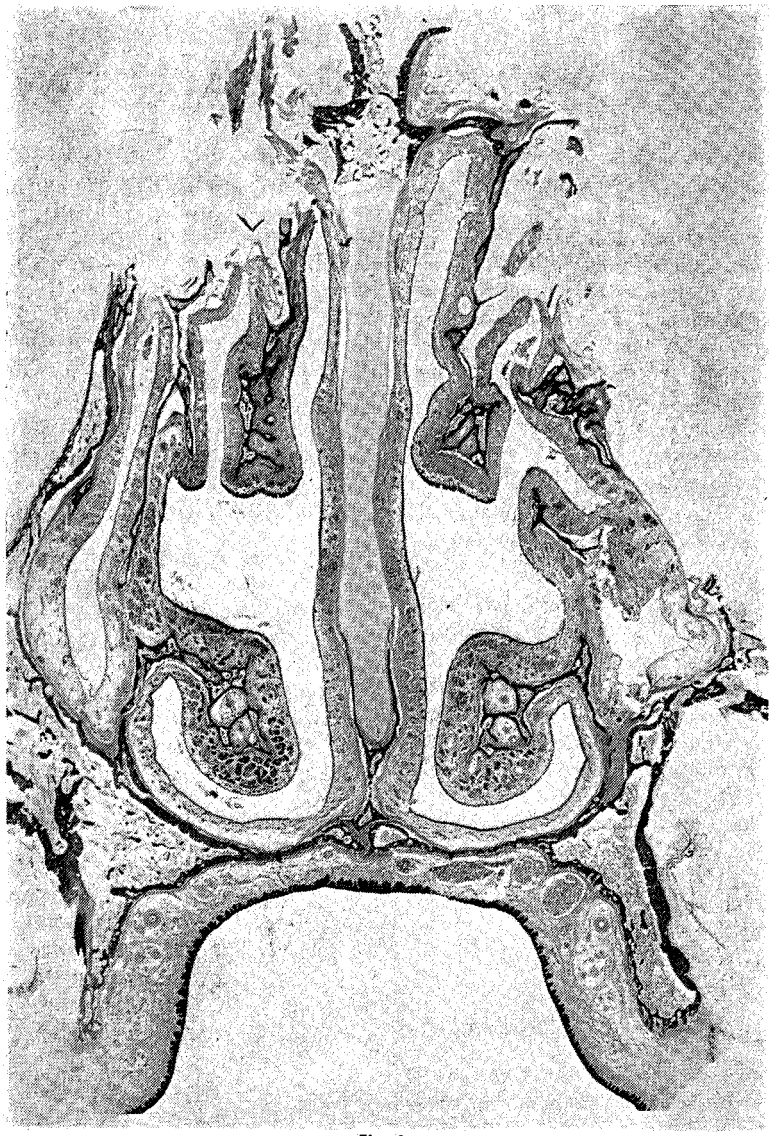


Fig. 3

Figs. 2 & 3: Normal Septum of 5 month foetus (fig. 2) and 6 months old child (fig. 3). Note straightness of septum, evenness of palate, equal turbinates and even growth of vomer bone.

This is an acquired congenital deformity and review of cases found deviated at birth after 3 - 4 years have demonstrated the development of the above mentioned deformities. Review of cases over the period of the commencement of the permanent dentition, i.e. from 5 to 8 or 9 years of age, have demonstrated that malocclusion in the primary dentition continues into the permanent dentition.

It has been found that the manipulation by caudal pressures on the palate (Gray 1965b and 1969) of severely obstructed cases at birth, selected by means of testing struts, will not only reduce the septal deviation but also largely prevent the malocclusion (see Figs. 11 and 12). A review of a series of 75 cases after 2 years demonstrated that about 85% (27 out of 32) of those passed as straight at birth were still straight, 95% (17 out of 18) of those found deviated at birth were still obviously deviated, and 75% (18 out of 25) of those found deviated and then manipulated, were now straight. The manipulation must be done early, preferably in the first few weeks, as the bony abnormalities become fixed by six months (see Fig. 7).

As the arch width is of extreme importance in the production of malocclusion (Dental Board 1956, Scott and Symonds 1958), any reduction will cause increased crowding of the teeth in the infant jaw. This birth moulding undoubtedly causes narrowing of the arch and change in alignment of the maxilla. The pressure may be so great as to squeeze a tooth germ (follicle) well out of alignment as shown by the canines in Fig. 9 with local compression of the central incisors.

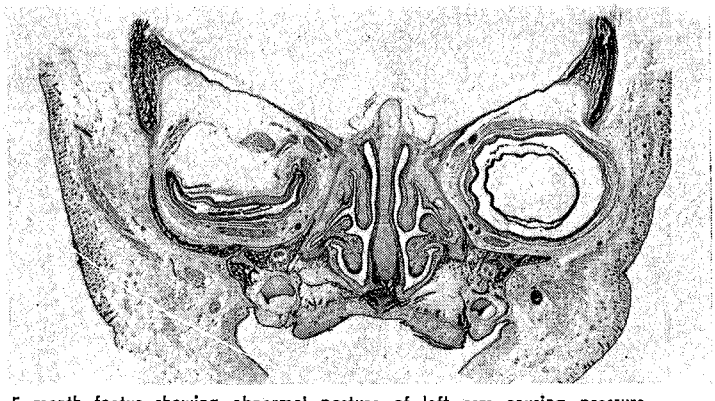
The change in angulation of teeth as well shown in Figs. 6 and 9 is permanent, for the bone is inelastic and there are no dilating forces. Nasal obstruction may occur due to the associated septal deformity, causing poor nasal airway.

Rapid Palatal Expansion as recommended by Griffin in 1958 is an efficient method of widening the arch. The earlier it is done the more likely are the teeth to assume normal positions. If some outward movement of the crowns of the teeth occur then it is all to the good. The new alignment of the outer wall of the maxilla and cheek means that the face will grow a little wider as the child grows older, this improving the nasal airway.

It is important to appreciate that this Combined Septal Deformity is present at birth. The degree of the deformity and the amount of its influence is variable, but the deformity exerts its influence from birth on the nose and teeth.

PART II:
Rapid Palatal Expansion in the Treatment of Deficient Nasal Airway

Introduction: The inter-relationship between septal deviation, palatal shape and malocclusion has been extensively investigated over the last eighty years. Griffin's work in 1958-61 is probably the most exhaustive and interesting.



Figs. 4 & 5: Birth Moulding Theory. 5 month foetus showing abnormal posture of left arm causing pressure on the cheek which has been transmitted to the maxilla. The section demonstrates the indentation of the cheek, narrowing of the buccal sulcus, unevenness of the palate with malalignment of the septum.

Despite the relative simplicity of the treatment he suggested and its favourable results, his work has aroused little interest. I feel this is largely due to lack of liaison between the medical and dental professions and a lack of understanding of each other's views on anatomy and development.

The most convincing proof of the relationship between malocclusion and septal deviation is that the diagnosis can be approached from either field. If the septum deviates to the left, a palatal inclination of the upper teeth or an actual crossbite on the right can be predicted. Similarly, the septal deviation can be predicted from an examination of the occlusion.

At Princess Margaret Hospital we have treated a number of ENT patients by palatal expansion. The patients selected have had a deviated septum, poor airway and a history of ear or nasal infection with, usually, an associated allergic or asthmatic condition.

Technique: The appliance consists of silver splints connected by a jack screw (Fig. 13). The splints are cemented to the posterior teeth and the screw given a quarter turn morning and night. The aim is to produce a relatively rapid expansion over a period of two to three weeks, splitting the inter maxillary suture (Figs. 14, 15 and 16). At this stage of treatment, the screw has been expanded about 6 - 8

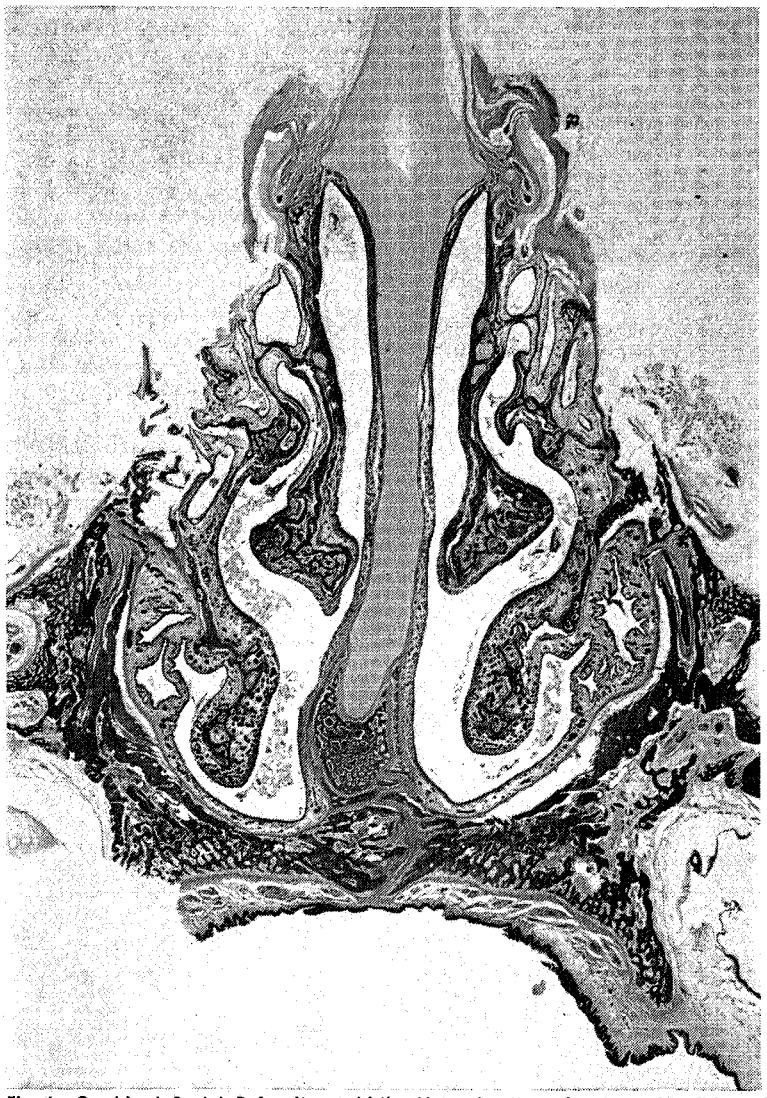


Fig. 6: Combined Septal Deformity at birth. Note elevation of palate with tilting of vomer. Note the equal turbinates.

mm. It is most important to supervise this stage of treatment closely as the expansion must be as rapid as possible. Full co-operation from parents and patients is essential for a successful result.

Once the desired expansion is achieved, the splints are locked in situ for 6 weeks and then removed. Some relapse occurs in the next month and normally an effective expansion of 2 - 5 mm remains (Fig. 16). In Cleft Palate children or cases with severe crossbite prior to expansion, a permanent retainer is placed to maintain the expanded segments in good occlusal relationship and optimal expansion.

Results: Results to date (up to 9 months out of retention) have been most encouraging. Most patients have had an appreciable remission of symptoms and have established an adequate nasal airway.

The most interesting result of this treatment is the rapid response to expansion. In many cases during the first week, after only 1 - 2 mm of expansion, the nasal airway is established, snoring ceases and speech improves. Obviously the improvement is not only due to physical expansion of the nasal cavity. The movement either triggers some reflex action

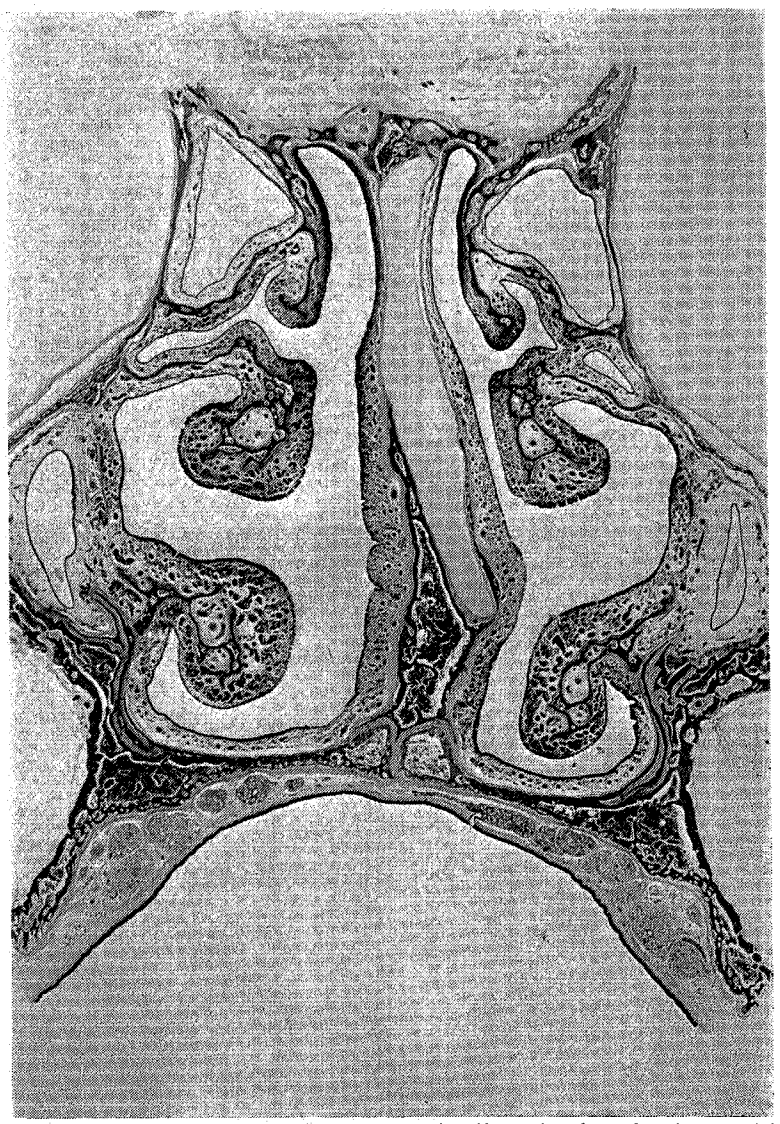


Fig. 7: Combined Septal Deformity at 6 months. Note elevation of palate, septal kinking with one sided growth of vomer and unequal size of turbinates.

or relieves a chronic irritant which has caused nasal congestion.

Sixty patients have been treated in the last 15 months. In some cases the overall improvement in general health has been dramatic. All cases have received some benefit. In 80%, an adequate nasal airway has been established and maintained with a consequent reduction in mouth breathing and snoring. In over 40%, the fairly severe allergic symptoms have considerably improved and this improvement has been maintained to date. Increased exercise tolerance, particularly running and swimming, is another clear indication of the improved airway and adequate nasal drainage. Depending on the initial condition, other changes associated with the improved airway fall into one or more of the following groups:—

(a) Reduction of allergic symptoms; sniffing, itching nose, wheezing and asthma.

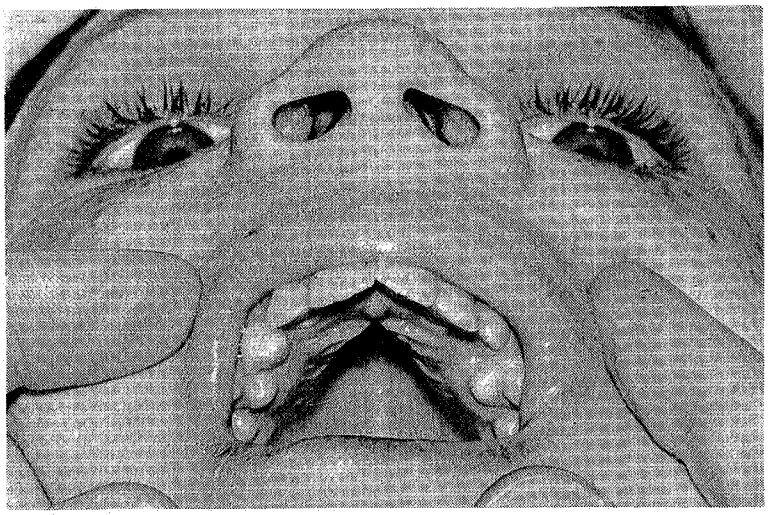


Fig. 8: Dental Changes. Symmetrical Bilateral Pressure. I.G. aged 10, septum to left. Note angulation of the palate, and normal rugae, over-riding and tilting medially of both central incisors.

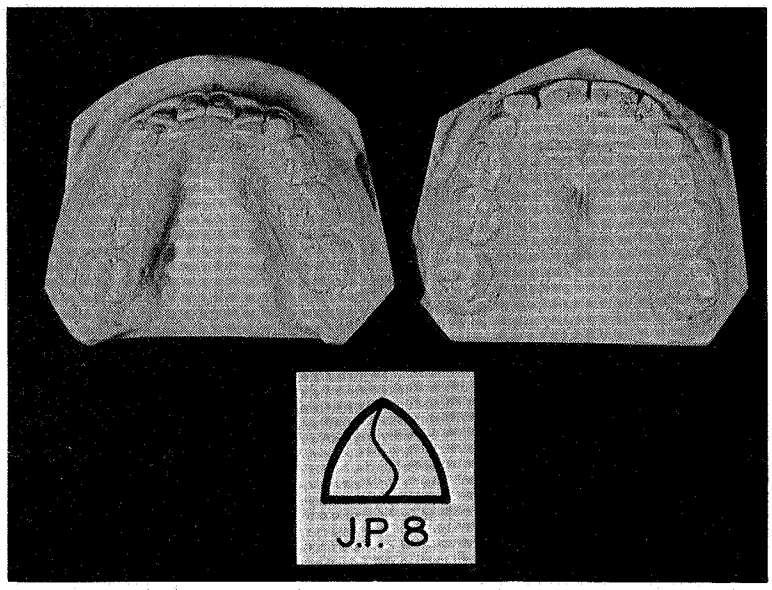


Fig. 9: Dental Changes. Local Compression over Central Incisors. J.P. aged 8. S shaped septum. Note splaying out and rotation of upper lateral incisors. Lower incisors are crowded and incline backwards. Normal occlusion of molars.

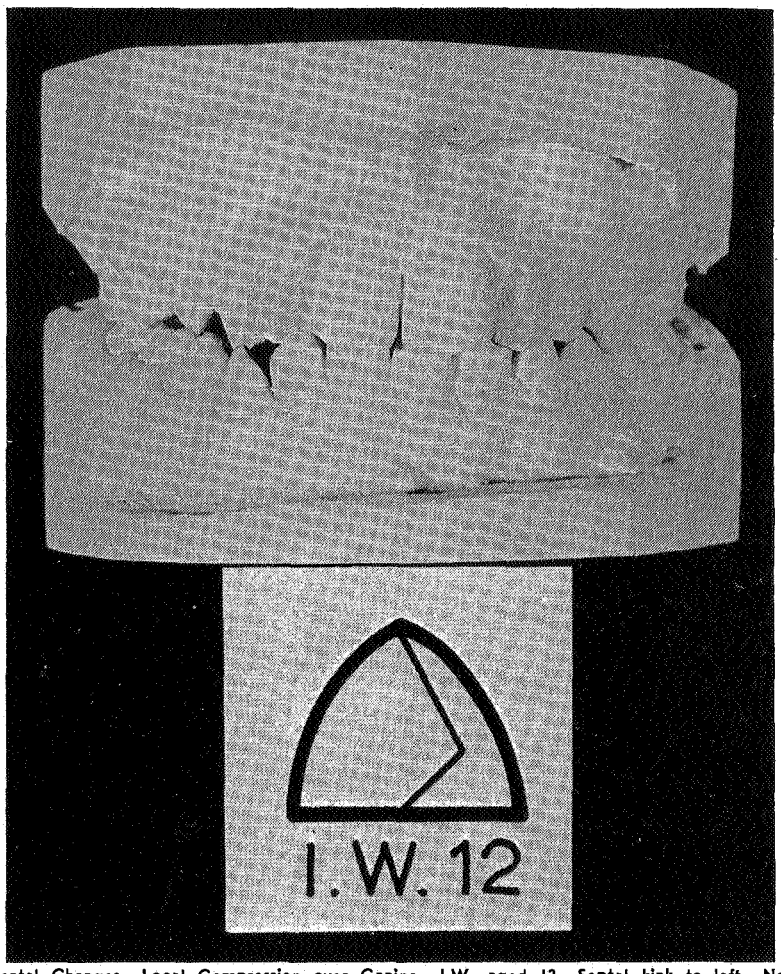


Fig. 10: Dental Changes. Local Compression over Canine. I.W. aged 12. Septal kink to left. Note medial displacement of right upper canine and lateral incisor.

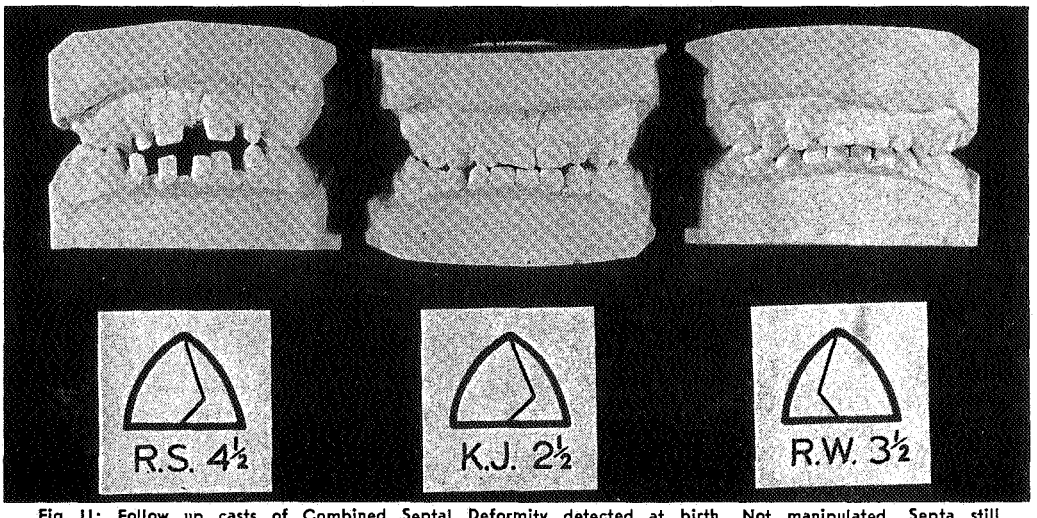


Fig. 11: Follow up casts of Combined Septal Deformity detected at birth. Not manipulated. Septa still deformed. Considerable malocclusion present.

(b) Reduction in respiratory infections—colds, etc.

(c) Speech clarity and nasal tone.

(d) Better appetite and consequent weight gain.

(e) Reduction in ear infection and associated deafness.

(f) Correction of crossbite.

(g) Relief of crowding and improved arch alignment.

Discussion: There are obvious problems which are being studied in a further series of patients.

Optimum age for treatment appears to be in the 4 - 6 year age group, prior to the eruption of the permanent teeth, anticipating the growth spurt in this period and deriving maximum benefit from it. Children in this age group tolerate the appliance particularly well and it appears to cause little interference in their social pattern (Harvey 1969). Older children derive considerable oto-laryngological benefit

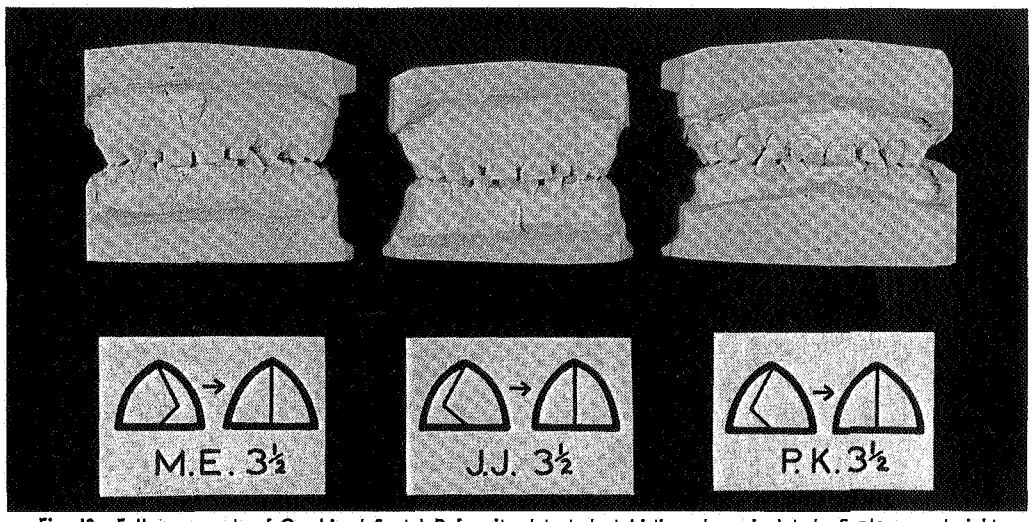


Fig. 12: Follow up casts of Combined Septal Deformity detected at birth and manipulated. Septa now straight and occlusion as good as normal.

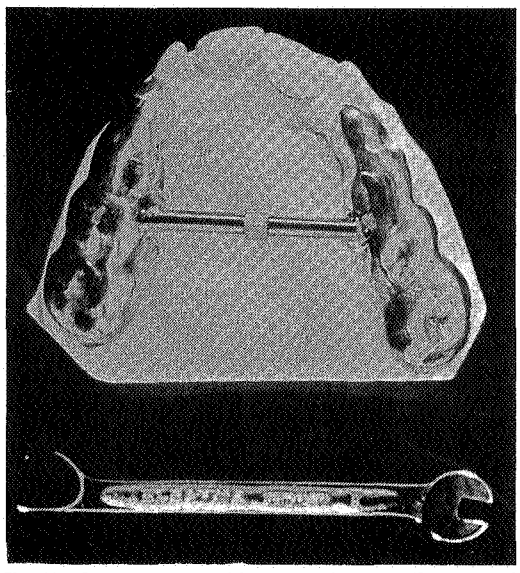


Fig. 13: Dental cast with expanding appliance and turning spanner.

from treatment but care must be taken to minimise occlusal disturbance. It is proposed to undertake long term studies on the increase in inter-canine width both in the maxilla and the mandible to establish the effects of palatal expansion on the growth pattern. Selection of cases is also being closely studied. Broad shallow palates do not respond well either clinically or orthodontically. Response by patients with marked bronchial symptoms has also been disappointing.

Conclusion: We consider this initial series has conclusively demonstrated the value of the technique in establishing a normal pattern of nasal breathing with a consequent reduction in symptoms associated with a deficient airway. Further investigations are being undertaken to establish the optimum age for treatment, possible effects on the occlusion, and the incorporation of the technique into other methods of oto-rhino-laryngological and orthodontic treatment.

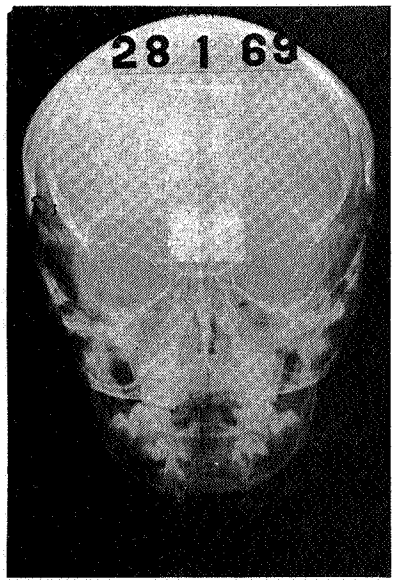


Fig. 14: Palate Expansion — pre expansion X-ray. N.P. aged 6.

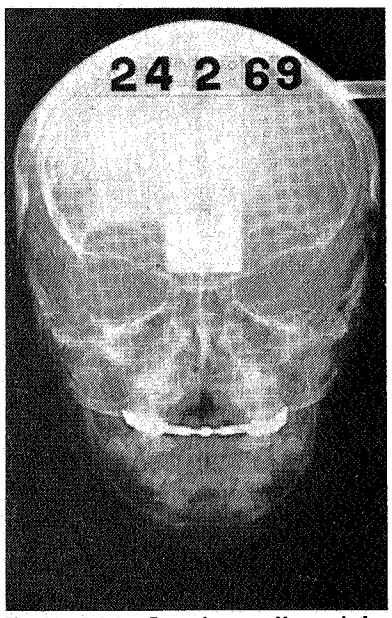


Fig. 15: Palate Expansion — X-ray during expansion demonstrating the intermaxillary widening.

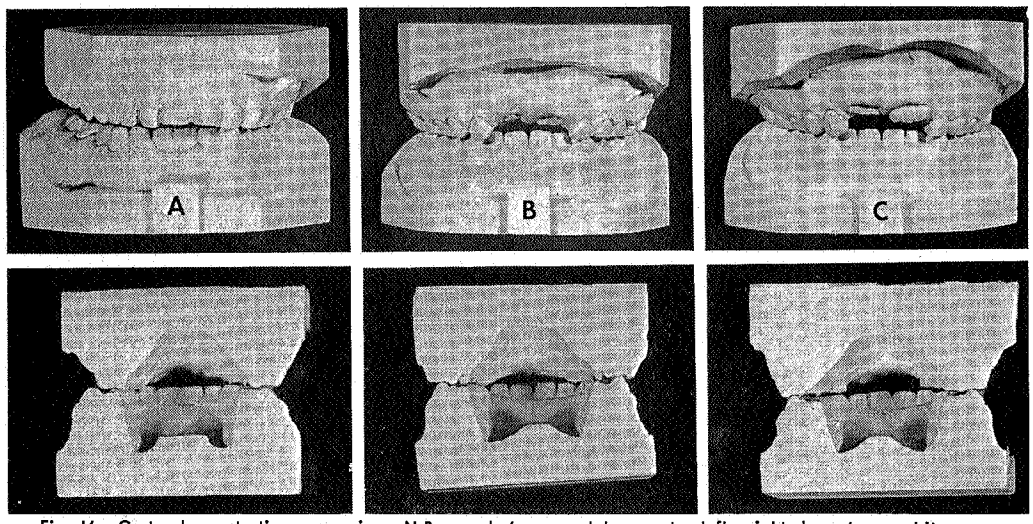


Fig. 16: Casts demonstrating expansion. N.P. aged 6 — septal spur to left, right buccal cross-bite. Casts before (A), just after (B) and 3 months after (C) expansion: Note the negatives of the sectional models have been reversed to highlight the deformity and movement of the maxilla.

Summary:

1. There are 2 kinds of septal deformity:
   (a) Anterior Cartilage Dislocation. This is confined to the quadrilateral septal cartilage and is due to trauma at any age.
   (b) Combined Septal Deformity. This involves all the septal components and the lateral wall of the nose. There are also associated abnormalities of the teeth, palate, external nares and cheek. It is an acquired congenital deformity due to pressures due to Birth Moulding.
2. Different types of dental abnormalities are described, due to different sites of compression of the maxillary arch, and thus, this is one cause of malocclusion.
3. The combined septal deformity is present in a severe form in at least 20% of normal vaginal deliveries and about 5% of cases of Caesarean Section.
4. The development of the septal and dental abnormalities can largely be prevented by manipulation at birth.
5. The rationale, technique and results of treatment by Rapid Palate Expansion is described.

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194-196 St. George's Terrace,
Perth 6000.

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