A CRITICAL SURVEY

OF

CURRENT PEDODONTIC LITERATURE

BY

SUSAN MARY HULL B.D.S.

CANDIDATE FOR M.D.S. DEGREE
INDEX

1. Embryology .................................................. 1.
4. Examination and Diagnosis ............................... 20.
9. Modified Procedures for Young Permanent Teeth ... 49.
12. Extraction and Anaesthesia .............................. 71.
13. Eruption and Occlusion During Deciduous and Mixed Dentition ........................................ 77.
14. Preventive Orthodontics and Space Maintainers ... 85.
Bibliography .................................................. 95
1. Development of the Face.
2. Development of the Palate.
3. Development of the Tongue
5. Abnormalities (a) Teeth (b) Face

A great amount of work has been done on the various stages of the human embryo, and so much accurate information is to hand on this subject that very little disparity occurs between the accounts given by different authors.

A very brief summary is given below of those aspects of embryology most important from the dental point of view.

1. Development of the Face.

In a three weeks old embryo the face consists of the bulging forebrain and the mandibular arch, separated by the primary oral groove. It is about this date that the buccopharyngeal membrane ruptures and communication is established between the oral cavity and the foregut.

The next stage is the development of the frontal process by proliferation of the mesoderm covering the anterior end of the brain. Then, (about the fourth week) the olfactory pits begin to develop, dividing the frontal process into a middle and two lateral nasal processes, which are adjacent to the maxillary process, but separated from it by the nasomaxillary groove.

At the fifth week the medial nasal process, which is growing more rapidly than the lateral process, contacts and fuses with the maxillary processes and later (6th week) it also fuses with the tip of the lateral nasal process. Thus the maxillary process does not border the nostril, nor do the lateral nasal processes border the oral cavity.

By this fusion an epithelial wall is formed between the nasal pit and the oral cavity. This thins out and is called the
bucconasal membrane. It finally ruptures so that the nasal groove opens into the oral cavity, leaving only the anterior part remaining, which contains mesoderm and forms the primary palate.

This is the only instance of actual fusion of the processes in the face, the grooves separating the other processes becoming shallower by proliferation of mesoderm and finally disappearing.

By the seventh week the eyes have moved round from the lateral to the anterior surface of the face.

In the mandible, which is at first an undivided arch, furrows, one median and two lateral, appear between the fifth and sixth week and these later disappear again.

The further development of the face depends on the differential growth of these various regions. In this way the width of the mouth is decreased, the eyes move closer together while the mandible at first small in proportion to the maxilla is normal by birth. The external nose is developing but is not fully developed until puberty.

2. Development of the Palate.

At the tenth week the oral cavity is increasing in height and the future nasal septum has commenced to grow down. The roof of the oral cavity is incomplete, consisting anteriorly of the primary palate and laterally of the inner horizontal surface of the maxillary process.

About this time the palatine processes begin to grow vertically down to lie either side of the tongue. Their oral surfaces grow faster than the nasal, leading to a change of direction to the horizontal. This can only happen when the tongue moves down and out of the way which is made possible by a sudden acceleration of mandibular growth.

The secondary palate is formed by the fusion of the palatine processes. The anterior parts fuse both with each other and with the nasal septum and in this area the hard palate develops. The posterior parts are not related to the nasal septum and form the soft palate and uvula. The space between the palatine
processes closes gradually in an antero-posterior direction. The epithelial suture remains only in the anterior region where the palatine processes fuse with the primitive palate and this becomes the primitive nasopalatine duct.

Two epithelial lamina arise from the shallow sulcus separating palate and lip, an outer vestibular and inner dental lamina. The mesoderm between these two lamina later forms the alveolar process.

3. Development of The Tongue.

The tongue is derived from the first second and third bronchial arches.

The anterior part of the tongue originates as three prominences on the oral aspect of the mandibular arch. The terminal sulcus remains on the tongue throughout life marking this division.

In this area, in the midline the thyroid an*large* develops and by downward growth moves into the correct position of the thyroid gland. The foramen caecum shows its position in the adult.


The first signs of tooth development occur about the sixth embryonic week when cells in the basal layer of the oral epithelium begin to proliferate in the region of the future dental arch to form the dental lamina. Ten swellings appear in this in each jaw in the region of the future deciduous teeth. These are the tooth buds.

As these tooth buds proliferate the deep surface becomes concave so that the tooth bud is next spoken of as being in the "cap stage." At this stage a layer of peripheral cells can be seen surrounding a central core of cells resembling mesenchyma known as the stellate reticulum. The peripheral cells have already differentiated into a layer of squamous cells, the outer enamel epithelium and a layer of columnar cells, the inner enamel epithelium.

The mesoderm which is to form the dental pulp begins to proliferate about this time and the primitive dental sac begins to appear.
As the tooth bud continues to develop the mesodermal invagination becomes deeper and the "bell stage", the stage of histodifferentiation is reached. The following changes take place. The inner enamel epithelium differentiates into characteristic ameloblasts and their nuclei move to the outer end of the cell. Several layers of squamous cells known as the stratum intermedium appear between the ameloblasts and the stellate reticulum.

The cells in the dental papilla underlying the ameloblasts differentiate into odontoblasts and between the cells is the future dentino enamel junction, formed as the ameloblasts move outwards depositing enamel and the odontoblasts move inwards depositing dentine.

At this time the dental lamina is disintegrating between the oral epithelium and the enamel organ while it is proliferating at the deep end to form the tooth bud of the succeeding permanent tooth. The permanent molars, having no deciduous predecessors, are formed by distal extension of the dental lamina, the first molar commencing before birth (about 4th month) and the second molar in the first year of life.

The roots of the teeth do not begin to develop until enamel and dentine formation has reached the cemento enamel junction. Root formation is controlled by Hertwig's Epithelial Root Sheath which is developed by the epithelial enamel organ. The epithelial root sheath degenerates after the odontoblasts have differentiated in the root area and laid down the first layer of dentine. Remnants may persist and are known as Epithelial rests of Malassez.

The final stage in tooth formation is known as Apposition and consists of the laying down of enamel and dentine (see next chapter)

5. Abnormalities
(a) Teeth

Abnormalities, both of the teeth and the face originating at this time, depend on the developmental stage at which they occurred.

For example, if the abnormality occurs during the initiation stage of the teeth, one or more teeth may be completely absent or supernumerary teeth may occur. Should the disturbance occur during
the proliferative stage supernumary cusps or roots may develop, fusion may occur, or parts of the tooth may be absent.

Again the disturbance may occur at the time of histodifferentiation as in Dentogenesis Imperfecta (hereditary opalescent dentine) where the odontoblasts are incompletely developed and irregular dentine is formed while the shape of the tooth and enamel formation is normal. Disturbances during morphodifferentiation affect the size and shape of the tooth while enamel and dentine may be normal.

(b) Face.

The most common malformations of the face are hare-lip and cleft palate. Little is known of the etiology though an hereditary tendency is recognised.

Harelip may be unilateral or bilateral but is never in the midline. A complete hare-lip extends from the lower border of the nostril through the upper lip and alveolar process to the region of the foramen incisivum, and is attributed to failure of fusion between the medial and lateral nasal processes and the maxillary process. The lateral incisor may be found on either side of the hare-lip, may be completely missing, or may be duplicated, occurring on either side of the cleft.

Cleft palate may occur alone or associated with hare-lip and is caused by failure of fusion of the palatine processes with other and the nasal septum. It may be unilateral or bilateral.

The process of fusion commences at the anterior end and proceeds posteriorly and may be interrupted at any stage, thus explaining the various degrees of cleft palate, which may involve only the uvular or may extend forward involving also both soft and hard palates.
CHAPTER 2.

THE STRUCTURE AND DEVELOPMENT
OF THE TEETH.

(A) Enamel

1. Composition of Enamel
2. Amelogenesis
   (a) Formation
   (b) Maturation
3. Chronology
   (a) Deciduous Dentition
   (b) Permanent
4. Clinical Observations
   (a) Hypoplasia
   (b) Erosion
   (c) Abrasion

(B) Dentine

1. Composition of Dentine
2. Innervation and functional changes
3. Development
4. Hereditary Opalescent Dentine

(A) Enamel

1. Composition of Enamel

Enamel is the hardest calcified tissue in the human body and chemically is similar to apatite. By weight 96% of it consists of inorganic material and the remaining 4% organic. The enamel consists of enamel rods, rod sheaths and interprismatic substance.

The enamel rods were first described by Retzius in 1825 and run throughout the enamel at right angles to the dentine surface, and are not quite straight but follow a slightly spiral course.

In the deciduous teeth the enamel is formed partly before and partly after birth and that which is formed in utero is usually better developed than that formed after birth, owing to the protected environment of the foetus. The boundary between these two parts is marked by an accentuated incremental line and is known as the Neo-natal line.

The crowns of newly erupted teeth are covered by the enamel cuticle usually known as Nasmyth's membrane and consisting of the primary (calcified) and secondary (keratinous) cuticles. This is more resistant to acids and alkalies and forms a protective layer while it remains on the enamel. It is worn off exposed surfaces by mastication and cleaning.
It has been suggested by Bodecker that dental lymph may diffuse through the organic material present in enamel, thus explaining the increased permeability of young permanent teeth and the increasing impermeability with age as more mineral salts are deposited through these channels. The surface of normal mature enamel is impermeable to saliva.

From the clinical point of view the direction of the enamel rods is very important in cavity preparation. As the interprismatic substance is apparently weaker than the rods the line of cleavage follows the direction of the rods. Thus gnarled enamel is harder to fracture than straight enamel. Also, enamel rods left unsupported by cavity preparation are likely to chip off leaving leaky margins to restorations.

2. Amelogenesis

The early part of this process has already been described in the previous chapter.

In the enamel organ the ameloblasts are at first nourished by the blood vessels of the dental papilla. When the first layer of dentine is formed this supply is cut off and the ameloblasts are then supplied by the capillaries surrounding the outer enamel epithelium which proliferate at this stage.

Orban writes - "Ameloblasts enter their formative stage only when the first layer of dentine has already been formed."

Amelogenesis takes place in two distinct phases, - formation of the enamel matrix and its maturation by influx of mineral salts. The matrix is identical in structure with the mature enamel, but contains only 25-30% of the quantity of mineral salts. Etc.

(a) Formation The first stage in the formation of the enamel matrix is the formation of the dentino-enamel membrane and this occurs just after the first layer of dentine has been laid down. Next the ameloblasts produce a short process at their basal end known as Tomes' process. These processes are hexagonal in shape and are actually a continuation of the ameloblasts but separated from them by the terminal bars.
These processes remain approximately the same length as they are transformed into enamel rod substance at the dentinal end at the same rate as they are rebuilt at the ameloblastic end.

The next stage is homogenization of the Tomes process, followed by chemical changes proceeding rhythmically along the process and converting them to pre-enamel rods.

The last stage is an influx of mineral salts, starting at the dentinal end and keeping pace with the deposition of pre-enamel.

The formation of the enamel matrix follows an incremental pattern, commencing at the occlusal part of the dentino-enamel junction.

(b) Maturation of the enamel matrix begins when the matrix reaches its final thickness in the occlusal portion of the crown.

This process consists of the influx of mineral salts into the matrix, their crystallization and the simultaneous disappearance of organic substances and water. The process of maturation starts at the incisal tip of the crown and proceeds cervically in a plane at right angles to the long axis of the tooth, that is in cross relation to the incremental pattern of the matrix formation.

The completely developed and matured enamel is protected by the reduced enamel epithelium from the surrounding connective tissue until the tooth erupts. If contact occurs the enamel may be either resorbed or covered with a layer of cementum.

2. Chronology

An excellent chronological table has been prepared by Logan and Kronfield and is used by many authors. It gives the times of first evidences of calcification, completion of the crown, eruption of the tooth and completion of the root of both dentitions. A brief summary of the most important points of clinical interest derived from this table, is given below.
(a) Deciduous Dentition

The crowns of all the teeth in the deciduous dentition are in the process of calcification by the age of six months in utero, and are completed between 4th and 12th month after birth. The roots are completely calcified one to one and a half years after eruption.

(b) Permanent Dentition

The calcification of the first permanent molar begins at birth and all the anterior teeth except the upper laterals begin to calcify in the first six months of life. Thus the upper laterals may escape a disturbance affecting the other anterior teeth as they do not begin to calcify till twelve months.

The bicuspids and second molars commence calcification between one and a half and three years of age and the third molar between seven and ten years.

The crowns of the teeth take between three and six years to complete with an average of four years, while the roots are normally all calcified three years after eruption.

Thus it may be seen that at birth the crowns of the deciduous teeth only are in the process of calcification and occasionally the tip of the first permanent molar and therefore there can be no pre-natal affect on the permanent teeth.

Also the crowns of all the permanent teeth except the third molars are completed at eight years of age and so cannot be affected by nutrition after that time.

Therefore the important years for dental development are between birth and the age of eight. Before birth and the mother almost always provides a source of adequate nutrition for the foetus, even at the expense of her own tissues, (see chapter on nutrition)


(a) Enamel Hypoplasia

Enamel hypoplasia is the general term used to describe congenital enamel defects by most authors. However, Orban
-10-
draws the following important distinction:-

"If matrix formation is affected enamel hypoplasia will ensue; if maturation is lacking or incomplete, hypocalcification of the enamel will develop. In the case of hypoplasia a defect of the enamel is found; in the case of hypocalcification a deficiency in the mineral content of the enamel."

Both these conditions may be caused by systemic, local or hereditary factors.

The systemic causes are not yet properly understood. Sarnot and Schour believe the exanthematous diseases to be relatively unimportant. Rickets and hypopara thyroidism are said to be the most important causes. Where the origin is systemic, the chronological arrangement of circumscribed areas of the defect may be seen on the teeth. These areas were under formation at the time of the disturbance.

Local enamel hypoplasia affects single teeth and may be caused in permanent teeth by periapical infection of their deciduous predecessors.

Hereditary enamel hypoplasia is a Mendelian dominant character and affects the entire crowns of all the teeth. The affected teeth are yellowish brown, hard glossy and peg shaped.

In hereditary hypocalcification the teeth are of normal shape but the enamel is opaque and dull. This hypocalcified matrix soon becomes discoloured and abraded and the surface becomes rough and irregular, the dentine being finally exposed.

Enamel hypoplasia is said to be far more common in the permanent than deciduous dentition. Schour, Massler and others state that enamel and dentine formed before birth and examined by them was all well formed and showed no deficiencies. However, enamel formed after birth in the deciduous teeth may be affected. (See Chapter 14)

McBride states:

"Hypoplastic deciduous teeth show slight sensitivity to operative procedures, while young permanent teeth are exceedingly sensitive, much more so than normally formed teeth."

Bodecker offers the explanation that the high organic content of hypoplastic young permanent teeth transmits intense irritation to the pulp, but after ten or twenty years he says they become less sensitive due to maturation of the dentine.
The same applies to deciduous teeth when newly erupted, he says, but owing to the transmission of impulses, secondary dentine is rapidly formed to protect the pulp hence lack of sensitivity.

One type of hypoplasia very commonly seen is opaque enamel areas, which appear quite irregularly on the surfaces of the permanent teeth. They may be white or pigmented brown yellow or grey by saliva or foods. Restoration is seldom necessary unless disintegration occurs.

**Pitted enamel** is another type of hypoplasia often seen and consists of grooves of soft stained enamel running transversely across the teeth. The cause of this is systemic as described on the previous page, so that the affected bands on the teeth represent a chronological stage in the development of the affected teeth. Often where the incisors are affected, the upper laterals escape, due to their later calcification.

**Mottled Enamel** occurs as striations across the tooth surface, the enamel remaining unbroken except in extreme cases. These striations are at first chalky-white and later stain yellow and brown.

Fluorine present in the water supply in quantities greater than two parts per 1,000,000 is given as the cause for this condition.

Several American towns have changed their water supply after finding that every child who had used the city water supply during the period of calcification had mottled enamel. The children born after the change showed normal enamel. The fluorine apparently does not affect the enamel formed before birth or during lactation unless in extremely high concentration. That is, the deciduous teeth are seldom affected.

J. Wilson Ames reports success in bleaching such mottled teeth using a hydrogen peroxide and ether mixture applied with heat. Other investigators have successfully used different methods.
(b) Erosion

McBride defines erosion as:

"A localised progressive decalcification of enamel and dentine appearing on the gingival third of the labial surfaces of the anterior teeth in the form of an etched or roughened enamel surface."

These white chalky areas may be any size or shape or may occasionally involve most of the enamel surface. This condition is also seen near the gingival margins of the posterior teeth.

The deciduous dentition is only rarely affected and the cause is not yet known. Some suggestions are - excess acid food, some systemic condition or some condition of the glands in the mucosa over the affected teeth.

These areas may be too small to merit any treatment, if larger they may be stoned, polished and occasionally restorations or even a jacket crown will be necessary.

(c) Abrasion

A certain degree of abrasion of the deciduous teeth is normal by the time of exfoliation. Sometimes, however, an extreme is seen, usually due to the habit of grinding the teeth. Sometimes such teeth need extracting as they are not exfoliated normally.

E. Dentine

(1) Composition of Dentine

Dentine, though harder than bone is softer than enamel, slightly compressable and highly elastic.

Dentine consists of 70% inorganic material, mainly apatite and 30% organic material, mainly of a collagenous nature.

The elements present in dentine are the protoplasmic processes of the odontoblasts, Tomes' fibres, contained in the dentinal tubules and set in a fibrillar calcified matrix.

The odontoblasts are arranged along the pulpal surface of the dentine and their processes in the dentinal tubules, seen run at right angles to the pulpal surface following a slightly curved course to the dentino enamel junction.

Incremental lines can be observed in the dentine and a
Neo-natal line is present in the deciduous teeth as in enamel.

2. Innervation and Functional Changes

Controversy still exists over the nerve supply to the dentine. According to some authorities the nerve fibres of the pulp end on the bodies of the odontoblasts while others think they may accompany the Tomes processes through the dentinal tubules to the dentino-enamel junction. Transmission of impulses through the dentine has been tentatively ascribed to the Tomes' processes themselves, and also to the effects of osmotic pressure on the fluid in the tubules.

Dentine must be considered as a vital tissue and normally dentine formation continues throughout life on the pulpal surface, thus decreasing the size of the pulp chamber. It has been assumed that a nutritional fluid, the dental lymph circulates in the dentine.

The odontoblasts react to stimuli such as caries, cavity preparation or thermal shocks by producing irregular or secondary dentine on the pulpal wall under the area affected. This frequently saves the pulp from exposure, or irritation due to conduction of stimuli.

The general opinion has been that secondary dentine is not produced in deciduous teeth. Bodecker, however, has written that, contrary to opinion, there is secondary dentine produced in the first dentition in cases of open cavities and slow progressing caries. This does not happen in closed cavities where food debris is easily harboured. Clinical experience seems to substantiate this observation.

3. Development of Dentine

A thickening of the basement membrane under the inner enamel epithelium is the first sign of dentine formation. The next step is the formation of Korff's fibres running from the pulp to this membrane. The cells under the basement membrane then differentiate into columnar shaped odontoblasts.

A protoplasmic process, the Tomes' dentinal fibre, extends from each odontoblast towards the dentino-enamel junction.
These Tomes' fibres are enclosed in the organic dentine matrix or predentine consisting of the Korff's fibres which have become collagenous and are embedded in a cementing substance.

As a new layer of predentine is formed the earlier layer undergoes calcification following an incremental pattern.

(4) **Hereditary Opalescent Dentine.**

This condition is also known as Dentinogenesis Imperfecta and is a dominant hereditary characteristic. Becks believes it is caused by the odontoblasts failing to function properly from the beginning so the dentine matrix is improperly formed. The shape of the tooth and enamel is normal but the teeth appear dark. Marked abrasion usually occurs and the exposed dentine has an amberlike appearance.
CHAPTER 3.

INTRODUCTION

To my mind, in a review of pedodontic literature the chapter on child management is at once the most interesting and the most difficult to concisely outline. All text books of children's dentistry and many other dental books and articles make some mention, be it detailed or brief, of child psychology and handling, and while most operators who have successfully worked for children, agree on the main aspects of this problem, their individual approach is necessarily different. For not only is every child different in temperament, but every operator varies in personality so that an easy and successful approach by one operator would be difficult and unconvincing for another.

In such a wide field, the following chapter can only attempt to point out some of the basic considerations in dealing happily and successfully with children.

THE OPERATOR

Mc Bride quotes Brauer as saying that there are more dentists frightened of children than children frightened of dentists, and it may well be this feeling of helplessness in the face of the child's refusal to co-operate that makes small children so unpopular in many surgeries.

The importance of the dentist's bearing cannot be over emphasised. He must show unceasing confidence and decision as children, like dogs, can at once detect even a moment's indecision and take advantage of it; he must therefore make no promises that he cannot, or does not intend to carry out to the last letter. Dentists who do not like children or who lack patience should refer their child patients to another dentist.
The important thing is to dispel the child's fears, gain and keep their friendship and yet keep them under control and this can not be done by someone who becomes cross or cruel in process of establishing control.

It has been pointed out by several authors that children dislike baby talk and despise operators who use it. Children, like adults, are hurt if you forget their names and should be called by them instead of using pet names.

The dentist, says McBride, must treat the appointment hour as a strictly business appointment and the child must realise this. On the other hand rushing a child too much may shake their confidence and permanently lose their co-operation.

3. Conduct of the Appointment.

Jordan mentions the responsibility of the person handling a child's early dental work, as the psychological effects of early emotional experiences may persist through life.

Thus the ideal situation exists where the child visits the dentist before any work is necessary, so that should any pain occur at a later appointment, it is looked on as the exception, not the rule in the dental surgery.

For the child's first appointment the dentist must be prepared to spend some unproductive time. While a few general remarks and queries are in order both dentist and child are interested in the main business of the visit. The child, not the parent, should have the dentist's full attention at this time. Time, however, is well spent in explaining the chair and instruments to the child, showing him how the bur works, letting him voice any questions or fears and answering them sensibly, truthfully and reassuringly.

Some dentists suggest a prophylaxis only at the first appointment while others prefer to prepare a small painless cavity at the first sitting so everything is familiar at the next appointment. Always explain patiently to the child what you are doing and why; it is of far more interest to him than fairy stories
or idle chatter. I find children almost always bear cavity preparation far better if told how many "goes" with the bur are necessary and told to count them. It is emphasized that more will be necessary if they wriggle as it makes the dentist slow; promises of this sort should never be broken.

Even a good patient - and the average child is a good patient, can have their courage broken by too long a session, too much pain, or too frequent visits, and this is to be avoided wherever possible.

If given something constructive to do, such as holding cotton rolls with a finger, most children will co-operate well, keep very still and often salivate less.

The most difficult cases occur where children are not brought to the dentist until multiple extractions and large restorations are necessary. On most children an extraction at the first appointment has a frightening effect even though they are not hurt. A general anaesthetic may be thought advisable where many extractions are necessary.

Most children respond well to consideration of their comfort by the dentist, praise, and encouragement. Shame, argument or persuasion seldom make a child do something it does not wish to do. Where children are defiant they must be controlled by force, the towel method being the most successful way to do this. Only babies or subnormal children should be held while operating on. Others must be subdued first by the towel method. In no circumstances must a child be allowed to win his stand against the dentist.

4. The Parent

The parents' attitude to their own and their children's experiences at the dentist has the utmost influence over young children's approach to this new experience. As the child grows older the influence of school and playmates are reflected in his attitude but these influences are usually outweighed by the parental attitude;

Sensible parents can help a great deal, and fortunately most parents do, by displaying an unemotional approach to the
dental visits and confidence in the dentist and from this attitude their children take their cue. However, certain types of parents usually present problem children. Briefly, some of the worst offenders -

(a) Discuss in their children's hearing their own and their friends' agony and fear at the dentist.
(b) Threaten a visit to the dentist as a punishment.
(c) Tell the dentist in front of the child how "nervy" the child is.
(d) Extend sympathy to a child just when it is trying to be brave.
(e) Say to the child - "If you're not good this moment I'll get the dentist to pull all your teeth out."

In such cases it is necessary for the dentist to tactfully reason with the parent before attempting to proceed with the child.

Most authors state that their rule is - "No parents in the surgery after the first visit." This seems rather unelastic as some children fear separation from their parents more than any dental operation and in these cases the dentist's most effective weapon is the threat of sending the mother outside.

As a matter of observation many children behave far better when brought by their father, elder brother, or some friend whose good opinion they apparently value more than they do their mother's.

5. The Child

All authors have their own classification of the various types of children, though few children fit rigidly into any one division. Brauer, 

(a) The Co-operative.

No more need be said about this type except that he is a pleasure to work for, usually comes from a happy, well balanced home and advantage should not be taken of his good nature and his courage broken by too long sessions in the chair.

(b) The Timid or Bashful.

This child is usually more overcome by the social than dental significance of the visit and time spent gaining his
friendship and confidence will usually pay good dividends.

(c) The Fearful

The prospect of pain seems far more terrifying to some children than others and some of these present difficult behaviour problems. Premedication is often of great assistance in these cases. Explanation, reassurance and demonstration may convince some of these children that their fears are groundless. However, where this fails the child should be shown that resistance is useless and if the work cannot be done pleasantly, it will be done unpleasantly - that is, it will be to their own advantage to co-operate. These children will not co-operate until they see they have something to gain by doing so.

(d) The Spoiled or Defiant

These children, often from undisciplined homes have usually attained gratification from this attitude in their home life. They are really bluffers and it is necessary to call their bluff and convince them that their attitude pays no dividends in the dental surgery. An early show of determination from the dentist uncompromisingly backed up by the towel method where necessary, usually converts these children into good patients. Strangely enough a dislike for the dentist is seldom engendered by his control of patients of this type.

(e) The Sick

Where possible sick children should not have dental operations as their tolerance is markedly decreased. Where necessary, temporary relief of pain only should be attempted.

(f) Subnormal Children, present a difficult dental problem and often have a high caries ratio. Sometimes many restorations can be completed under a general anaesthetic. Sometimes the child must be held by force. Occasionally these children prove good and uncomplaining patients.
CHAPTER 4.
EXAMINATION AND DIAGNOSIS

1. Introduction
2. Methods of Examination
3. Diagnosis of Oral Conditions.

1. Introduction

All authors of pedodontia text books lay great stress on the importance of examining the child's mouth as a whole. Breuer, Higly and Boyd say "The dentist must not only be informed of the mouth condition as a whole, but he must also be cognizant of related possibilities of the entire body. Too frequently in the past have dental practitioners received patients in the office, wherein the complaint was an aching tooth, and a diagnosis as well as service was rendered on the basis of this one tooth, and not relating it to the mouth as a whole."

An important point is the age at which the child should be brought to the dentist for its first examination. McBride feels that three and a half to four years is early enough for two reasons. Firstly cavities below this age are nearly always occlusal and can be seen by the parents if present. Secondly, below this age children are usually uncooperative patients and may form a behaviour pattern that will make their subsequent appointments more difficult.

At the preliminary examination a chart should be fully filled in for the patient. This should be a complete and workable chart such as Dr. Kenneth Baslick's modification of the Rhobotham Chart. This includes such relevant points as physical condition, speech habits, and temperament as well as oral conditions such as carious processes, mouth hygiene and occlusion.

An observation of these general conditions allow the
dentist to relate the child's general health to its oral conditions. The old adage about "curing the disease but killing the patient" can apply also to pedodontia (see chapter on systemic conditions).

Finally a complete explanation of the condition of the child's mouth must be given to the parent. As well as pointing out carious processes, any need for orthodontia may be discussed, space maintainers suggested, doubtful teeth indicated, defective occlusal grooves and their prognosis explained and the oral hygiene commented upon.

The period between routine examinations varies with the age and oral hygiene of the child. The feeling among pedodontists seems to be that four monthly intervals are ideal, combined with a prophylaxis (see chapter on Preventive Dentistry) though in caries free mouths twice yearly visits will be sufficient.

2. Methods of Examination

A clear mirror, sharp explorer and a chip blower form the basis of the examination. Each quadrant of the mouth should be thoroughly dried before being examined and if necessary a prophylaxis should first be performed.

Radiograms are of great value in examining children's mouths. Small size bite-wing films of the molar area remove all doubt as to interproximal or recurrent caries. Individuals films of any apical condition greatly assist diagnosis. A third, a most important aspect of radiographing children's mouths is to determine the condition of any unerupted teeth. (see below).

Finally an electric pulp tester is most useful for vitality tests on questionable teeth. Tests with heat or cold may be substituted.

3. Diagnosis of Oral Conditions

(1) Carious Teeth. A wide range of conditions will be met with here. Ideally all defective grooves should be filled whether carious or not, as should initial carious lesions on
the proximal surfaces however small. Erupting teeth partly covered by flaps of gingiva should be carefully examined and are often deeply carious before complete eruption. Larger cavities may need a sedative dressing and where there is much work to be done this will protect the teeth till a permanent restoration can be placed.

Toothache may indicate a vital or non-vital tooth, depending on its nature. A restoration, pulpotomy or extraction may be indicated. The diagnosis and treatment of the various types of toothache is discussed under the chapter on pulp.

A non vital tooth may have an acute abscess and consequent swelling and pain and possibly raised temperature. Chronic abscesses with fistulas are often thought by parents to be gum boils. In deciduous teeth the fistula is usually located on the gum midway between the bifurcation and apices of the roots. Full description and treatment of these conditions is also discussed in the chapter on pulp.

(2) Soft Tissue Infections

Aphthous Stomatitis or "Canker Sores" are quite often seen in children and usually occur in the fold of the mucous membrane between cheek and gum and elongated along the fold. They are yellowish white ulcers, of varying sizes surrounded by inflamed zone.

The etiology is unknown but may be connected with gastric disturbances. Warner believes them to be an allergic manifestation.

McBride advises treatment by application of 10% silver nitrate or 8% zinc chloride.

Gingivitis. McBride says:- "Because of the constantly changing status of the child's mouth from six years until twelve years of age, gingivitis, in varying stages, appears and disappears intermittently."

Prophylactic measures—home care must keep the tissues as healthy as possible during this stage and gingival stimulation is very important (see prophylaxis)

Vincent's Infection occurs in children as well as adults.
The characteristics and diagnosis of the same and will not be discussed here. The same treatment is used for children as for adults. For example 2½ chromic acid followed by peroxide mouth washes at home gives good results. The mother is instructed to segregate the child's utensils, give a nourishing diet and plenty of orange juice and keep the bowels open. As soon as possible a thorough prophylaxis is given.

**Thrush.** According to Mills and Humphrey occurs chiefly in ill nourished children. It appears as a number of small whitish spots on the mucous membrane of cheeks and tongue. They are not painful and are caused by a fungus, oidiun albicans. Painting with disinfectants such as triple dye and mouth washes are the treatment.

(2) **Oclusion** Any deviation outside the range of normal occlusion should be observed at the first examination and indicated to the parent. For this reason the teeth should always be observed in centric relationship. At this time any harmful habits such as thumbsucking can be discussed, space maintainers suggested if necessary and any developing malocclusion indicated. In these cases models made at this appointment are useful for comparison at a future date. (see chapter on Preventive Orthodontics).

(4) **Hypoplasia** has been discussed under the chapter on enamel. It should be pointed out to the parent, an explanation given if possible and in severe cases any remedial measures discussed.

(5) **Missing Teeth** Brauer, Higley and Boyd state:

"Missing teeth are more common than supernumeraries, especially in the permanent dentition. Very few deciduous teeth are found missing."

Most commonly absent are the upper laterals, followed by the second bicuspids. The condition may be congenital, when it is usually bilateral, or may be due to damage to the tooth bud. Where permanent teeth are absent the deciduous predecessors are often retained past their normal exfoliation time.
(6) Supernumerary Teeth occur in both the deciduous and permanent dentitions, the most common area being in the maxilla anterior to the cuspids. Fourth molars occur next in frequency. These supernumerary teeth are often rudimentary in shape and their greatest importance is that they may interfere with the eruption of the permanent teeth. For this reason they should be removed when discovered.

(7) Fused Teeth occur in both deciduous and permanent dentitions. Crowns or roots may be fused, and the pulp chambers may be separate, or there may be a common pulp chamber. These teeth occur most commonly in the anterior region. Fused deciduous teeth should be periodically checked with X-rays and extracted if endangering the eruption of their permanent successors.

(8) Submerged Deciduous Teeth are not uncommon, the second deciduous molar being most commonly affected. Kronfield assumes this may be due to ankylosis. Another possible cause is wedging of the deciduous tooth in place by eruption of the first permanent molar. The danger of submerged deciduous teeth is that they are retained too long and interfere with the eruption of their successors.

(9) Delayed Exfoliation of all the deciduous teeth may be due to the child's chronological age being in advance of his physiological age. Where the delay is restricted to one or two teeth some abnormality is usually present such as ankylosis or a missing permanent successor. An X-ray is imperative in such cases so that the position of the permanent successor may be determined. Where its eruption is prevented, the retained deciduous tooth should be extracted.

(10) Calculus Boyd Higley and Brauer say:-

"Children up to the age of ten or twelve years rarely have calcareous deposits. However, there are some patients as young as two or three years that do."
(11) Stains both green and black are commonly seen on children's teeth, in both dentitions. The green stain, usually on the labial face of the anterior teeth, is more common in neglected mouths and there may be superficial decalcification beneath it.

The black stain recurs quickly after removal and is not associated with any lack of oral hygiene. The removal of these stains is described in the chapter on oral prophylaxis.

(12) Accidents causing injury to the teeth are by no means uncommon in children as this is probably the most active period of their lives. A later chapter is devoted to the description and treatment of these injuries.

(13) Systemic Conditions. Owing to the regular observation of the child by the pedodontist he may be first to suspect some systemic condition of his child patient. For example, the condition of the oral mucosa may lead him to suspect either a vitamin deficiency or some blood dyscrasia. Any such suspects should of course, be referred to a doctor. More detail is given in the chapter devoted to this aspect of the work.
CHAPTER V.

PREVENTIVE DENTISTRY

Introduction - Dental Caries
Measures to Control Dental Caries

(1) Prophylaxis
(2) Nutrition and Tooth Development
(3) Diet and Dental Caries
(4) Fluorine
(5) Silver Nitrate
(6) Dibasic Ammonium Phosphate and Urea
(7) Penicillin
(8) Synthetic Vitamin K

Introduction - Dental Caries

Considering that dental caries is perhaps the most widespread of all diseases of mankind and an enormous amount of research has been done regarding its etiology, while some facts have been definitely established, much of the literature at present to hand is conflicting. And so, in spite of the research and publicity given to the importance of diet, prophylaxis etc. over the twentieth century, the caries susceptibility or D.M.F. rate of the civilised population to-day is apparently as high or higher than it has ever been.

However, while some points remain controversial, other contributing etiological factors are recognised throughout the world. The definition of caries agreed on at the University of Michigan Workshop parallels W.D. Miller's theory of Dental Decay expressed nearly sixty years ago:

"Dental Caries is a disease of the calcified tissues of the teeth. It is caused by acids resulting from the action of micro-organisms on carbohydrates, is characterised by a decalcification of the inorganic portion and is accompanied or followed by a disintegration of the organic substances of the teeth. The lesions of the disease predominantly occur in particular regions of the teeth and their type is determined by the morphological nature of the tissue in which they appear."

This is known as the "Acid Theory" and is generally
accepted though many other theories have been advanced, most important perhaps being the proteolytic theory.

The acid theory depends of course on the carbohydrate intake as it effects the environment of the tooth. A much more controversial point is the resistance of the enamel of the tooth and the importance of this resistance in preventing caries. How the enamel is influenced by diet during formation, whether it can be affected after formation, and whether the degree of calcification of the enamel alters its caries resistance, are points still under dispute.

When the condition of the saliva, the oral bacteria, the systemic condition, hereditary, race, pregnancy and tooth shape and alignment are all considered, the problem becomes of great magnitude.

Rather than attempting to review the effect of these influences on caries, the following pages will outline the means, at the pedodontist's disposal in the light of present knowledge, to reduce the caries rate in his child patients.

1. Prophylaxis

In 1938 the Research Commission of the American Dental Association made a world wide survey and published a book "Dental Caries - Findings and Conclusions on its Cause and Control." In this volume a list of well known authorities are quoted (Brekhus, Churchill, Cotton, Enright and others) who state that there is no consistant relationship between oral hygiene and caries. Nevertheless most pedodontists still feel that the regular prophylaxis serves several valuable purposes. It helps remove plaques and stains, keeps the child reminded of home care and particularly gingival stimulation, and stimulates interest in his teeth while offering an opportunity for re-examination.

McBride outlines a thorough routine prophylaxis including pumice with rubber cups and brushes, disclosing solution if needed scaling where necessary, polishing restorations, cleaning interproximal areas with strips or dental
floss and finally a mouthwash. Brauer suggests using a
discoloring solution, such as two percent mercuriochrome, to
indicate unclean areas to patient and parent.

Green stains can be removed with pumice in a rubber
cup or brush, a drop of iodine in the mixture assisting. Any
decalcified enamel beneath these areas should be stoned away
and the surface polished. Black stains are easily removed but
usually recur soon after.

A thrice yearly prophylaxis is recommended by many
authors who take this opportunity to check up on the home care
of the teeth and gums. Young children cannot be expected to
brush their own teeth conscientiously and the mother must be
shown how to brush the buccal and lingual surfaces with a
rotary motion, simultaneously providing gingival stimulation.
Older children, while brushing their own teeth need constant
checking on the correct method and regular performance of this
duty. After breakfast and after dinner at night should be the
time for tooth brushing and if the pedodontist can form regular
habits of mouth hygiene, they are liable to persist and
benefit the child during his whole life.


The 1938 survey states that there is general agreement
that enamel is not a vital tissue. However, some disagree with
this, and Bodecker believes that enamel has vitality and is
a defensively reactive tissue.

The significance of the non-vitality of enamel is
well summed up by Carl Sebelius in his article "Diet, Nutrition
and Dental Caries." He says "It must be remembered that once
enamel is completely formed it has no blood supply and
therefore cannot receive an appreciable amount of nourishment
from the rest of the body."

As the calcification of the crowns of the permanent
teeth is completed by the age of eight years (except third
molars), nutrition can have no influence after this time.
Taylor and Day in 1940 further demonstrated the inability of
enamel to change once it has been formed. In a group of women
with osteomalacia and subsequent decalcification of bone, the teeth were found unaffected.

In regard to the deciduous teeth Sibelius quotes Hess, Lewis and Roman as concluding that during pregnancy, as far as the developing teeth are concerned, the mother has sufficient calcium and phosphorous in her own bones to normally calcify these teeth, even with a diet low in these minerals.

Thus the period from birth to eight years is important for nutrition. What substances then are important for good tooth development during this period?

The Michigan Workshop agreed upon the following conclusions.

1. Severe vitamin A deficiency produces characteristic abnormalities in developing teeth.

2. No conclusive evidence has yet been produced to show that deficiency of vitamins B and C has any effect on developing teeth.

3. It has been demonstrated that vitamin D is of importance in the formation and calcification of teeth and possibly in their caries susceptibility.

4. Sufficient calcium and phosphorous to prevent skeletal defects will be adequate for normal tooth development in normal children.

The debatable point now arises as to whether normal tooth development with proper calcification of the enamel brings with it any degree of caries resistance or immunity. Mellanby, for example, states that adequate vitamin D, at all ages lends to maintain perfection in tooth structure and so prevent or reduce the incidence of caries. Evidence collected by other investigators seems to prove the opposite. For example in some parts of the world where the inhabitants exist on a most inadequate diet, or in the undernourished countries during the war, the caries rate was lower, not higher as might be expected if this were so. As regards mineral intake, areas whose water supply is "hard" and therefore the calcium and other mineral intake increased, showed as much or more caries than
Thus, to sum up, while an adequate diet is essential between birth and eight years to produce normal teeth and prevent hypoplastic enamel, it cannot be said with certainty that normal tooth development and well calcified enamel brings with it any degree of caries resistance.

3. Diet and Dental Caries

The summary of the 1938 Review of Dental Caries states:

"There is general agreement among the authors that in addition to indirect factors that predispose to caries, direct attacking factors initiate the disease. Most authors regard the direct external attacking factors as preponderant influences."

Experimental evidence seems to substantiate this theory. Bunting says:

"The observation of the Michigan group that children on a known adequate high sugar diet had active caries and that children on an inadequate low-sugar diet had very little are significant."

Similar experimenters have agreed with this conclusion but again cases of caries-immune people who eat candy freely are quoted to confuse the position. In the 1938 Review a list of authorities including Boyd, Mellanby etc., believe that the chief detrimental effect of sugar is that of displacing essentials in the diet.

However, in reviewing the sum of evidence at present available the pedodontist seems fully justified in advising parents that a reduction of the sugars and starches in their children's dietary should assist in reducing their caries ratio. Quite understandably most people would rather lose their teeth than completely revise their eating habits to avoid all refined carbohydrate. The pedodontist's best plan is to give a concrete list of the most harmful things to be avoided where possible. For example - all sweets, jams, biscuits and cakes, soft drinks and white bread. Where these substances are given as a treat, advise cleaning the teeth as soon as possible afterwards.
Starches are not considered so harmful as sugars in this respect as they need an additional chain of reactions to convert them to lactic acid. Some investigators consider that the nature rather than the composition of the foodstuffs is important and advise hard and crisp foods for young children rather than the soft mushy type usually given. This hard food promotes chewing, thus developing the arch and lessening the likelihood of food impaction between crowded teeth, and also is less glutinous in nature and less likely to form mucinous plaques. Vigorous chewing of raw fruits or raw vegetables, which also act as detergents, tends to prevent dental caries.

The pedodontist should give this advice to all mothers interested in their children's teeth. The child's diet however, usually results in a compromise between the ideal and what the mother can afford to buy and persuade the child to eat; also important is what she can prevent it eating when away from home.

(4) Fluorine

The effect of fluorine on teeth has already been mentioned in "mottled enamel." To-day, fluorine seems one of our most concrete hopes in the problem of caries control, though the investigations along this line are by no means complete.

Quite a number of investigations have been carried out in America on children brought up on a water supply containing fluorine. For example in South Dakota in 1938:-

"It was noted that there was a relative freedom from dental caries in deciduous teeth as well as permanent teeth of these children, whether or not their teeth showed macroscopic evidence of mottled enamel." 37

Independent investigators have recorded similar results in different areas.

The fluorine produces this effect by combining with the enamel and dentine to form fluoroapatite which is less soluble in acid than the normal tooth constituent hydroxyapatite. Thus it acts during tooth formation to produce a more caries-resistant tooth. It may also inhibit dental caries by its action as an enzyme poison.
Experiments have been made to determine the optimal amount of fluorine in the water supply to reduce caries incidence without causing any harmful result, such as mottled enamel. This amount seems to be about one part per million.

At present fluorides are being used in two main ways in control of dental caries - addition to public water supply and topical application.

Walter J. Pelton in his article "Current Effort to Control Dental Caries" mentions the support given to this programme by the State and Territorial Health Officers Conference in U.S.A. He says that about fourteen such projects - namely to add one part per million fluorine to the public water supply - are now under way, while many more are being organised.

As regards topical application of fluorine the U.S.A. Congress made funds available in 1949 for a nation wide demonstration.

Though this method is not as beneficial as fluorine in the water supply it is of definite assistance and has the great advantage of being easily available to all dentists and patients wishing to use it.

Three methods of application have been used.

1. Fluorine incorporated in a dentifrice
2. Fluorine in solution as a mouthwash
3. Fluorides in solution or in cleansing paste applied by the operator.

Clinical trials have shown the latter method to be the most successful. Several different techniques are suggested for topical application, the solutions ranging from 2% to 4% sodium fluoride. The method used in the 1949 demonstration consisted of four treatments, the first preceded by a prophylaxis and spaced at once or twice a week and given when the child is 3, 7, 10, and 13 years old. Different time intervals are suggested by different operators. Jordan says at least four treatments a year are necessary and apparently the more frequent the applications the greater the caries reduction.
(5) Silver Nitrate

It has been demonstrated by Dr. James M. Prime and others that silver nitrate may be employed as a preventive in dental caries. He recommends Howe's ammoniacal silver nitrate precipitated with eugenol and uses it as a disclosing agent. Sound enamel cannot be stained but any slight etching caused by incipient caries will appear stained. At the same time he claims the reaction has a immunising effect forming an alkaline, inactive, insoluble area in which caries will not progress. He suggests treating the inter-proximal surfaces of the permanent teeth in this manner as they erupt.

However, the more recent trend is expressed by Knutson when he says:-

"---the conclusion has been reached that the topical application of silver nitrate has not been adequately shown to reduce or retard the progress of dental caries."

(6) Dibasic Ammonium Phosphate and Urea

In the last couple of years dentifrices containing dibasic Ammonium phosphate and urea have been quite widely publicised in the press and by the manufacturers.

Kesel is one of the main research workers in this field and has demonstrated a decrease in the lactobacillus counts of patients using this dentifrice. This work is based on experiments with caries-immune saliva. The inhibitory effect on lactobacillus of this saliva was found to be due to two synergistic bacteria, whose metabolism always produced ammonia. Ammonium compounds added to the saliva were found to have the same inhibitory effect as these bacteria. The urea is converted to ammonia in the mouth by urease.

The theory behind this principal seems sound but widespread clinical experimentation must be made before any definite beneficial results can be claimed. Kesel reports that one such experimental project including 1,900 children has just commenced and will take two years.

The American Dental Association, on accepting for clinical trial several dentifrices containing dibasic ammonium phosphate (5%) and urea(3%) sums the position by saying:-
"available evidence indicates that they potentially useful." 45

(7) Penicillin

Inconclusive results have so far been obtained in experiments with the use of penicillin for caries control. J.T. Hill and his associates are at present working with this drug and record encouraging clinical experience.46

(8) Synthetic Vitamin K

In his article already quoted Walter J. Pelton says:-

"Synthetic Vitamin K has anti-bacterial properties and preliminary studies on the use of this quinone as a caries prophylactic in humans appear successful. The evidence to support the claims of vitamin K incorporated in chewing gum is sufficient to encourage further controlled research."
CHAPTER 6.
MORPHOLOGY OF DECIDUOUS TEETH

Introduction

1. First Deciduous Molar
2. Second Deciduous Molar
3. Mandibular first Deciduous Molar
4. Mandibular second Deciduous Molar
5. Contacts of the Deciduous Molars
6. Deciduous incisors and cuspids

Introduction

In "Juvenile Dentistry" by Walter C. McBride, there is a long and detailed description of the morphology of the deciduous teeth by James Nuckolls, D.D.S., F.A.C.D., of some of the salient points contained therein will be of assistance in the following chapter on "Operative Procedures for Deciduous Teeth." From the clinical point of view the most important points are the location of the pulp chambers as regards operative procedure and the contacts between the teeth as regards caries susceptibility.

1. Maxillary First Deciduous Molar

This tooth usually has three cusps, two buccal and one lingual but sometimes there is a small disto lingual cusp as well. The buccal, mesial, and lingual surfaces are convex and the distal concave, and the mesial and distal surface converge markedly towards the lingual. Two constant features of this tooth are the deep central pit and marked bucco-gingival ridge.

The form of the pulp cavity roughly compares with the surface form of the tooth except that the horns of the pulp are longer and more pointed. The mesio buccal horn is the largest and the disto buccal the shortest and the occlusal wall of the pulp chamber is markedly depressed under the central pit. The dentine outline is similar to the surface form of the tooth. There are three roots, two buccal and one lingual.
2. Maxillary Second Deciduous Molar

This tooth resembles the maxillary first permanent molar, main differences being the axial surfaces are more convex and the buccal and lingual surfaces converge more towards the occlusal. A small fifth cusp is sometimes present on the middle third of the lingual surface of the mesio-lingual cusp. The mesio-lingual cusp is the largest of the four and connected to the disto buccal cusp by the oblique ridge. The disto lingual cusp is the smallest.

The pulp cavity corresponds, more or less, to the surface form of the tooth. The occlusal wall is deeply concave and the mesio buccal pulp horns the largest and longest.

On the whole this a relatively large tooth with angular crown form and three roots.


This is a relatively small, four-cusped tooth, the mesial half of the tooth being relatively more developed and larger than the distal half. The deep central pit and marked buccal gingival ridge are the most constant anatomical characteristics. The mesio-buccal is the largest cusp and the mesial marginal ridge is prominent while the distal marginal ridge is shorter and less prominent.

The pulp cavity roughly corresponds to the surface form of the tooth. The occlusal wall shows a deep well formed central pit, a small mesial pit and no distal pit. The mesio buccal pulpal horn is the largest, and unlike any other deciduous pulpal horn, blunt. The tooth has a mesial and a distal root.

4. Mandibular Second Deciduous Molar

This is a five cusp tooth and resembles in general the mandibular first permanent molar. As a whole the axial surfaces are more convex and the angles more rounded. The buccal and lingual surfaces converge more towards the occlusal and the gingival ridge is more pronounced. The occlusal surface presents three cusps on the buccal border and two, the largest, on the lingual border. The marginal ridges are well developed, the mesial being more pronounced.

The pulp cavity has five horns and corresponds in general to
the surface form of the tooth. The occlusal wall is deeply concave. The mesio buccal and mesio lingual horns are the largest and longest and extend for a considerable distance above the others and may be bridged by an extension of the pulp cavity.

5. Contacts of the Deciduous Molars

A large flat contact area between the teeth is naturally more prone to caries than a well formed rounded contact.

The maxillary cuspid-first molar contact is favourable as both these proximal surfaces are convex.

However, the contact of the maxillary first and second deciduous molars is broad and unfavourable and the deep distal marginal groove of the first molar increases the danger from caries in this area.

A favourable contact occurs between the cusp of the second deciduous molar and the first permanent molar, according to Nuckolls. However, according to Dr. Ernest M. Jones quoted by Hogeboom, the contact is flat and thus a common situation for proximal caries.

The contact between the mandibular cuspid and first molar is favourable as two angular surfaces are touching.

The mandibular first and second molar contact, though unfavourable is said to be less so than in the maxilla, so is probably second in caries susceptibility.

The well-defined angles of the deciduous second and permanent first mandibular molars make this a favourable contact.

6. Deciduous Incisors and Cuspids

Though considerably smaller, these teeth resemble their permanent successors in general surface form. They are, however, not so angular in contour and show a marked cervical constriction. The pulp chambers more or less conform to the surface form of the tooth and the pulpal horns are not so pronounced as in the deciduous molars.
CHAPTER 7.

OPERATIVE PROCEDURES

FOR

DECYDIOUS TEETH

1. Introduction
2. Sensitivity of Deciduous Teeth
3. Cavity Preparation

(1) Class 1 2 Cavities
(2) " 2 "
(3) " 3 & 4 "

Introduction

The principals of cavity preparation in the deciduous dentition are fundamentally the same as those laid down by G.V.Black for the permanent dentition, and so a detailed description of cavity classification, and the form and preparation of the various types of cavities is not considered necessary for this review.

This chapter will be confined to the modifications of cavity preparation necessitated by the particular anatomy of the deciduous teeth (see previous chapter) and variations in operative procedures which assist in the management of the child.

2. Sensitivity of Deciduous Teeth

An interesting point relevant to cavity preparation is the comparative sensitivity of the two dentions. Bodecker states:

"The permanent teeth remain highly permeable ten or fifteen years after their eruption. The deciduous teeth on the other hand appear to mature more rapidly -- This may be one of the reasons that the deciduous teeth are not so sensitive to the dental drill as those of the permanent dentition.

In addition the proportionately larger pulp, wider root apices and thinner enamel should contribute to less pain from heat generated by friction. In McBride's opinion there is little difference in sensitivity between the two dentitions.
In the deciduous dentition most pain seems to be caused at the
dentino-enamel junction. Brauer says:-

"Comparatively few children need or require an
anaesthetic for cavity preparation, however in some instances
it has proved a decided advantage."  

Phlegmatic children even when asked very seldom
complain of pain during the preparation of small cavities in
deciduous teeth which leads to the assumption that nervous
children cannot differentiate between pain and pressure.

One other important point when preparing cavities in
children's mouths is to use a fairly slow motor speed. In
addition to minimising pain the psychological effect is important.
Children usually tolerate hand instruments better than burs.

More attention must be paid to helping the child
tolerate cavity preparation than is necessary in working for adults. In brief:-

(1) Cut down operative procedure to the shortest
    possible time.
(2) Leave painful steps till the last.
(3) If possible warn where hurt is expected.
(4) Use hand instruments in preference to burs.
(5) Use a slow motor
(6) Use as little pressure as possible.

3. Cavity Preparation.

Hogeboom says that the rubber dam is frequently of
great assistance in proper tooth preparation. His rule is-

"Place the rubber dam only on the tooth to be operated
on."  

Ward feels the rubber dam is not feasible for children's
work and recommends cotton rolls held in place either by a small
cotton roll holder or the operator.

When operating on the mandibular teeth I usually ask
the child to hold the cotton roll next the tongue with one
finger for me, and find that even very small children co-operate
amazingly well in this respect and enjoy the feeling of helping
the dentist.
The main anatomical features influencing cavity preparation in deciduous teeth are the smaller size, relatively larger pulp chamber and thinner enamel. All deciduous teeth are constricted at the cemento-enamel junction and the dentine is usually easier to cut.

Hogeboom states:

"Remove all the carious dentine if possible, but if the pulp is to be involved by removing a hard piece of carious dentine, it is better to cauterise with some reagent with the hope of preserving the pulp."

(1) Class 1 Cavities, Class 5 Cavities

These occur in similar situations and are prepared in a similar manner to those in the permanent dentition. There is greater risk of exposing the pulp, especially on the mesial. The safest way of removing soft caries is with a slowly revolving large round bur.

(2) Class 2. Cavities

As explained in the chapter on the morphology of deciduous teeth the most usual situations for proximal caries are between the two deciduous molars and between the second deciduous and first permanent molar. Treatment of the first permanent molar is discussed in a separate chapter.

If two approximating surfaces are carious it is far easier and quicker to prepare both cavities at once because of better access, less changing of burs, and no danger of damaging a previous filling. It is generally agreed that the proximal portion of the cavity should be prepared first, leaving the occlusal step, usually the most painful part to the last.

When preparing the proximal, the gingival wall should not be wider than a millimetre or the pulp will be endangered. For this reason a rounded cavity outline in the region of the gingivo-buccal and gingivo-lingual angles is recommended by Ward, who cuts very small retention points at these angles.

Brauer says the axial wall should always be convex, parallel to the outer enamel surface, and in this manner the proximal part of the cavity may be extended as far as desired.
without endangering the pulp.

The long mesio buccal pulp horns of the first molars and both mesial horns of the second molars are most frequently exposed, so that greater care must be exercised on the mesial.

For this reason the occlusal step must be shallow and therefore as wide as possible to allow sufficient bulk. The occlusal step should be prepared from the centre of the tooth towards the proximal cavity, rather than vice versa; as well as being easier it is less likely to expose the pulp.

The weak point in Class 2 cavities is the junction of the proximal and occlusal surfaces. This should be as wide as possible so the occlusal portion is not markedly dovetailed and the axio-pulpal line angle should be rounded to give extra strength in this area.

A Slice preparation is described by Dr. R.C. Willet for use with inlays specially designed for maximum conservation of tooth substance. However, it would be hard to obtain a good gingival margin and recurrent caries at this area seems a possibility with this restoration.

Where difficulty is encountered with the gingiva bleeding during cavity preparation dilute trichlor-acetic acid is recommended as a styptic; I have also found penicillin powder useful in this respect.

G.V. Black recommends, where contacts of deciduous molars are wide and flat disk the adjoining teeth so that the contact point is small as a preventive measure.

(2) Class 3 and 4 Cavities

A typical Class 3 cavity can usually be prepared in a deciduous cuspid and filled with amalgam or silicate. However, this is seldom possible in the incisors because their small size seldom allows sufficient bulk to prepare a cavity that will have sufficient retention.

Where this is the case the usual treatment is to disk the proximal surfaces of the teeth till sound tooth substance is reached and then polish. More tooth should be removed on the
lingual than labial for aesthetic reasons. Though the appearance is bad, this treatment usually preserves the teeth till their exfoliation time, which is usually not very long, as anterior teeth seldom become carious at a very early age and are the first to be exfoliated.

This treatment does not cause loss of space and contraction of the arch as it is only carried to the gum line, and also during this period there is a natural growth expansion of this part of the arch.

This treatment can be supplemented with the application of silver nitrate, though the appearance is far from pleasing and this should only be done where caries is rampant.
CHAPTER 8.

RESTORATIVE MATERIALS
FOR
DECIDUOUS TEETH

1. Silver Amalgam
2. Copper Amalgam
3. Silicate Cements and Kryptex
4. Inlays
5. Cements - (a) Black Copper
(b) Fleck's Red Copper
(c) Zinc
6. Gutta Percha and Zinc Oxide.

1. Silver Amalgam

Among the various plastic filling materials silver amalgam is a general favourite, both for the permanent and deciduous dentitions on account of its strength, ease of insertion, rapidity of setting, length of service and comparative cheapness.

Most authors mention the fact that silver amalgam is frequently blamed for causing many deaths of the deciduous pulps over which it is placed. However, they seem unanimous in replying that the deaths of these pulps is probably due either to placing restorations in teeth whose pulps are already degenerating, or to the thermal shock occasioned by inserting a deep metallic restoration without adequate pulp protection, as could easily be given by a cement lining.

Silver amalgam is the filling material of choice in class 1, 2, and 5 cavities in deciduous molars and class 3 cavities in deciduous canines. Occasionally it is possible to insert it in class 3 restorations in deciduous incisors. Bad aesthetics are considered relatively unimportant in the deciduous dentition.

Where the manufacturers directions are faithfully adhered to, silver amalgam will give excellent service in all
these situations. Most common causes of failure are -
incorrect proportions of alloy and mercury, insufficient
trituration, failure to use a matrix for class 2 restorations,
wrong cavity preparation, and fracture from biting force due
to lack of occlusal carving.

Use of Matrix

While Hogeboom says that where difficulty is encount-
ered in placing a matrix the cavity may be overpacked and later
trimmed with sharp instruments, Ward, McBride and many others
state that a matrix is essential to satisfactorily condense on
amalgam and prevent overhanging margins.

Quite often an ordinary Ivory or Wagner type of
matrix holder can be used if the matrix bands are cut to fit
the smaller deciduous teeth. Where the matrix persistently
slips off it can be held in place with one finger while
placing the restoration.

Some dentists use a spot welded steel matrix where
stock types are unsatisfactory, or else use a long stainless
steel strip wrapped round the tooth and the free end held
between the contact points of neighbouring teeth.

The failure to use matrices must be responsible for
the loss of a great percentage of restorations in deciduous teeth.

Finishing the Restoration

While occlusal carving need not be accentuated in
deciduous teeth, the importance of freeing the occlusion cannot
be over emphasised in class 2 restorations. The occlusion
should be checked very carefully, as these fillings are often
fractured before the child leaves the chair and sometimes
it will be found necessary to stone down a sharp opposing
cusp. In addition all excess should be removed from
proximal surfaces and the marginal ridge slightly rounded.
It is advisable to check that the child actually has rinsed
out all the fragments of excess amalgam, as they may remain
in the mouth to be swallowed or fracture the filling at a
later date.

2. Copper Amalgam
Black had great faith in the physical properties of copper amalgam and stated:-

"The power of the material in the arrest of caries is in these physical properties, not in any chemical or disinfectant property of the copper or its salts." 68

However, experiments by Dr. L.L. Hurst, formerly of the Bacteriological Laboratory, College of Dentistry, University of Southern California, show a decidedly inhibitory effect on cultures of common oral bacteria by copper amalgam and the general feeling to-day seems to be summed up by McBride when he says:-

"It is believed the formation of copper salts is responsible for the absence of recurrent caries at the filling margins." 69

The absorption of these copper salts into the dentine tubules with their subsequent discoloration and claimed bacteria inhibiting effect, argues that copper amalgam must be to some extent soluble in oral fluids which seems an undesirable property for a restorative material. This solubility and formation of copper salts is responsible for the cupping effect, which is the main disadvantage of copper amalgam. Another disadvantage is its difficulty of manipulation.

As the chief virtues of copper amalgam are its antiseptic quality and its adaption and adherence to the cavity margins, it is especially useful for demuded and hypoplastic teeth, situations where hygiene is poor and recurrent caries likely, and situations where it is impossible to exclude saliva during treatment.

Hogeboom states:-

"As a preventive material in deep sulci and fissures in first permanent molars, either normal or hypoplastic, copper amalgam is without rival." 11

It is, however, contra-indicated where strength is required.
3. Silicate Cements and Kryptex

On account of the excellent aesthetic results obtainable with silicate cements they are sometimes used in the deciduous dentition. In all other respects, however, they are inferior to silver amalgam and should only be used where aesthetic considerations are important.

According to the manufacturers Kryptex is "a good silicate" with a strength far beyond that of oxyphosphate cement. It is particularly useful to replace ordinary silicate cements in the deciduous dentition because of its rapid setting time.

The main use for silicate cements of course, is proximal cavities in anterior teeth. They are not strong enough to resist much masticatory stress so should not be used for class 2 restorations but sometimes give good service in small class 1 restorations.

4. Inlays

The gold inlay is generally considered the ideal restoration for permanent teeth. However, in the deciduous dentition, except where no other restoration is possible, it seems wiser to avoid the excessive cavity preparation necessary for inlays and the cost does not seem justified for the comparatively short life of the tooth. Also many children's behaviour would render almost impossible the intricate processes necessary to produce a good inlay. Where inlays are unavoidable it would seem wiser to use an indirect technique in children's mouths.

For the first permanent molar, it is preferable to postpone placing inlays till the eruption is complete and the pulp chamber reduced to adult size, so that an inlay placed in the late teens should last the life of the tooth. Otherwise recurrent caries may occur at the gingival margin as the gingival attachment moves rootward.

Dr. Willet uses inlays in deciduous teeth (see cavity preparation) and has also designed the Willet cast overlay as a fixed anchorage for orthodontic appliances.
Dr Phillips of Chicago has designed a series of gold plugs to fit corresponding cavities made by special burs which are used for restorations in small pit cavities. For inlays in children's teeth quite a few cheaper alloys have been evolved and give quite good results. Some of these are Acolite, Dee's low fusing metal H, Weston's metal and Watt's metal, two formulae of Willet and Paliney. Some of these are also used for orthodontic attachments, though others are too low fusing to permit soldering.

5. Oxyphosphate Cements

None of these can be considered as a permanent restoration of any value, though they are unfortunately widely seen in deciduous teeth. Ward remarks:--

"A restoration of any kind made with a cement is not permanent if the cement is exposed to the fluids of the mouth and the friction of mastication."

Easlick points out that every cement examined by the Bureau of Standards was found to shrink upon setting.

Ame's black copper cement or embalming pulp capping cement, is sometimes used to mummify pulps and depends for its effect on the formation of copper salts and their action on the adjacent pulp and dentine.

Fleck's Red Copper Cement is said to have a high antiseptic and germicidal action, but any cement which has this action must obviously undergo some dissolution in the mouth and is therefore of questionable value.

Cement Linings.

For pulp protection under metallic restorations, cement linings should be placed wherever there is room in cavities in deciduous teeth. The deciduous pulp is very sensitive to thermal shock. McBride says:--

"Every cavity in which the depth is greater than twice the thickness of the enamel, should have a lining of some nature."

This subject is further discussed under the chapter on pulp.
6. Gutta Percha and Zinc Oxide

Neither of these materials can be considered other than as a temporary filling material.

Zinc Oxide is stronger for temporary fillings in deciduous teeth if mixed with resin before incorporating the eugenol. Its use in deep cavities as a lining and as a sedative dressing will be discussed in the chapter on the deciduous pulp.

Where the cavity has little retentive form Gutta Percha forms a stronger temporary filling than Zinc Oxide.
CHAPTER 9.
MODIFIED OPERATIVE PROCEDURES
FOR
YOUNG PERMANENT TEETH

First Permanent Molar

Introduction
Growth and Development
Methods of Conservation
Pulp Treatment
Hypoplasia
Extraction

Bicuspid
Anteriors

First Permanent Molar

Introduction
Though at the present time much emphasis is laid on the importance of the first permanent molar among the dental profession, a large percentage of parents are under the impression that it is a temporary tooth so that it receives less consideration than other permanent teeth.

In addition, Hogeboom, listing the characteristic attributes of the first molar, states that it is the most susceptible of the teeth to deep caries and pulp disease and has less resistance to spread of caries. Thus this tooth is the one most frequently lost.

A survey by the Hyatt Study Club gave the information that 92% of all 1st permanent molars require treatment by the time the child is twelve years old.

From the orthodontic point of view the first permanent molar is extremely important in maintaining the positional relationship of the jaws during the transitional period when the deciduous teeth are being shed.

Hence the care of the first permanent molar is an important
facet of every pedodontist's work.

Growth and Development

The work of Kronfield, corroborated by many others shows that centres of calcification of the first permanent molar appear at birth. He gives a detailed description of the process of enamel formation and makes the important point that this process is completed at the age of from three to four years. The significance of this is that after this time it can no longer be affected by disease, medication or other influences. If normally formed and calcified at three years it will be so when it erupts three or four years later.

The caries susceptibility of the first permanent molar is to a large extent due to the pits and fissures occurring in the great majority of these teeth on the occlusal surface and on the buccal. Some authorities consider these to be pathological and due to "Failure of fusion" of the cusps. Others, including Bodecker and Kronfield, feel that this condition is so widespread as to be completely normal.

Methods of Conservation - Occlusal

Various methods are at the disposal of pedodontists, to either completely prevent the inception of caries, or to tide the first permanent molar over its early years and postpone extensive cavity preparation till the pulp chamber is somewhat reduced in size.

1. Hyatt's Prophylactic Odontotomy is the opening of non carious pits and fissures to prevent caries. The cavity is not extended into the dentine unless caries in some portion necessitates it, and is cut to include all the fissures. It is not undercut and is made about the size of a 557 bur and is restored with silver amalgam.

2. Precipitation of Silver Nitrate in accessible fissures is recommended by some authors but seems to be of questionable value. McBride's opinion is that this precipitation of silver is not alone sufficient to inhibit incipient caries in occluded areas and once precipitated, the resultant discoloration obscures all natural evidence of caries.
3. **Immunisation** is a term used by the Hyatt study club. It refers to the polishing away of fissures in newly erupted molars finishing with tapering stones and polishing with pumice. This procedure may delay the need for restoration for four or five years, but in general, seems unsatisfactory. In selected cases with multiple fissures running in all directions, it may be of value.

4. **Packing into fissures** without moving any tooth structure, using either copper amalgam or cement, has been suggested. Results gained do not seem to justify this procedure.

**Proximal Caries**

The wide contact area between the first permanent molar and the second deciduous molar makes the mesial surface of the first permanent molar a common site for interproximal caries. This is seldom extensive till the age of eight or nine but any doubtful areas before then should be treated with silver nitrate.

The optimum time for treatment is after the loss of the second deciduous molar and before the eruption of the adjacent bicusped. A small decalcified area may be disked smooth or a larger lesion treated with a class I type of restoration. Of course a large carious lesion will require a classical class II restoration.

The Kellog treatment has been mentioned for incipient caries in young bicuspid and molars. Briefly his method consists of opening from the occlusal just inside the marginal ridge, a deep well into which are placed one or two small crystals of silver nitrate and the restoration inserted. He has reported encouraging clinical findings from this method but some contemporary writers doubt its efficacy and query the desirability of using silver nitrate without fixing the silver by original precipitation.

**Buccal Caries** Small decalcified areas merely requirestoning away, while larger areas need a class 5 restoration. Where caries is rampant, or hypoplastic tooth structure is present, copper amalgam may give better results.

**Pulp Treatment** As in deciduous teeth, deep cavities and near exposures of the first permanent molar require the insertion
of a base for pulp protection under metallic restorations. In these deep cavities the routine use of a zinc oxide and eugenol dressing for one or two weeks before insertion of the permanent restoration is advisable.

Pulp Capping. In young first Permanent Molars has quite a good prognosis when the exposure is of instrumental origin. An exposure in a child aged seven or eight years should respond more favourably to capping than will one in an older patient, due to the open root apices and consequent increased vascularity. The same technique as described for deciduous teeth is used.

A carious exposure, on the contrary, has not a good prognosis and of course, the general health of the patient and the condition of the pulp must be taken into account. Pulpotomy and Pulpectomy do not, as a general rule, seem to be considered advisable. McBride says:

"If a first permanent molar tooth has a questionable prognosis, it is much wiser to remove it early - the earlier the better."

This enables us to take advantage of the mesial drift of the second molar.

A successful vital pulpotomy technique carried out on young permanent molars will enable root development to take place. Devitalising paste should not be used. The pulpotomy is carried out in the normal manner under aseptic conditions, the cavity phenolised and the pulp stumps covered with a paste of calcium hydroxide. Radiographic evidence of secondary dentine formation over the amputated stumps of the pulps should be visible in three months.

Hypoplastic First Permanent Molars Orban states:

"The systemic influences, causing enamel hypoplasia, are in the majority of cases active during the first year of life. Therefore the teeth most frequently affected are the incisors, cuspids and first molars."

McBride mentions that this condition is not common in deciduous teeth. He describes three types of hypoplasia.
1. Well formed crowns with multiple pits on one or more surfaces.
2. Rudimentary cusps with intervening areas of denuded dentine.
3. No semblance of a crown remaining.
The basis of treatment for these cases is to provide some temporary restoration, requiring little cutting, till the child reaches such an age as to permit the placing of a permanent restoration without damaging the pulp. For the first permanent molar such an age would be twelve to fourteen years.

Where these teeth are very sensitive McBride recommends an "amalgam wash" as a sedative treatment. Any medium which seals the small cavities will be effective.

For very broken down teeth a cast overlay may be necessary. The permanent restorations to be inserted are beyond the scope of this survey.

**Extraction of the First Permanent Molar**

It would of course be impossible to lay down any rigid rules governing the extraction of first permanent molars, but the following rules, given by Dr. Lawrence W. Baker of Boston for teaching purposes are quoted by Hogebom and agreed with by the Pedodontic section of the Detroit Clinic Club and apparently most other authorities.

1. Before the eruption of the second permanent molars any broken down or pulp infected first permanent molars should be extracted. If three are involved, extract all four.
2. After the eruption of second permanent molars, save the first permanent molar if possible, where extraction is unavoidable supply the full mesiodistal diameters to prevent tipping of the second permanent molar or molars.

**Bicuspid and Anterior**

Only the early care of these teeth comes within the field of the pedodontist.

Irving advocates the spot filling for proximal surfaces of erupting bicuspid as described for molars. Though this may, and probably will need replacing at a later date, its object is to eliminate extensive cavity preparation and possible pulpal irritation resulting from a large two surface cavity.
Another important responsibility of the pedodontist is the frequent and careful examination of lingual pits in upper anteriors. Caries in this area seems to spread rapidly pulpwards and menace the vitality of the tooth while practically no external lesion can yet be seen. Pulp exposures from caries in this area occur quite frequently at a very early age.
CHAPTER 10.

PULP MANAGEMENT IN DECIUOUS TEETH

1. Introduction
2. Protection of the Pulp
3. Diagnosis of Pulp Conditions
4. Pulp Capping
5. Pulpotomy
6. Pulpectomy

1. Introduction

The case for root canal treatment of deciduous teeth is well summed by Gerlach who states that it is a practical procedure if a satisfactory technique be used. She goes on to say:

"The forces may solve an immediate problem, but eventually the premature loss of a tooth may lead to a more complicated dental problem." 37

Gerlach's reasons for retaining deciduous teeth when possible are to prevent the following evils - loss of masticatory efficiency and subsequent interference with nutrition, formation of a soft diet habit which may persist into later life; unilateral mastication and subsequent malocclusion; drifting of teeth; and too early eruption of permanent successors, both causing malocclusion. She also mentions the importance of retaining deciduous teeth with no permanent successors.

On the other hand any root therapy is contra indicated in any child suffering from pyelitis, endocarditis, diabetes, tuberculosis or any severe chronic systemic disease, or in any child whose general health appears below par. The conservation of teeth must always be considered as of secondary importance to the general health of the patient.

A very important point is made by Brauer when he states:

"The same criteria for success and failure certainly
does not hold true in the two dentitions. In the deciduous teeth the root ends are usually undergoing physiological resorption which affords an excellent blood supply far in excess of the constricted narrow apical foramina of the adult permanent teeth --- The amount of blood supply has much to do in the control of infections or overcoming any shock that may be evidenced in pulpal irritation. The criterion of success or failure in the partial pulpectomy of deciduous teeth depends upon physiological resorption of the roots."  

2. Pulp Protection

McBride in his book "Juvenile Dentistry" states, as one of the chief reasons for the general unpopularity of children's dentistry, the devitalisation that follows the insertion of many large fillings. The most common reason for this, he states is the placing of restorations over a sick pulp and next, the failure to place a cavity lining or base.

In deep cavities in deciduous teeth, or where there has been any history of aching of the tooth it is considered unwise to immediately place a large metallic restoration.

McBride recommends removing as much of the soft caries as possible without causing much pain and sufficient to obtain retention and inserting a dressing of zinc oxide and eugenol to which a small portion of silver nitrate powder has been added to hasten the setting and harden the mix.

"This sedative treatment," says McBride, "works a dual purpose. Primarily it relieves the ache and resultant soreness during cavity preparation and secondarily presents a pulp free from hyperaemia that will better withstand the thermal shock incident to a large restoration."  

He also quotes Bodecker's article "Histological Evidence of Benefits of Temporary Fillings," as additional evidence of the benefits obtained by this method.

The dressing is left in position for three or four weeks after which time the remaining caries can be removed and the cavity completed with much less pain, treated with silver nitrate and the restoration placed over a healthy pulp.

Histological experimental evidence quoted by Thoma shows that less pulpal reaction occurs to zinc oxide and eugenol than any other material. Thus if all the caries has been removed and a dressing of this placed, the ideal treatment at the subsequent appointment seems to be to leave the deep
portion of this in place as a base under the amalgam instead of using cement.

The sterilization of the completed cavity and use of non-conductive bases are two very important points for pulp protection. For cavity sterilization McBride suggests phenol and alcohol or silver nitrate and eugenol and has lately been using merocresin with good results. Brauer says:—

"There is no particular reason why the operator should complete the cavity in toto and then remove the leathery decay over the pulp to expose it." 14

He recommends leaving hard brown dentine over the pulp and treating this with silver nitrate reduced with eugenol.

It is always advisable to use a cavity varnish to seal off the dentine tubules, and this is essential under silicate restorations and zinc phosphate cements.

Authorities seem to agree that to prevent pulp reaction to thermal shock any cavity that is deep enough to contain a base without spoiling the retention should have one. As already mentioned zinc oxide, silver nitrate and eugenol may be used or zinc oxyphosphate cement or Fleck's red copper cement.

3. Diagnosis of Pulp Conditions and Treatment Planning

Primarily there are three distinct types of aching teeth.

(a) Vital teeth with hyperaemic pulps
(b) Teeth in which the pulp is dying
(c) Non vital teeth

(a) The vital tooth usually gives a pain response to irritations such as masticatory force, accumulations in the cavity or thermal stimulation. Thus the ache is usually intermittent and brought on by certain definite conditions.
(b) A tooth in which the pulp is dying will ache intermittently with varying and increasing degrees of discomfort as the devitalising process ensues.
(c) A non vital tooth may ache at any time but is certain to give greater distress when lying down as this position increases the blood supply and hence the pressure to the already congested area. This tooth will be sore to percussion and the pain increased by heat and relieved by cold.

When diagnosing an aching tooth the following summary recommended by Dr. Suthers lecturer in Pedodontia at Sydney Dental Hospital.

(a) Percussion test for looseness.
(b) Inflammatory areas adjacent to tooth,
(c) Is the tooth sore to pressure?
(d) Check old restorations
(e) Is the pain periodic or steady?
(f) If periodic how long are the periods and what effect has heat, cold, sweet food, position of patient?
(g) Are there any erupting teeth in area?
(h) G.P. test for vitality
(i) Radiograph.

Having diagnosed the condition of the pulp the treatment, whether pulp capping, pulpotomy, pulpectomy or extraction must be decided upon. Great disagreement at present exists among different authorities with regard to these treatments and so far very few generally accepted conclusions have been drawn in this field. The general indications and popularity of these procedures will be discussed under their separate headings.

In some cases extraction will be the only solution and a good summary of these cases is given by Brauer.

"In deciduous teeth extraction is indicated when: -

1. The age of the patient is such the tooth should be normally exfoliated
2. The child is in poor health
3. Caries has penetrated the bifurcation of the roots.
4. There is a periapical abscess
5. There is multiple involvement in the mouth."
4. Pulp Capping

Much disagreement at present exists between various operators on the advisability of pulp capping in deciduous teeth. Gerlach never mentions it, preferring pulpotomies in all cases. Rosenstein, however, in a report on 628 cases over a nine year period at the Children's Dental Clinic Columbia University shows a ninety percent successful response.

The method recommended by McBride and used at Sydney Dental Hospital seems a happy medium. Pulp cappings are restricted to exposures of instrumental origin where the saliva can reasonably be kept out. The method used is simple.
1. Isolate and dry cavity
2. Apply phenol followed by warm air
3. Cover exposure with Zinc Oxide and Eugenol (or thymol)
4. Gently flow over rapid setting cement
5. Insert restoration

Bodecker believes the pulps of deciduous teeth to have greater recuperative powers than those of permanent teeth. This may be due to the opening of the root apices by the resorptive process permitting greater vascularity.

Bodecker has also written that there is secondary dentine produced in the first dentition in open cavities with slow caries. In closed cavities this is not so. This seems to account for the fact that one can cut more deeply into a self-cleansing cavity than a closed cavity without involving the pulp.

5. Pulpotomy

In carious exposures of the first dentition most operators favour pulpotomy. McBride states that clinical observations have shown a better response to pulpotomies than pulp capping when the exposure is due to caries. Gerlach always uses it for freshly exposed pulps in preference to capping.

The use of paraformaldehyde paste sealed over the cavity for two or three weeks seems a very efficient method as the coronal portion of the pulp can then be removed.
painless. If this method is employed, patients should be warned of a possible period of subsequent toothache following in the next few days.

Gerlach recommends the use of pressure anaesthesia and immediate removal of coronal portion while the use of nitrous oxide or local anaesthesia are also mentioned.

The importance of an aseptic technique is emphasised by all authors and the general opinion seems to be that where the patient is uncooperative or the field impossible to isolate extraction is the safer solution.

After removal of the coronal portion of the pulp the pulp chamber is cleaned out and sterilized with phenol and the pulp stumps covered with zinc oxide and eugenol. A cement base and amalgam filling may then be inserted.

Such cases should have a periodic radiographic check up to ascertain that no periapical infection has occurred and resorption is proceeding normally.

6. *Pulpectomy*

Complete removal of the pulp tissue is preferred by most authors where the pulp is already exposed or where lack of haemorrhage suggests a partially putrescent pulp. Anaesthesia - either pressure or infiltration, is obtained and the canals reamed out in the normal manner. Eugenol dressings on paper points every twenty-four hours may be used.

McBride uses Kerr sealer powder and glyceride of iodine solution as a root filling material and has observed no irritation from overfilling the canals.

Gerlach, however recommends the use of G.P. points in chlorapercha or euchapercha. Other authors query the effect of G.P. on root resorption but she states that the roots are resorbed normally and when the crown is ultimately shed the points are carried with it. Hence she stresses the importance of attaching them firmly to the coronal portion of the filling.
7. Non Vital Deciduous Teeth

The treatment and retention of infected and non-vital teeth is perhaps the most debated in the whole range of Dentistry, and varies from complete retention to extraction in all cases.

Dr. Suthers, at Sydney Dental Hospital states that where the pulp is infected or putrescent the tooth must be extracted. On the other hand, Gerlach suggests that where there is no periapical involvement the canals can be treated with beechwood creosote and iodine and thus rendered aseptic and successfully filled. She also recommends a trial of this method for chronic periapical involvement but says it is not suitable for acute cases.

McBride has a practical outlook on the subject when he states that in general practice the treatment and retention of non-vital teeth is far-fetched, non indicated as well as being grossly unprofitable. There are, however, he says, certain occasions on which the operator is particularly desirous of maintaining a certain tooth and in these cases, should the patient’s general and oral health be satisfactory and the radiogram show a satisfactory apical condition, he treats and maintains the tooth.

For these cases he recommends dressings of camphorated mono-chlorophenol, and mentions that deciduous teeth usually respond immediately or not at all.

McBride mentions, as a last resort, where a fistula persists after root treatment the "Rose Bur Treatment" which is surretting the necrotic tissue between the roots. This does not seem a widely popular method.
CHAPTER 11.

INJURIES AND FRACTURES
OF
CHILDREN'S TEETH

1. Introduction
2. Deciduous Teeth
3. Fracture of Enamel only
4. Fracture of Enamel and Dentine only.
5. Fracture involving the Pulp
6. Loss of Anterior Teeth through Trauma
7. Fracture of the Root
8. Displacement of the Tooth without Fracture

1. Introduction

A recent survey of several large secondary schools in a large city quoted by Dr. Ellis shows the great majority of fractured teeth to be maxillary central incisors, followed by mandibular central incisors and then both upper and lower lateral incisors. These anterior teeth are, apart from health and functional importance, of vital importance to the appearance of their owner. Hence Dr. Ellis lays great stress on treating these cases so that the aesthetic result is pleasing as well as the functional aspect. All writers on this subject agree with this, and Brauer states:

"An unsatisfactory restoration of a fractured tooth often leads to an inferiority complex which may be a direct factor in the future."

Fractured teeth are by no means uncommon among children on account of the various accidents likely due to their violent activities. Hogeboom states the eight to ten years age group to be the most affected. Where the child is seen shortly after the accident, by the dentist, the prognosis is usually better.

McBride, a member of the Children's Section of the Detroit Clinic Club, quotes the results of a survey made by
this club of the various methods of treatment suggested by dentists for several atypical fracture cases. A wide variety of answers was received, showing the great variety of opinion on this subject.

This same variety is apparent in the classification of fractures given in various text books. Dr. Ellis' is used for this survey as being the most universal and complete.

All fracture cases treated should have a concise case history taken and a thorough examination including type of fracture, mobility, displacement, laceration of tissue, vitality reaction, percussion reaction, occlusion, radiographic examination.

2. Injuries of Deciduous Teeth

Injuries to the Deciduous teeth are mentioned first as being most particularly the concern of the pedodontist. The frequent falls occasioned by young children learning to walk make accidents to the anterior teeth quite common in the first years of life.

McBride says:-

"The supporting structure of the deciduous teeth is so pliant that blows or impacts involving the body of the crown result more often in injury or fracture of the process than fracture of the tooth."

The teeth may be extruded or intruded. If intruded attention to oral hygiene and "watchful waiting" is about all that can be done. Ellis states that:

"These intruded teeth will probably re-erupt in a relatively short time, but ultimate necrosis of the pulp seems to be almost inevitable."

If portion of the alveolus is fractured it can sometimes be replaced in position and immobilised till healing takes place.

Fractured crowns usually expose the pulp in deciduous teeth, probably because of their shape. Ellis says:-

"Pulpotomy is excellent, if cooperation of the patient can be obtained."

If extraction is necessary a space mainteance is not indicated (see chapter on Space Maintenance). A fracture
involving only a small portion of the tooth is treated as for permanent teeth.

Fractured roots of deciduous teeth usually indicate extraction, but immobilisation by splinting could be attempted where the patient was cooperative.

Discoloured deciduous teeth are quite frequently seen, evidently due to trauma. Kronfield and Bunting say that this is due to haemorrhage in the pulp and diffusion of some of the blood pigment into the dentinal tubules. Resolution may occur with absorption of some of the pigment, or the pulp may die and decompose. This will take at least six to eight weeks from the time of trauma so that the tooth should be kept under observation. McBride feels that injuries to deciduous teeth frequently cause premature resorption of the root, and adds that these teeth can seldom be maintained to the normal exfoliation period.

In conclusion Ellis mentions a number of cases where injuries to the deciduous dentition seem to have affected the permanent successors, causing malformation, malposition or hypoplasia of the incisal tip. "

3. Fracture of Enamel Only

Where enamel only is exposed by the fracture, or a very small area of dentine, the tooth will, in all probability recover. However, the patient should be warned that possible degeneration may follow. As Ellis says:

"Despite the apparently minor nature of the disturbance to the tooth, there is no means of diagnosing the pulp reactions to the shock to which it was subjected, nor can one forecast accurately the future of the pulp." He adds that six to eight weeks seem to constitute the critical recovery period for the pulp.

This type of fracture most frequently involves the mesio incisal angle, and less often the disto incisal angle or middle lobe of the incisal edge. The immediate treatment is limited to carefully smoothing any rough edges and protecting the area with a coat of varnish. Brauer recommends using a desensitiser such as formalin or phehol.
The tooth should be kept under observation and if normal after about eight weeks the permanent restoration may be considered. Careful stoning may be sufficient to restore aesthetics or an inlay or even a jacket crown may be necessary.

4. Fracture of Enamel and Dentine

This is the most commonly seen type of fracture and varying degrees of dentine may be exposed up to the stage where the pulp may be seen showing pink through a thin wall of dentine.

The problem in cases of this nature is summed up by Hogeboom:

"The tooth root is not complete in its formation in these early years and the pulp is very large and the apical foramen is a large funnel. No restoration of a permanent nature is practical before the teen age, consequently a protection must be built which will allow the tooth root to complete its formation and the horns of the pulp to recede sufficiently so that a permanent restoration may be placed when the child is of proper age."

The immediate treatment in these cases is to wash, isolate and dry the tooth and cover the dentine with a thin mix of rapid setting non-irritating abutment paste. No strong irritating drugs should be used and no pressure exerted. This is then covered with a quick-setting cement and when set a celluloid crown form filled with cement or ciliate is fitted in position. Some authors use a piece of gold plate or orthodontic band instead of a celluloid crown form. These may be stronger, but are more trouble and unsightly.

"The object of emergency treatment," writes Ellis, "is reduction of the hyperaemia of the pulp which follows the initial shock and protection of the pulp against further irritation. The ability of the pulp to survive the initial circulatory disturbances is greatly influenced by the size of the opening at the apex of the root."

No response to vitality tests at the time of the accident is only an indication of the degree of shock which the pulp has suffered and must not be interpreted as indicating probable death of the pulp.

The permanent restoration of choice in these cases is ultimately a porcelain jacket crown. However, some temporary-permanent restoration must be inserted to last until
the child is old enough and this restoration can be placed about eight weeks after the fracture of the tooth seems normal to tests and examination.

Hogeboom uses a cast gold crown for this period, Brauer suggests a three quarter spring clasp basket crown and describes its preparation in detail. McBride suggests a similar three quarter veneer crown and Ellis suggests a gold cap or what is probably the best of the lot, an acrylic jacket crown. The virtue of the acrylic jacket crown for young teeth lies in the fact that owing to the properties of this material, a minimum removal of tooth structure is necessary.

5. Fracture Involving the Pulp

Where the pulp is exposed by a fracture the dentist is faced with the question whether it will be possible to save the tooth. Where these cases are seen immediately, conservative treatment has a greater chance of success.

Four alternatives are possible, pulp capping, pulpotomy, pulpectomy and extraction. While pulpectomy is quite unsatisfactory on young teeth with wide open root apices, a pulpotomy has a better chance of success, at least temporarily, in these cases.

The treatment selected depends on various aspects of the case.

(a) Pulp Capping

Ellis lists the following indications for pulp capping — small exposure, little or no haemorrhage, exposure time not over fifteen to eighteen hours, root apex closed or nearly closed, vitality reaction good, no complications.

The technique for pulp capping is similar to that described in the chapter on pulp, and a celluloid jacket crown is placed for six to eight weeks and the patient instructed to report any symptoms. If after that period tests are satisfactory and radiographic evidence negative a permanent restoration may be placed.
(b) Pulpotomy

McBride writes:-

"A pulpotomy is indicated only when the apical ends of the roots have not yet closed, ordinarily prior to nine, or nine and a half years. If the canals are closed routine root canal therapy is indicated and much to be preferred. It is done with the thought in mind that the remaining portion of the pulp will continue and complete the apical formation of the tooth.

The pulpotomy is performed as described in the chapter on Pulp Treatment.

Infiltration or conduction anaesthesia may be used and injection of the incisive canal is often most effective in these cases. This technique is adequately described by Phillips and Maxmen.

The operation must be performed with rigid asepsis. The coronal portion of the pulp is removed and the haemorrhage controlled. While Brauer and McBride recommend phenol for this purpose, Ellis says no strong drugs should be used.

The pulp stump is covered with a capping paste such as zinc oxide and formocresol or Kerr sealer powder and glyceriodine, followed by quick setting cement.

Check radiographs should be taken regularly and Hogeboom shows a series indicating closing root apices and a deposit of secondary dentine under the pulp sealing material. When this occurs the operation can be considered a success.

(c) Pulpectomy

A pulpectomy is indicated for fractures exposing the pulp where the root development is complete and infection is thought to have taken place. Routine root canal therapy is instituted, followed by an apicectomy. Where the pulp is obviously putrescent, root canal therapy may be successful if not too much apical infection has taken place.

(d) Extraction

Where root formation is incomplete and infection and death of the pulp has occurred extraction seems the only solution.
6 Loss of Anterior Teeth through Trauma

Speaking of lost anterior teeth Ellis says:-

"A permanent restoration cannot be considered until the child is fourteen - fifteen years of age." 130

Meanwhile it is essential to maintain this space so that normal appearance may ultimately be restored. Loss of space where permanent anterior teeth are lost occurs quite quickly, especially at an early age, and if not checked a malocclusion may result. Ellis also mentions the importance of speech maintenance and aesthetics and says that function is of secondary importance in this temporary restoration.

The points to consider when deciding on the nature of the appliance are - the temperament of the patient, physiological age, development of roots of permanent teeth used as stabilisers, degree of resorption of roots of deciduous teeth, caries susceptibility and maxillary-mandibular relationship.

The permanent restoration will probably be a bridge or partial denture and the following temporary appliances are suggested for use until this time.

(1) A simple space maintainer consisting of orthodontic bands on adjacent teeth and a wire connector. This may be soldered to both bands or have a pin and tube connection to one of them.

(2) Where the adjacent teeth are not completely erupted, a lingual anch wire may be used with spurs projecting to keep these adjacent teeth from encroaching on the space.

(3) Orthodontic bridges may be used instead in both above types, consisting of a metal backing and porcelain facing soldered to the orthodontic wire.

(4) Removable partial dentures may be used providing the bite permits, the child is a fairly responsible type, and constant adjustment to allow for erupting teeth is made. Three types have been suggested, the full palate denture, with or without clasps, the "horseshoe" denture with clasps and the Morgan type of denture which allows wide relief of the gingival tissues. Finally Ellis mentions the orthodontic movement of the remaining teeth to close the gap and alteration of the contour.
of the tooth replacing the lost tooth by means of a jacket crown.

F Fracture of the Root.

McBride says:

"Where fracture of the root is evident, providing the portion containing the crown is held reasonably firm by the supporting structures, it is wise to proceed with caution so far as extraction is concerned."

Austin found in a study of forty fractures of single rooted teeth, thirty one remained vital and serviceably. Of course a fracture in the apical third of the root has the most favourable prognosis while a fracture in the cervical third will in all probability necessitate extraction.

Kronfield says:

"If the root fractures are in close adaption, they will be cemented together by cementum. If the fractured extremities are farther apart each will be covered over by cementum. Fibrous tissue will remain between and no union will take place."

Thus, with a healthy patient, no infection present, good aposition of the fragments and the fracture line not in the cervical third, the prognosis is reasonably good if the fragments are immobilised.

Three methods of immobilisation are suggested; wiring the tooth to the adjacent teeth, use of orthodontic bands soldered together, or construction of a cast splint. The stabiliser should be left on from three to six months. Should the fractured tooth become non vital, it is improbable that root canal therapy would be successful.

Where the tooth is quite firm and the fracture in the apical third, no stabiliser may be necessary.

8 Displacement of a Tooth without Fracture

The degree of displacement of a tooth by trauma may be minor, severe, or complete. The most usual time for displacement to occur is while the root formation is still incomplete, often shortly after eruption. The same force applied when the root is complete and the supporting structures more mature is more likely to be translated into a fracture of the crown or root. Ellis says:
"The prognosis for a partially displaced tooth is favourable when root development is not complete." 155

In all cases of displaced teeth warm saline mouth washes are prescribed and the patient recommended to rest the tooth. The possibility of subsequent avulsion is always explained to the patient.

(a) Minor displacement needs little more treatment than this, followed by regular observation. If the tooth is slightly extruded, the incisal edge may later be stoned down.

(b) Severe displacement may be extrusion or intrusion.

An extruded tooth may have to be repositioned under local or general anaesthesia and some type of splint used to immobilise it.

Where the tooth is intruded it is better to leave it and the tooth usually moves back to its fully erupted state.

Several complications may occur following displacement of teeth. Should the tooth become non-vital, root therapy has a good chance of success if instituted before much apical destruction takes place. Rare complications are giant cell epulis or median line cyst.

(c) Complete displacement. Reimplantation of teeth has been tried without much success. Ellis mentions that the average life of reimplanted teeth is probably seven to ten years.

He recommends placing a root canal filling before replacing the tooth. The usual reason for the eventual failure of these teeth is resorption of the root.
CHAPTER 12.

ANAESTHESIA AND EXTRACTION

A. Anaesthesia

(1) Introduction

(2) Local Anaesthesia  (a) Topical
                        (b) Infiltration
                        (c) Conduction

3. General Anaesthesia
   (a) Nitrous Oxide
   (b) Ethyl Chloride
   (c) Pentothal Sodium
   (d) Chloroform.

B. Extraction

A. Anaesthesia

When choosing between a general and local anaesthetic for a child the following points have been mentioned for consideration.

(a) Age. Under three years, and sometimes older the lack of co-operation of the patient makes local anaesthesia very difficult.

(b) Physical Condition. Where the child suffers from respiratory or circulatory disorders a general anaesthetic should not be given without the consent and assistance of a doctor.

(c) Wishes of Parent and Patient. More co-operation is usually obtained from older children by allowing them to choose their own anaesthetic.

(d) Type of Patient. Very nervous or highly strung children are usually less frightened by a general anaesthetic.

(e) Number of Extractions. Multiple extractions over different areas of the mouth prove less distressing to the child if completed at once under a general anaesthetic.
(f) Spastics, Subnormal children. As these children are unable to co-operate a general anaesthetic, given by a doctor, is used, not only for multiple extractions, but as many restorations as possible may be completed while the patient is anaesthetised.

It is emphasised that injections should never be made into tissue in a stage of acute infection. This is discussed later in the chapter.

Pre-medication is often very effective for nervous children. One-half to three quarters of a grain of Nembutal or Seconal is most generally used, given about half an hour before the operation.

Finally, although reviewed in the same chapter as extraction, the use of local anaesthesia for painful cavity preparation must not be overlooked. In my opinion a wider use of local anaesthesia in this field would greatly assist in removing many children's fear of dental appointments.

2. Local Anaesthesia

(a) Topical Anaesthesia

Speaking of topical anaesthesia McBride says:-

"It is purely a local obtundant use specifically to relieve the pain of the injection."

He also lists a large number of topical anaesthetics on the market and states that he himself had had the best results with butyn. Harry E. Straul, D.D.S., writing in Hogeboom's book "Practical Pedodontia" mentions the problems in the technique of using these topical applications and states:-

"--- after going to all this trouble one seldom finds a sufficient degree of anaesthesia to be of any value. Marked tissue irritation frequently follows, and even sloughing may occur."

Thus, these topical anaesthetics are only of value to relieve the pain of injection. Ethyl chloride however may be applied topically to extract a tooth. It is particularly useful where acute infection renders it unsafe to
inject, and is used for conditions of this sort in Sydney Dental Hospital, both for deciduous and permanent teeth.

(b) Infiltration Anaesthesia

While pain can be entirely eliminated by infiltration anaesthesia, very young children are unable to differentiate between pain and the pressure and noise associated with extraction and are thus frightened and upset by extractions under a local anaesthetic.

When injecting, the use of a sharp needle of a fine gauge eliminates unnecessary pain. McBride suggests carrying the syringe to children's mouths with the needle sheathed in a cotton roll to avoid frightening them.

Straul lists the points desired in a local anaesthetic and states that novocain is superior to all other agents in these respects. A 2% solution is used and may be bought in individual ampules, or made up fresh daily from tablets.

Infiltration is used to anaesthetise all upper teeth, deciduous and permanent and any lower deciduous teeth whose roots are nearly resorbed.

Some authorities recommend gingival injections for deciduous teeth but unless the soft tissue is thick in this area injection into the muco buccal fold is less painful and equally effective.

(c) Conductive Anaesthesia.

The mandibular block injection is essential for all lower permanent teeth and lower deciduous teeth before the roots are resorbed.

The technique is the same as for adults but the parent must be warned to watch the child does not bite the lip before sensation returns. Mentioning this to the child usually only draws his attention to it and makes it more likely to occur.
3. General Anaesthesia

(a) Nitrous Oxide

Brauer says:-

"Nitrous oxide is most valuable in dentistry for children, and there are certain cases, particularly in the very young child where other anaesthetics would be impractical."

Straub also says:-

"Nitrous oxide and oxygen, since the perfecting of the apparatus for its administration is accepted as the safest and best of all general anaesthetic agents."

Before commencing to anaesthetise a child the procedure should be explained to him carefully and his cooperation gained so that he will not be frightened by unexpected developments.

McBride says:-

"The technique of administering nitrous oxide and oxygen to children does not differ from that used for adults, but the child is more difficult. The plane of anaesthesia is very narrow and the slightest variation in the mixture of gases may carry the patient from one plane to another very rapidly."

Several different methods are suggested, one starting with 100% nitrous oxide and adding about 10% oxygen when consciousness is lost, another starting with 95% nitrous oxide and gradually increasing the oxygen.

E.I. Mckesson is quoted as an authority and states that young children require from two to three percent more oxygen than adults. A few breaths of nitrous oxide followed by 10% oxygen in the mixture produces satisfactory anaesthesia in a surprisingly large proportion of children under twelve years of age.

A light anaesthesia only is required for dental work. This is indicated by the pupils turning up or down and becoming fixed with loss of pupillary reflex. The muscles are relaxed and the patient breathing regularly.

Should the patient become cyanotic it indicates too much nitrous oxide and some pure oxygen should be given. The usual precautions should be taken to prevent the inspiration of blood, teeth etc.

(b) Ethyl Chloride
M.H. Jacobs M.D., D.M.D. writes of the great success with which ethyl chloride has been used at the Forsyth Dental infirmary over a number of years.

In dental operations it is useful where short periods only of anaesthesia are required, two or three minutes being the usual time of anaesthesia obtained by one application.

Three stages of anaesthesia are recognised with ethyl chloride, the primary or deep analgesia being used for short dental operations. This is followed by the secondary stage of excitement and the third is the surgical stage.

Ethyl Chloride is usually administered sprayed on gauze placed over the mouth, the nostrils being closed.

The same signs mentioned for nitrous oxide indicate the deep analgesia stage.

(c) Pentothal Sodium

This most popular intravenous anaesthetic is unfortunately contra-indicated in children under twelve years of age. The very high metabolic rate, high oxygen requirements, small veins and constricted air passages all tend to complicate its use in children.

(d) Chloroform

Long and involved dental operations require hospitalisation and chloroform. Its use carried only to the analgesic stage for short operations is contra indicated by its comparatively high mortality rate, apparently due to some paralysing action on the vagus nerve.

B. Extraction

The problem of extracting deciduous teeth is not so much the problem of getting them out, as the problem of doing it without hurting or frightening the child and thus making him view his future dental appointments with fear. With adequate anaesthesia no actual pain will be felt, but the instruments, pressure, cracking sound and bleeding will be quite enough to terrify an unprepared child. For this reason pedodontic authors emphasise the importance of always telling
a child before extracting a tooth and explaining the procedure in simple language so that no unexpected sensations will frighten the child. As McBride says:-

"The 'sneak-up-and-snatch-'em idea answers the purpose for the immediate time, but what a deluge of remonstrance and fear it entails when another dental appointment becomes necessary."

The usual instruments are quite satisfactory for the extraction of deciduous teeth and the same technique is used. Care should be taken not to damage or extract the developing bicuspids when extracting the deciduous molars. For broken down deciduous molars, elevators are often useful. Small forceps which can be concealed in the hand are available for temporary teeth.

Abscessed teeth should not be extracted during the acute stage, while temperature and swelling are increasing. Injections into the swollen and infected tissue are particularly dangerous at this time. Any operative procedure during the acute stage, risks spreading of the infection and a possible subsequent osteomyelitis.

Drainage should be established through the pulp chamber if possible but never through the soft tissues in the acute stage. Hot packs may be recommended at this time to give relief and help localise the inflammation and the patient recommended to watch the general health for a few days till the infection becomes chronic, when the temperature will drop and the swelling become localised. The tooth may then be safely extracted.

Very little post operative treatment is needed for deciduous teeth and very little post operative pain seems to be experienced. McBride says "dry sockets" are unknown. Profuse haemorrhage may occur as with adults and the same haemostatic agents are used such as tannic acid, ferric perchloride or adrenalin hydrochloride. Pressure alone is usually quite sufficient except in such cases as haemophiliacs who may require hospitalisation and blood transfusion or preliminary injection of haemostatic serum.
CHAPTER 13.

ERUPTION AND OCCLUSION

DURING

THE DECIDUOUS AND MIXED DENTITIONS

1. Eruption of the Deciduous Teeth
2. Occlusion of the Deciduous Teeth
3. Period of Mixed Dentition

1. ERUPTION OF DECIDUOUS TEETH

The period from birth to five years of age has been described by Kirk as "The period of dentitional stress." During this period, the maxillary bones have a cribiform effect produced by the tooth buds occupying spaces in the maxilla almost to the floor of the orbit and in the mandible down to the mandibular canal. Kirk stresses the fact that during this period there must be harmonious synchronisation between growth and resorption. He says that this delicately balanced mechanism is dependant for its stability upon the nutritional and physiological balance of the entire infant organism. It is common knowledge how easily this balance may be disturbed in children especially during the teething period.

TEETHING: The eruption of the deciduous teeth may be accompanied by a wide range of symptoms, or they may arrive entirely unnoticed. Hogeboom lists the following signs of teething in healthy children.

1. Increased flow of saliva
2. A tendency to put finger or some hard article in mouth and bite upon it.
3. Swollen and congested gums
4. Fretfulness and disturbed sleep
5. Often a slight fever
6. Loss of usual appetite
7. Sometimes slight diarrhea

Reflex disorders due to eruption of teeth may take such forms as vomiting and convulsions.
Bunting and Hill mention "teething cough" and a "teething rash" and Kirk mentions the wide range of disorders caused by dentitional reflexes.

**ERUPTION TIMES** The eruption times of the deciduous teeth vary quite widely in different children. The "Rule of Four" as mentioned by McBride is easy to remember and useful for general practice — that is the eruption of four teeth every four months, beginning at seven months.

<table>
<thead>
<tr>
<th>Teeth</th>
<th>Eruption Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central incisors</td>
<td>7 months</td>
</tr>
<tr>
<td>Lateral</td>
<td>11 &quot;</td>
</tr>
<tr>
<td>First molars</td>
<td>15 &quot;</td>
</tr>
<tr>
<td>Cuspid</td>
<td>19 &quot;</td>
</tr>
<tr>
<td>Second molars</td>
<td>23 &quot;</td>
</tr>
</tbody>
</table>

Any variation from normal is a frequent cause for parental concern. McBride himself feels from his clinical observations that the eruption times are unimportant as regards structural difference and caries susceptibility, but he quotes both Kronfied and Gottlieb as indicating that the rate of eruption is influenced, to a certain extent by the degree of calcification. A child whose deciduous teeth are tardy in erupting, would naturally be expected to retain them to a later age than a child whose teeth erupt early. This fact seems to depend on the physiological age of the child which varies between children of the same chronological age.

**LANCING THE GUMS.** It is generally agreed that lancing the gums over troublesome or slowly erupting deciduous teeth should be the exception rather than the rule. The risk is of doing it too early and of the tissue healing more rapidly than the tooth erupts so that the resulting scar tissue is even more difficult for the tooth to penetrate. Lancing should not be performed until the tissue covering the crown is completely white and avascular, when a cruciform incision can be made and the four triangular flaps severed with scissors or scalpel, leaving a rectangular opening.
Orban has an excellent chapter on the eruption of teeth which is summarised below. Much of it also applies to the eruption of the permanent dentition, which is reviewed later in this chapter, but is included here for convenience.

Orban states that eruption of the teeth begins at the time of root formation and continues throughout the lifespan of the tooth. The emergence through the gingiva is merely an incident in this process in which the teeth are continually moving, both to attain and retain their position in the jaws. He divides tooth movement into the pre-eruptive, pre-functional and functional phases. During these phases the teeth may undergo axial drifting, tilting or rotating movements.

(a) **Pre-eruptive Phase.** During this time the enamel organ develops to its full size and formation of the hard substance of the crown takes place. The developing teeth maintain their position in the growing jaw especially their relation to the alveolar ridge by two processes - bodily movement of the entire tooth germ, and eccentric growth which gives rise to a shift of the centre of the tooth germ. The deciduous tooth germs grow in length at about the same rate as the jaws grow in height, thus maintaining their superficial position throughout the pre-eruptive phase.

(b) **Pre-functional Phase** begins with the formation of the root and is completed when the teeth reach the occlusal plane. The enamel epithelium covers the crown until the oral epithelium is reached when the two fuse. This fused epithelium degenerates in the centre and the tip of the crown emerges into the oral cavity. From now on the eruption of the tooth is due to both occlusal movement of the tooth, (active eruption) and separation of the epithelium from the enamel (passive eruption).

During this time the jaws are growing rapidly so that to emerge, the deciduous teeth must move more rapidly than the jaws increase in height. Where growth of the root is not sufficient, a rapid formation of bone takes place at the fundus. Thus the trabeculae in this area are seen to increase markedly during the
prefunctional phase but not uniformly in all teeth. The distance the teeth have to move during this phase seems to influence the amount of trabeculae formation.

(c) Functional Phase When the erupting teeth meet their antagonists their movement seems to halt. Nevertheless clinical experience and histological findings show that the teeth continue to erupt throughout their functional life. A continual mesial drift is observed (see next section) and also continued occlusal eruption to keep pace with the growth of the jaws and loss of tooth structure by occlusal attrition.

Orban lists the following factors as having been advanced to explain tooth eruption: growth of the root, growth of dentine, proliferation of dental tissues, pressure from muscular action, pressure from the vascular bed in the pulp, periapical tissue, and formation and resorption of bone. He also suggests the importance of what he calls the "cushioned hammock ligament" in transmitting and combining these forces.

He also suggests that tooth eruption may serve as an indicator of the physiological condition of a growing individual. As the eruption times vary so widely only cases not within the range of variation are to be considered abnormal. Retarded eruption is far more common than accelerated eruption and the causes may be local or systemic.

Local causes are such factors as ankylosis caused by severe trauma. Amongst the systemic causes (which tend to affect the entire dentition rather than individual teeth) are endocrine disturbances, e.g. hypothyroidism and nutritional deficiencies e.g. vitamin D deficiency. Hereditary may also be a factor.

2. OCCLUSION OF THE DECIDUOUS TEETH "The normal occlusion of the deciduous dentition manifests many of the characteristics of the normal in the adult dentition," says Hempler and enumerates the following points of interest.

Each of the deciduous teeth is smaller than its succeeding permanent tooth except the second deciduous molars which are larger than the second bicuspidis. As in the permanent dentition the lower teeth articulate posteriorily to the corresponding upper
tooth, while the distal surfaces of the second molars finish in the same vertical plane owing to the larger size of the lower tooth.

The deciduous teeth do not have the mesial axial inclinations of the permanent teeth, nor is there any curve of Spee or transverse curve in the normal deciduous dentition.

Between the ages of four to six spaces may develop between the deciduous incisors. These are normal, though not always present and are later taken up by the larger permanent incisors.

The overbite in the deciduous dentition is at first relatively greater than that found in the permanent teeth but this tends to decrease as the child becomes older so that often, by the time the deciduous incisors are ready to be shed, an edge to edge bite has developed. This decrease is due to the relatively greater forward growth of the mandible, and also at times by the marked abrasion so often seen in the deciduous dentition.

3. PERIOD OF MIXED DENTITION

Phenomena of Resorption The cause of resorption seems as yet to be undecided. While some authors believe it to be stimulated by the eruption of the permanent successors, others (Bromell, Bunting, and Kronfield) mention the appearance of a "resorptive organ" which destroys the tooth. Tomes believes resorption to be independent of the pressure from the permanent successor. Urban states "The elimination of deciduous teeth is the result of the progressive resorption of their roots by osteoclasts.--- The osteoclasts differentiate from the cells of the loose connective tissue in response to the pressure exerted by the growing and erupting permanent tooth germ".

Resorption begins on the side of the deciduous root nearest the developing permanent successor. Thus deciduous incisors and canines are usually attacked at the lingual surface of the apical third, though later the permanent germ may come to lie directly apical to the deciduous tooth, in which case the resorption takes place occlusally. Thus the permanent incisors and canines may erupt exactly in position of their predecessors or erupt on the lingual while the deciduous tooth is still in place.
Developing bicuspid at first lie between the roots of the deciduous molars, and resorption starts here. Later they lie apically, resorption proceeds in an occlusal direction so that the bicuspid appear with the tips of their crowns in the place of the deciduous molars.

Kronfield has stated that resorption is not a continuous process but a series of periods of activity and periods of rest. In fact sometimes, during an active period, too much root is resorbed, and during the next rest period, new bone formation takes place. This accounts for alternate periods of tightness and looseness of deciduous teeth.

McBride states that the resorptive period is presumed to be of approximately three years duration and Kronfield says that the resorption of the roots of deciduous teeth does not occur in any set order chronologically. However, the following rule, given by Black, can be used to give some idea.

<table>
<thead>
<tr>
<th>Deciduous incisors</th>
<th>commence resorption at 4 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot; lateral &quot;</td>
<td>&quot; 5 &quot;</td>
</tr>
<tr>
<td>&quot; 1st molar &quot;</td>
<td>&quot; 7 &quot;</td>
</tr>
<tr>
<td>&quot; 2nd &quot;</td>
<td>&quot; 8 &quot;</td>
</tr>
<tr>
<td>&quot; canine &quot;</td>
<td>&quot; 9 &quot;</td>
</tr>
</tbody>
</table>

Parts of the roots of deciduous teeth which are not in the path of erupting permanent teeth may escape resorption and may remain in the jaw for a considerable time. Such remnants are usually found in the bicuspid area.

Decisuous teeth may be retained for a long time if the corresponding permanent tooth is congenitally absent; this is most frequently observed in the upper lateral incisor region. Where the permanent successor is impacted, the deciduous tooth may be retained, commonly found in the upper cuspid area.

These retained deciduous teeth may give good service for many years. On the other hand they may loosen and become lost, probably due both to loss of regenerative powers and the increase of masticatory forces beyond those for which they were adapted.
As mentioned before, traumatic lesion may lead to ankylosis of a deciduous tooth. An ankylosed tooth ceases to erupt and later appears shortened by comparison with its neighbours and may eventually become submerged in the alveolar process. Such submerged teeth prevent the eruption of their permanent successors.

ERUPTION OF PERMANENT DENTITION

Hemley says "There is no set rule or standard of the normal in the 'mixed' dentition, that period of transition from deciduous to permanent dentition. Such apparent abnormal conditions as may appear during this time are frequently normal transitory phenomena".

The following table by Logan and Kronfield is given as an indication of when the permanent teeth may be expected.

<table>
<thead>
<tr>
<th></th>
<th>Upper</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central incisor</td>
<td>7-8</td>
<td>6-7</td>
</tr>
<tr>
<td>Lateral</td>
<td>8-9</td>
<td>7-8</td>
</tr>
<tr>
<td>Cuspid</td>
<td>11-12</td>
<td>9-10</td>
</tr>
<tr>
<td>First Bicuspid</td>
<td>10-11</td>
<td>10-12</td>
</tr>
<tr>
<td>Second</td>
<td>10-12</td>
<td>11-12</td>
</tr>
<tr>
<td>First Molar</td>
<td>6-7</td>
<td>6-7</td>
</tr>
<tr>
<td>Second</td>
<td>12-13</td>
<td>11-13</td>
</tr>
<tr>
<td>Third</td>
<td>17-21</td>
<td>17-21</td>
</tr>
</tbody>
</table>

Surveys of a large number of school children do indicate that in general, the teeth of females erupt earlier than do those of males and the lower teeth precede the corresponding upper teeth. The First Permanent Molars are guided into position by the distal surfaces of the second deciduous molars. Thus it will be seen that they are at first guided into a cusp-to-cusp relationship in most instances. However, as the difference in size between the second bicusped and second deciduous molar is greater in the mandible, the mandibular first permanent molar can move or tilt forward when the second deciduous molar is lost, thus reaching its characteristic cusp-to-fossa occlusion with the maxillary first molar.
The Permanent Incisors erupt a good while before the next permanent teeth, and will sometimes worry parents by seeming too large by comparison with the smaller deciduous teeth. The centrals, when first erupted show no mesial axial inclination, and usually a space is present between them. This is well within the range of normal, and will be corrected as the permanent laterals and canines erupt, forcing them to both move and tilt towards each other and thus closing the space. A frenum excision is very seldom indicated in these cases.
CHAPTER 14.

PREVENTIVE ORTHODONTICS
and
SPACE MAINTENANCE

1. Classification of Malocclusion
2. Etiology of Malocclusion
3. Simple Remedial and Preventive Measures
   (a) Habits
   (b) Space maintenance
   (c) Maxillary Incisors in Lingual Version
   (d) Impaction First Permanent Molar
   (e) Prosthetic Appliance for Children.

1. Classification of Malocclusion

Angle's classification of Malocclusion is universally recognised to-day and is used as a basis for orthodontic treatment. It is based on the mesio-distal relationship of the teeth and jaws and judged primarily by the mesio-distal relationship of the first permanent molars.

Class 1. Normal relationship of arches
Class 2. Lower arch distal to the normal
Class 3. Lower arch mesial to the normal

A very important aspect of the pedodontic work should be the early recognition of cases of malocclusion or of conditions predisposing to malocclusion. Cases of class 2 and class 3 malocclusions should always be referred to an orthodontist, but there are many instances in class 1 cases where simple methods of intervention, instituted by the pedodontist at the right time, will preclude elaborate orthodontic treatment at a later date.

2. Etiology of Malocclusion

The causes of Malocclusion may be classified as (a) general or systemic, and (b) local or mechanical. Under general causes are listed:

- Hereditary
- Endocrinal disturbances
- Congenital disorders
- Dietary
- General health

These factors are of course outside the range of dentistry
but are of interest to the dentist in that he may from his examination of the mouth be first to discover some hitherto unsuspected condition.

The main local causes are given below.

1. Habits  Thumbsucking is easily the most widespread of these and has the most obvious results. It is characterised by a forward placement of the maxillary anterior teeth. Where carried into later life it tends to produce abnormal lip and tongue habits and mouthbreathing. However, where the habit can be broken by five years of age any malocclusion present tends to correct itself.

Lipbiting is characterised by the labial placement of the maxillary incisors and lingual placement of the mandibular incisors. This is caused by the habit of sucking the lower lip up between the upper and lower incisors.

Mouth breathing occurs in cases of nasal obstruction due to tonsilar or adenoid tissue. This habit gives rise to a characteristic high narrow palate and protruding maxillary incisor teeth.

2. Early loss of Deciduous Teeth.

It has been stated that 25% of cases of malocclusion can be traced to premature loss of deciduous teeth. Broadbent has stated that in the mandible the growth potential is forward and downward and is transmitted by the temporary teeth. Thus if one of these teeth is prematurely lost, this growth potential closes the space.

As the mesio-distal width of the deciduous molars exceeds that of the succeeding bicuspids, the space can close a little without harmful results. If too great a closure occurs however, the erupting bicuspids will either be impacted or erupt out of position. Some dentists feel so strongly about this that they prefer to retain all deciduous teeth and roots, treated or untreated, that are not actually causing pain, as space maintainers.

3. Early loss of permanent Teeth  May allow the other permanent teeth to drift into malocclusion.
4. **Too Long Retention of Deciduous Teeth** may cause impaction of their permanent successors. This prolonged retention may be due to ankylosis caused by previous trauma. Check X rays should thus be obtained of any deciduous tooth retained after its normal time for exfoliation. This condition is most commonly observed in lower incisors causing the permanent successors to erupt lingually, and in upper cuspid. Extraction may need to be followed by orthodontic treatment.

5. **Caries with loss of Mesio-distal Contact.** According to research figures the combined width of the maxillary bicuspids is 1.5 mms less than the deciduous molars and the mandibular bicuspids 3.6 mms less. Thus some loss of space through interproximal caries can be tolerated, but too much may lead to malocclusion.

6. **Anomalies** and supernumery teeth may cause malocclusion and can be detected by radiograms and removed.

7. **Large Permanent Teeth** may be inherited together with a small arch. Orthodontic treatment should be sought and extraction may be necessary.

8. **Abnormal Labial Frenum** may occasionally be the cause of separation of the maxillary incisors. In true cases of this nature, the upper incisors present a divergent appearance and the condition will not correct itself and surgical removal of the frenum will be necessary.

3. **SIMPLE REMEDIAL AND PREVENTIVE MEASURES**

(a) **Habits**

Thumb sucking is really a psychological problem and can usually best be treated psychologically. Different methods succeed in different cases but fundamentally they are based on making the child conscious of a previously unconscious habit.

However, sometimes the pedodontist may be called upon to make an appliance to help break the habit. Dr. G.E. Morgan suggests a palatal bar attached to the two first molars by crowns and standing slightly off the tissues, thus preventing the child obtaining suction with his thumb.

Other methods used are cloth hand mittens, thumb guards,
elbow splints and unpleasant tasting medicaments painted on the thumb.

Mouthbreathing can seldom be cured without surgical intervention, the removal of tonsils and adenoids frequently being necessary

(b) Space Maintenance - Indications for Use

While excellent in theory, space maintainers tend to be limited in practice by the wishes, lack of interest, and financial condition of the parents. A careful study of the mouth as a whole is necessary before deciding to insert a space maintainer. Berger has stated that children with plenty of basal bone may never need a space maintainer. Examples of this are maxillary spaces in a class 2 malocclusion and mandibular spaces in a class 3 malocclusion where hereditary tendencies to a very crowded arch are already showing; space maintainers are not advisable as orthodontic treatment and extractions will probably be indicated at a later date in any case. Also where the mouth is already ruined by multiple extractions, one more extraction would not merit the placing of a space maintainer.

Probably the most important indications for a space maintainer are extractions in the mandible in Class 2 cases and in the maxilla in Class 3 cases. Where both arches are normal space maintainers are desirable where certain teeth are lost. Hogeboom summarises the importance of space maintenance for various teeth under the heading "Order of Serious Results"

(1) Least unfavourable results occur from the loss of anterior deciduous teeth. The period of rapid growth just prior to the eruption of the permanent incisors seems to overcome any loss of space in this area so that space maintainers are contra-indicated except occasionally for aesthetics.

(2) Next in progressive importance is the early loss of a deciduous first molar. If lost at a very early age a space maintainer may be inserted. Cohen, however, reports that 94% of his study cases have developed quite normally in spite of premature loss of deciduous first molars.

(3) The premature loss of the second deciduous molars seems to give the most unfavourable results as the developing first permanent molar tends to tip forward into the space created,
blocking the space for the second bicuspid. Cohen's report shows that only 60% of his cases developed normally where the second deciduous molar was prematurely lost.

Hogeboom concludes this summary by saying "A good general rule is that if a deciduous tooth is extracted a year or more before its average exfoliation time, a suitable space maintainer should be employed."

Types of Space Maintainers.

The requirements of ideal space maintainers are as follows.

1) Must maintain the mesio distal dimension of the space
2) Must not interfere with the vertical growth of the teeth and alveolus.
3) Must maintain the individual functional movement of the teeth.
4) Must not interfere with the eruption of the permanent teeth under the appliance.

The various types of space maintainers are divided into removable, fixed to patient, but removable by dentist, and completely fixed. The retention of the appliance and its caries producing effect must be considered when the design is being planned. The main types are briefly described below:

(1) Small acrylic dentures are useful where all the molars are lost as they restore function as well as maintain space. Caries activity is likely under clasps, and tissue clasps are sometimes used for this reason. Of course erupting permanent must be watched for.

(2) Cast crown and bar types are described with slight variations in all text books; the bar prevents exfoliation of the opposing tooth. A cast span may be substituted.

(3) Orthodontic band and bar is a similar idea.

(4) Crown or band with double loop wire allows for any inaccuracies or alterations as the wire can be lengthened or shortened; the wire is contoured to the gingiva.

(5) Two cast crowns with bar, pin and ring attachment, allows individual movement of the teeth.

(6) Bilateral appliance with bands on both first permanent molars,
lingual anch wire and spurs on the cuspids.

(7) Merchon Appliance is similar to above type but is semi-removable and has a tube and wire attachment in the centre to allow for lateral expansion.

(8) Cast crown and spur into ridge. This type is used where the first permanent molar is unerupted when the second deciduous molar is lost. The spur passes into the gingiva at the mesial border of the unerupted molar and is said to cause no irritation. Its point of entry is determined by X-rays and palpation. If the second deciduous molar is to be extracted, the appliance can be made first and the spur inserted into the socket on extraction.

(c) Maxillary Incisors in Lingual-Version

Cases are quite frequently seen where one or more maxillary incisors have erupted lingually to the mandibular incisors though the case shows none of the characteristics of a class 3 malocclusion. Cases of this nature can be quite successfully handled by the pedodontist. Both McBride and Hogeboom suggest "jumping" the tooth into place by biting pressure on a tongue depressor or similar instrument. The less violent method of cementing an acrylic bite plane to the lower incisors is used at Sydney Dental Hospital and gives some excellent results. Though the tooth is usually moved in a few days the bite plane is left on for a fortnight to prevent relapse.

(d) Impaction of First Permanent Molar

Sometimes the first permanent molar fails to erupt at the normal time and radiograms show it to be impacted under the distal border of the second deciduous molar. This may cause resorption of the distal root and devitalization of the deciduous tooth.

The treatment recommended in such cases is the placing of a separating wire at the point of contact and thus obtaining separation. The wires may be further tightened until the tooth erupts normally.

(e) Prosthetic Appliances for Children

Prosthetic appliances for children are comparatively rare occurrence in private practice and are included here for
A partial denture replacing the molar teeth may sometimes be necessary where the child is suffering from lack of masticatory function and subsequent malnutrition through loss of teeth due to caries. Partial dentures replacing anterior teeth are seldom necessary except for professional children such as child film stars or where the child is acutely conscious of its appearance. In designing partial dentures for children Hogeboom states - "Very little stress should be exerted by clasps, as the plate then becomes an orthodontic appliance," but it seems to me that if the retentive arms are properly reciprocated there is no more danger of this than in adult partial dentures. An important feature, however, is the caries producing effect of clasps on deciduous teeth and, for example, should the cuspid be clasped in a partial denture they should first have a cast crown or band constructed. The crown may be designed to give more retention than the natural tooth surface.

Full dentures are sometimes necessary where rampant caries has destroyed all the teeth, or where teeth have been congenitally absent. Many authors report surprisingly successful tolerance by children of these and some most successful dentures have been made at Sydney Dental Hospital.

As regards the retarding effect on growth by dentures, there probably is a certain amount, but on the whole this seems less significant than the child remaining edentulous, or partially edentulous for a period of years. Naturally new dentures are necessary at frequent intervals and erupting permanent teeth must be constantly checked by radiographic examination and sections of the denture removed to permit their eruption.

The time of greatest increase in width of the deciduous arches is said by Lewis and Lehman to be between six and eight and a half years, so dentures will need frequent renewal during this period. Perhaps the greatest danger is the toughening of the tissue under the partial denture with the possibility of difficult eruption of the permanent teeth.
1. Introduction

There are several reasons why the pedodontist should be familiar with the more common systemic infections and conditions which have oral manifestations and are thus most likely to come under his notice.

Primarily he may, through observation of child patients be the first to suspect some condition as yet unnoticed by the parents, which would benefit by medical attention. For example the condition of the gums may suggest some form of leukaemia. Secondarily by early diagnosis of unsuspected cases of the infectious fevers he can prevent the spread of infection. Again sick children seldom prove cooperative patients and it is wiser to cancel their appointment.

2. Endocrine Disturbances

(a) Thyroid

Congenital hypothyroidism results in the typical cretin, with retarded mental and physical development and delayed ossification. There is late eruption of the deciduous
dentition and retarded exfoliation often resulting in crowding and various degrees of malocclusion of the permanent teeth.

Hypothyroidism may also be acquired with similar results if acquired during infancy. This causes myxedema and caries may be prevalent.

(b) Parathyroid

The parathyroid glands control the blood calcium so that hypoparathyroidism causes reduction of blood calcium resulting in spasmophilia and tetany. Enamel defects in the form of pits are found on any teeth undergoing development during a hypoparathyroid condition.

Hyperparathyroidism raises the blood calcium by demineralisation of the skeleton causing cystic areas of resorption, but is not very common in children.

(c) Pituitary

The anterior lobe of the pituitary gland secretes the general hormone of growth. Thus hypopituitarism causes infantile size and characteristics to be retained resulting in a dwarfed condition.

On the contrary, hyperpituitarism, occurring early in life causes gigantism. The teeth erupt early and are large with a fairly normal arch form, but usually showing characteristic spaces between them especially in the anterior region.

3. Blood Dyscrasias

Swollen, discoloured and bleeding gums may of course be due to purely local causes. However, lack of response to treatment may lead the dentist to suspect a blood condition such as leukaemia or anaemia.

Marked bleeding round the gingiva may be a sign of haemophilia.

4. Diet Deficiencies

(a) Scurvy

Scurvy is due to vitamin C deficiency. Clinical scurvy is characterised by haemorrhage into various tissues especially the gingiva and periosteal tissue. It is uncommon in breast fed babies but may occur in children fed on patent
foods. The incidence of severe scurvy has greatly decreased with modern methods of baby care, but subclinical vitamin C deficiency is thought to be still rather common. Treatment with ascorbic acid produces rapid improvement.

(b) Rickets

A deficiency of vitamin D interferes with the utilisation of calcium salts with the characteristic symptoms of rickets. This is of interest to the dentist as teeth undergoing calcification at this time show corresponding enamel defects.

5. Chronic Infections

Syphilis

Syphilis in children is usually of the congenital variety and the symptoms may appear at birth or be delayed till a later age. Mills and Humphrey state:

"The prominent symptoms of congenital syphilis are: General malnutrition, rhinitis, skin rashes, mucous patches, dental lesions and keratitis."

Syphilitic affects on the teeth are usually confined to the second dentition, most commonly to the upper incisors. These are smaller than normal causing an open bite, and conical in shape often having a deep central notch in the incisal edge. These characteristic incisors are known as Hutchinson's teeth. The lower incisors may be similarly affected and the molars may be imperfectly developed when they are known as Moon's molars.

6. Acute Infections

The first signs of some of the common childhood infections are seen in the mouth and it is important for the dentist to quickly recognise these so that he may protect himself and his other patients from infection.

The oral manifestations of the most common infections are given below.

(a) Measles

Koplik's spots on the inside of the cheeks together with a raised temperature are almost diagnostic of this infection. The skin rash appears later.
(b) Mumps

The parotid gland is most commonly involved but any of the salivary glands may be affected by mumps, becoming swollen and tender. This condition must be differentiated from swollen glands caused by infection from the mouth or teeth or blocking of the salivary ducts by calculus.

(c) Scarlet Fever

A sore throat and characteristic strawberry looking tongue and high temperature indicate this disease followed by the rash.

7. Metal Poisoning

The first indication of chronic poisoning with heavy metals appears round the gingiva. A dark marking near the free margin of the gums should lead to enquiries about the possibility of lead or mercury poisoning. Painful swelling and salivation may also occur.
<table>
<thead>
<tr>
<th></th>
<th>Author(s)</th>
<th>Title and Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.</td>
<td>Brauer, Higley, &amp; Boyd</td>
<td>1939, 1st Ed. pp 65 -72, Phil., Blakiston</td>
</tr>
</tbody>
</table>
21. McBride

22. Mills, G.P. & Humphreys, H.

23. Brauer, Higley & Boyd
   Op. Cit. p 106

24. Kronfield, Rudolph,

25. Brauer, Higley, & Boyd
   Op. cit p 22

26. Easlick, K.A
   Ed. "Dental Caries Mechanism and Present Control Techniques as Evaluated at the University of Michigan Workshop", Reports of Evaluating Committees, St. Louis, C.V. Mosby, 1948, p 201

27. Research Commission, American Dental Assn.

28. McBride,

29. Brauer, Higley, & Boyd,
   Op. cit. p 23

30. Sibelius, C.I.
   (1949) "Diet, Nutrition and Dental Caries." Jour. Dent. for Children XVI, p 12


34. Research Commission American Dental Assn. as above

35. " " "

36. Bunting, Russel W.
   "Diet and Dental Caries" J.A.D.A., Jan. 1935.

37. Dean, H.T.

38. Pelton, Walter J.
   "Current Effort to Control Dental Caries", Jour. Dent. for Children, XVI, pp 1718.

39. Martin, Noel D.

40. Jordan, W. A. et al
   J.A.D.A. 33. pp 1385 - 91. 1946

41. Prime, James M.
59. Hurst, Dr. I.L. (per Hogeboom), p 138
61. Hogeboom Op cit., p 139
64. " " p 226
86. Irving Dent Cosmos, Jan., 1935
90. " " p 159
93 McBride Op. cit p 161
94. Brauer, Higley & Boyd " " p157
95. Dr. Suthers, Notes issued to Students, Sydney Dental Hospital, 1949
97. Gerlach " " p 224
98. Rosenstein J.A.D.A. Sept 1942. (per McBride) p 162
104 Dr. Suthers Lectures to Students Sydney Dental Hosp., 1949.
106. McBride " " p 166
107. McBride " " p 171


110 McBride " " p 209
111 McBride " " p 174
112 Ellis " " p 235
113 Ellis " " p 233
114 Kronfield, R. 8 "


117 Ellis " " pp 238 - 45
118 Ellis " " p 30
119 Brauer, Higley & Boyd " " p 172

120 Hogeboom " " p 291
121 Ellis " " pp 41 - 42
122 Hogeboom " " pp 295 - 296
123 Brauer, Higley & Boyd " " pp 173 - 176

124 McBride " " p 200
125 Ellis " " pp 48 - 60
126 Ellis " " p 85
127 McBride " " p 202


130 Ellis " " p 154
131 Ellis " " pp 176 - 178
132 McBride " " p 204


135 Ellis " " p 199
136 Ellis
137 McBride
138 Straub, H.E.
139 Brauer, Higley & Boyd
140 Straub
141 McBride
142 Kesson, E.I.
143 Jacobs, Max H.
145 McBride
146 Kirk, Edward C.
147 Hogeboom
148 Bunting & Hill
149 McBride
150 Kronfield
151 Orban
152 Hemley, Samuel
153 McBride
154 Orban
155 Kronfield
156 McBride
157 Black
158 Hemley
159 Logan W.H.F. & Kronfield, R.
160 Broadbent
161 Black, G.V.
162 Morgan Dr. G.G.
163 Berger, H.
164 Hogeboom

" " p 236
"Anaesthesia for Children (per Hogeboom)
" " p 339
" " p 243
J.A.A.D.A. Jan., 1939.
"Value of Ethyl Chloride in Extractions for Children J.A.A.D.A. June, 1922, pp 1060 - 65
"Oral Path. 3rd Ed., 1945, Lea & Febiger
Op cit., p 74
" "
" " pp 229 - 42
Op.cit., p 77
" " p244
" "
" " p 77
Development of the Human Jaws and Surrounding Structures from Birth to the Age of Fifteen Years. J.A.A.D.A. March, 1933, p 379 - 42
per McBride p 254
165 Cohen, Joseph T.  "The Selection of Cases for Space Maintainers", Nor West Dent Jour, 20. 75, 1941


167 Hogeboom  " " p 265

168 Hogeboom  " " p 269
