Colour Atlas of a New Concept of Enamel Caries

by L.K. Bandlish

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FOREWORD by N W JOHNSON

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FOREWORD

It is a great pleasure to be invited to write a foreword to Mr Bandlish's book. I have enjoyed many stimulating discussions with him in recent years concerning his valuable and highly original observations on the natural history of the carious lesion in enamel.

Mr Bandlish is a dedicated and extremely able practitioner who applies the highest standards of clinical care to his patients. He is an excellent example of the fact that high quality research can be conducted within general dental practice which represents, nationally, a vast resource of important research data. An alert mind, accurate powers of observation and an ability and enthusiasm to think critically exists in Mr Bandlish and serve as an example to the profession at large.

N W JOHNSON
(April 1987)

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I must also thank the staff at the British Dental Association Library, 64 Wimpole Street, London W.1. for their help.

Last but not the least, I must mention my wife and children who have been a source of constant inspiration to me and went through many hardships.

Lalit K. Bandlish

Dedicated to The Unknown Researche

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PART I

1. INTRODUCTION

Tooth decay or dental caries is an oral disease with a complex etiology influenced by a large number of factors. Enamel of tooth is the hardest of all tissues and it is paradoxical that the hardest of all tissues is so susceptible to dental caries in the living humans while it is most indestructible in the dead. The name "Civilisation dystrophy" for dental caries etiologically is connected with damage caused by civilisation, seems quite justified.

This atlas presents a pictorial synopsis of a new concept in the natural history of enamel caries. Tooth surface may be divided into two parts; that is, one part where there is attrition and the other part where there is plaque. The term 'Attrition' in this book has been used in its broadest sense to include attrition and the scouring effect of food. It has been seen that the enamel caries occurs where these two parts meet. Dental plaque, attrition and fluoride play a very important role in the causation control and prevention of enamel caries.

It is generally believed that the locus of initial approximal caries lesion is situated just apical to the contact area[1-3] and is situated on the sites covered with plaque[2]. Beust[4] suggested that in practically all cases the lesion began at the actual point of contact of a tooth with its neighbour. The author[5-9] is convinced that the locus of initial approximal carious lesion is situated mostly at the contact area, and the carious lesions in general are situated on sites with least attrition and least plaque.

There are many contradictions in the literature on enamel caries. This book attempts to find answers to some of these contradictions by formulating some new concepts based upon clinical observations, which have been recorded in colour photographs.

Most researchers have concentrated on the histological and statistical approach rather than a careful look at the clinical picture. The books available on enamel caries carry histological pictures, statistical tables, but few radiographs and photographs of enamel caries. They have described the location of the carious lesion on the approximal surface but have presented few illustrations of the lesion.

The author has assumed that the reader possesses a basic knowledge of the pathology of dental caries.

The observant reader will find some repetition in the illustrations which has been done deliberately to put emphasis on certain points for clarity and to try and develop an interesting, and thought provoking concept.

It is hoped that this atlas will provide a vivid pictorial understanding of enamel caries and will be useful to the dental students, practioner and researchers.

2. CONCEPT OF ENAMEL CARIES

Dental caries involves demineralisation of enamel over a period of time by organic acids produced by bacterial fermentation of carbohydrates.

Enamel is ectodermal in origin and is the hardest of all tissues. One of the ways it protects itself is by shedding its superficial layers through attrition and/or abrasion. The skeletal records tell us that the primitive man seldom lost teeth. They could become worn with advancing age to the point where the roots were left in the jaws but the dentition still functioned. In other words dental decay seems to be a rather recent phenomenon and it flourished in the nourished population due to lack of attrition. In other words caries occurs where there is least attrition.

Oral fluids protect the enamel by providing a protective covering on the enamel surface. This protective covering is always invaded by bacteria except under strict experimental conditions and is known as dental plaque. It has been seen that there is little topographical relationship between dental plaque and carious lesion. Enamel caries occurs where there is least plaque and least attrition.

Attrition makes the fissures wider and removes the superficial layer of the enamel along with the initial carious lesions, if present. The new layer of enamel becomes protective again with the help of oral fluids on it. Where the oral fluids cannot reach, that is the contact areas, the new surface layer of enamel cannot be made protective against the carious attack.

Attrition and plaque must be regarded as defence mechanisms against caries. Organic acids produced by the bacterial fermentation of the carbohydrates cause subsurface demineralisation of the enamel without the penetration of the bacteria through the intact enamel surface. Some of the products which are removed as a result of demineralisation are recycled into the enamel during the process of remineralisation. Demineralisation and remineralisation continue with time, but caries occurs only where there is more demineralisation.

Dental caries occurs at the contact area because the contact area is not exposed to the protective action of the oral fluids and the protective action of the plaque. The area below the contact area is covered by plaque. The organic acids from the plaque attack the perimeter of the contact area as shown in Figure 1. The carious lesion starts at the perimeter of the contact area. Figure 2 shows the perimeter-area ratio of square and circular areas. Smaller the area more the perimeter per unit area, as the area becomes larger, the perimeter per unit area falls. Similarly smaller the contact area, more the perimeter per unit area. As the contact area becomes greater with attrition, the perimeter per unit area falls. All other factors remaining constant the intensity of the acid attack on the contact area depends on the length of the perimeter per unit area. Greater the length of the perimeter per unit area, the stronger the acid attack on it. As the length of the perimeter per unit area falls with the increase in the size of the contact area so does the strength of the acid attack. Even with a small amount of attrition, the size of the contact area increases considerably.

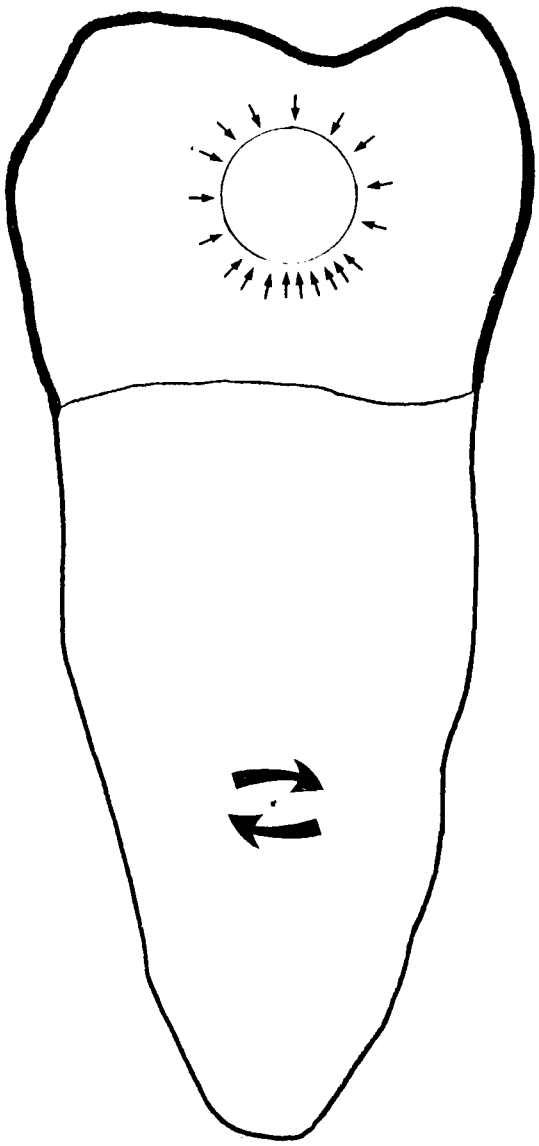
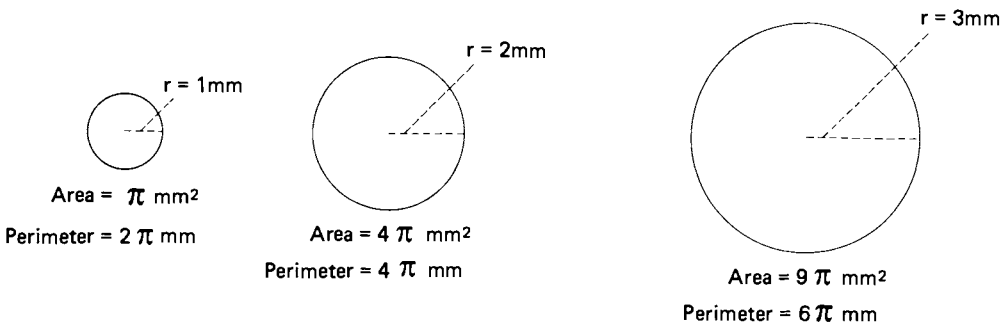


Fig. 1. The circle represents the contact area and the arrows represent the acid attack on it.

The surface area of a three dimensional object varies with its size; that is, the smaller the particle size, the larger the surface area. Similarly the perimeter of a two dimensional surface (contact area) varies with its size, that is, the smaller the surface the more the perimeter per unit area. Smaller crystals dissolve more quickly, the quantity of solvent and solute remaining constant. Similarly the carious lesion progresses faster in a smaller contact area, all other conditions remaining constant.



Perimeter = $2\pi r$

Area = πr^2

Perimeter area ratio = $\frac{2\pi r}{\pi r^2} = \frac{2}{r}$

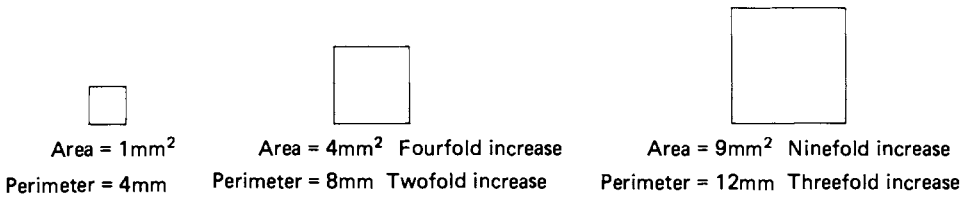


Fig. 2. Shows the perimeter-area ratio. As the area becomes larger in size, the perimeter area ratio decreases. The acids from the plaque attack the contact area at its perimeter, as the contact area enlarges with attrition, the perimeter area ratio decreases leading to reduced acid attack on the contact area.

3. ORAL HYGIENE AND ENAMEL CARIES

It is not possible to eliminate plaque completely and to remove all the bacteria from the mouth. Normal brushing inevitably leaves some plaque. It has been reported that the removal of plaque does not reduce caries[10, 11] and the level of debris on teeth has no relationship to approximal caries and restorations[12].

Organic acids from plaque diffuse into the relatively unprotected areas of the enamel surface. It has been claimed that removal of plaque reduces enamel caries[13] but in fact there is no convincing evidence to prove this.

Meticulous plaque control through brushing and professional cleaning reduces caries not by removing plaque but by removing some of the surface layer of the enamel. Professional cleaning is more effective because during the professional cleaning abrasive pastes are used. It has been suggested that gradual regression of active enamel lesions to a large extent is a result of surface wear[14].

Chewing sticks used for cleaning teeth in some parts of the world, help in the reduction of enamel caries through increased wear and by increasing the accessibility of the inaccessible surfaces of the teeth to the protective actions of the oral fluids through the functional movements of the teeth.

Plaque in a broad sense protects the enamel surface by its neutralising, diluting and buffering capacity and acts as a reservoir for minerals. It plays a very important role in the maturation of enamel.

4. MOVEMENTS OF TEETH AND ENAMEL CARIES

The functional movements of teeth help in the attrition of the approximal surfaces and expose these approximal surfaces to the beneficial effects of the oral fluids. Figure 3 shows the bucco-lingual movements of a tooth diagrammatically. The three circles represent the three positions of the contact area. Maximum caries occurs where the three circles meet or overlap. During the bucco-lingual movements of the teeth, there is more movement at the occlusal border of the contact area and less at the cervical border, because the cervical border is nearer to the fulcrum of the movement of the teeth. According to the principle of the lever, there is less movement nearer the fulcrum. Where there is more movement there is less incidence of caries; where there is less movement there is more incidence of caries. Accordingly, the cervical border of the contact area is more prone to caries.

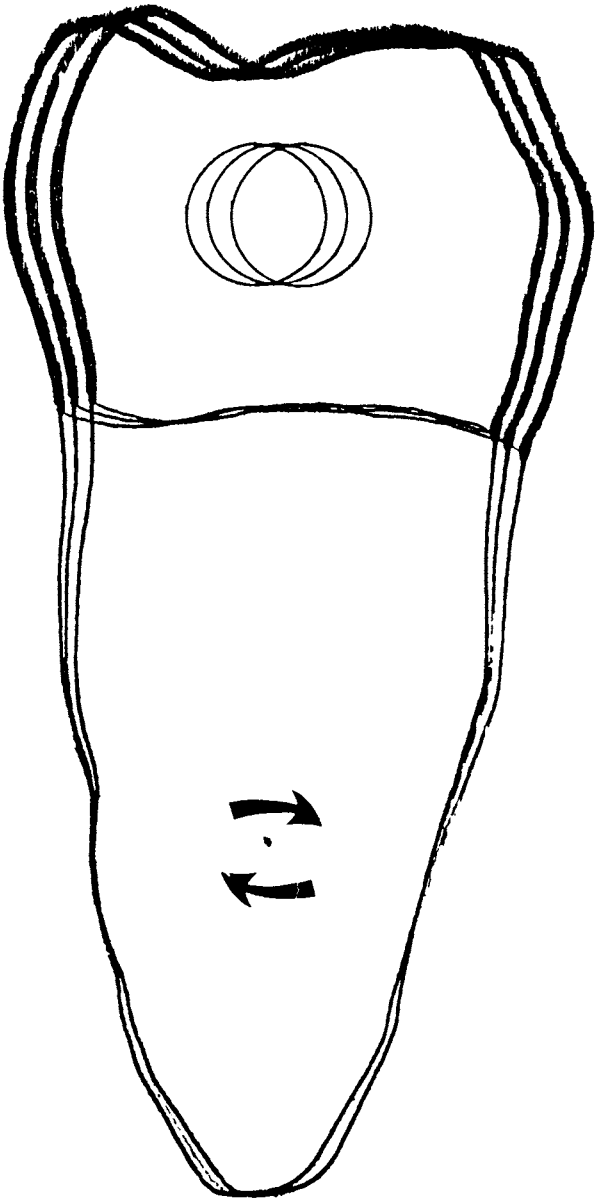


Fig. 3. Shows the bucco-lingual movements of a tooth diagrammatically. The three circles represent the different positions of the contact area. Maximum caries occurs where the three circles meet or overlap.

5. ATTRITION, ABRASION AND ENAMEL CARIES

Attrition and abrasion in some way help to remove or even-out the defects in the enamel surface. These defects may be developmental or environmental in origin.

With attrition or abrasion the surface layer of enamel is removed and the new surface of enamel becomes protective as it is exposed to the action of the oral fluids on it. Wherever the oral fluids cannot reach the surface layer, that is the contact of two enamel surfaces specially fissures and the contact areas; the enamel surface is more prone to caries.

Some researchers have described the locus of the initial approximal caries lesion as being at the margin of the abraded enamel cuticle just apical to the contact area. But the enamel surface below the contact area is very much protected from abrasion or attrition and therefore the caries occurs at the contact area and not below it.

Most clinicians have been led to believe that the initial carious lesion occurs cervical to the contact area but it is an optical illusion. As a matter of fact the lesion is at the contact area. As the cervical part of the contact area becomes carious, the appearance of the facet is lost and it gives the optical illusion of occuring below the facet.

6. EXTRACTION OF TEETH AND FACET

Physiologic movements between the adjoining teeth cause attrition thereby producing facets. The movements of teeth by the dentist during the extraction of teeth may modify the existing facet or modify the initial carious lesion or create a new facet. Extracted teeth, therefore may in some cases give a false impression that the contact area is not prone to caries and the caries occurs below the contact area.

7. CARIES SUSCEPTIBLE SITES

Enamel caries starts at places where there is least attrition and least plaque, i.e. the contact of two or more enamel surfaces, cervical half of the buccal, lingual and palatal convexities and the cusp tips.

There is general belief that enamel caries occurs in occlusal pits and fissures, because these are full of plaque but in fact there is little plaque in the functioning pits and fissures.

It is generally believed that deep pits and fissures are more prone to caries as compared to shallow pits and fissures. It is not the depth of a fissure which is important but the narrowness of a fissure which makes a fissure more prone to enamel caries. Maximum enamel caries occurs in a fissure where the two walls of a fissure either meet or come very close to each other.

The use of a fine probe in the diagnosis of enamel caries has nothing to do with the depth of a fissure. The use of a fine probe helps to diagnose the narrow fissures which are usually more prone to caries. Recently some researchers[15] have clearly come out against the use of probe as a diagnostic instrument for the diagnosis of pit and fissure caries, advocating the use of blunt probe instead of a fine probe. The author is convinced that a fine probe is the best instrument available to the dental profession for the diagnosis of caries susceptible sites or carious lesions. A fine probe can do no harm to the normal enamel. The harm which can be done by the use of a fine probe to a carious lesion can be no more than the harm done by the normal masticatory forces to these lesions.

8. SHAPE OF THE INITIAL CARIOUS LESION

The initial carious lesion (which is usually located at the cervical margin of the facet) in the vertical section of an approximal surface is wedge shaped or triangular in outline, the base of the triangle being the surface enamel. The occlusal margin of the lesion is usually fairly smooth while the cervical margin is serrated. The occlusal margin of the lesion is fairly smooth because this part of the lesion is located in the region of the contact area where only demineralisation occurs. The cervical margin is serrated because here demineralisation and remineralisation can occur depending upon conditions prevailing in the environments.

The shape of the initial carious lesion in artificial caries is quite different than the lesion in vivo. The lesion in artificial caries is not wedge shaped or triangular in outline and is of uniform depth throughout.

9. CONVEXITY OF ENAMEL SURFACE AND ENAMEL CARIES

There is greater similarity in the caries incidence in the adjacent approximal surfaces than the approximal surfaces of the same tooth. One of the main factors which affects the incidence and intensity of caries at the two adjacent surfaces is the convexity of the surfaces involved. During functional movements, the more convex the surface, the smaller is the contact area; the less convex the surface, the larger is the contact area. When there is a contact between two surfaces of varying convexities, the contact area on the more convex surface is smaller. Accordingly, the caries incidence is higher in the more convex surfaces.

Generally the distal surfaces are more convex and the mesial surfaces are flatter except in the case of upper incisors where the mesial surface of the laterals is more convex and distal surface of the centrals is less convex.

The above mentioned concept of convexities when applied to the caries incidence of different adjacent surfaces in the human mouth, seems to be correct except in the case of the contact between the first permanent molars and second premolars. Mesial surfaces of the first permanent molars are less convex, still these surfaces are more prone to caries. The reason for this exception is that the permanent first molars remained in contact with the second deciduosus molars before the contact being established with the second premolars, during which period some caries might have been initiated in the first permanent molars.

10. CARIES SUSCEPTIBILITY OF DISTAL SURFACES

In the approximal surfaces of two adjoining teeth, the distal surface is generally more mature than the mesial surface since it has been longer in the mouth; netherless the distal surfaces decay more often. When the mesial surface of a newly erupting molar establishes a contact with the distal surface of the erupted molar, caries is initiated on both the adjoining surfaces but the lesions on the distal surfaces progress faster. Berman D.S. and Slack G.L.[16] table XI shows that the total number of lesions on the mesial surfaces of second molars is higher than the lesions on the distal surface of the first molars but the number of higher grade lesions on the distal surfaces of first molars is more than double the number of higher grade lesions on the mesial surfaces of the second molars.

When analysing the statistical data about the susceptibility of the mesial and distal surface to caries, there are many factors which need to be taken into consideration. There are equal numbers of mesial and distal surfaces but more mesial surfaces are in contact than the distal surfaces because the distal surfaces of the last teeth in both the arches are not in contact. The mesial surfaces are restored more often as they are easily accessible for clinical examination. Further research is needed on the subject of caries susceptibility of approximal adjoining surfaces. It is best to analyse the number and site of the carious lesions on the surfaces of adjoining teeth before these are restored.

11. CAVITATION AND THE INTERPROXIMAL FORCES

Subsurface demineralisation weakens the enamel surface and actual cavitation occurs because of the physical forces. The smaller the contact area, the more the interproximal forces per unit area, the sooner the cavitation occurs. As the contact area enlarges because of the attrition, there are more forces on the perimeter of the contact area, especially at the cervical part of the contact area as it is nearer to the fulcrum of the movement of the teeth. The discoloration of initial caries may be confined to the contact area or extend beyond or below it, but the cavitation always occurs at the contact area, as there are no physical forces acting on the tooth below the contact area. Billi J. and Thylstrup A. (1982)[17] and Thylstrup et. al(1986)[18] looked for maximal extent of the lesion in the gingival wall, cervical to the interproximal contact area. The maximal extent of the lesion is at the contact area, maybe at its cervical border but definitely not below the contact area. Sometimes there may appear cracks in the enamel surface instead of the frank cavitation and the carious lesions progress through these cracks.

12. CONTACT AREA AFTER CAVITATION

The mesio-distal dimension of the crown is maximum at the level of contact area. The mesio-distal dimension of the crown is more occlusally compared to the mesio-distal dimensions of the crown cervically. Since the cavitation occurs because of the interproximal forces, a new contact is established at the maximum dimension of the cavitated tooth which is usually located occlusal. In other words the contact area shifts occlusally after cavitation, thereby giving the appearance of caries occuring below the contact area. Sometimes the new contact area is established at the perimeter of the cavitation, the new contact restricts the minerals but allows the acids. Cavitation because of the occlusal forces involves both the occlusal and approximal surfaces.

13. FISSURE SEALANTS AND ENAMEL CARIES

According to the author's concept of enamel caries, fissure sealants not only prevent caries on occlusal surfaces but also decrease enamel caries on approximal surfaces[19]. The fissure sealants load the occlusal surface, the increased occlusal loading increases the movements of the teeth thereby leading to the increased attrition of the approximal surfaces. The increased attrition of the approximal surfaces leads to larger contact areas thereby reducing the rate and incidence of enamel caries. The fissures of unopposed teeth in individuals who are not prone to caries may sometimes be sealed by calculus deposits.

14. IMMUNISATION AND CARIES

Review of literature reveals that more than 90% of population in western countries develop caries. It is generally assumed that natural immunity is ineffective. Lack of immunity in caries does not seem to be a problem. The real problem appears to be that the antibodies or the defense mechanism of the body cannot reach the susceptible sites such as the contact between two enamel surfaces.

The plunging action of masticatory forces helps to pump the oral secretions into the occusal fissures of the teeth. The masticatory forces also help to pump the oral secretions into the region of the contact area. Modern food is getting softer and less fibrous; thus the masticatory forces are reduced. The reduced masticatory forces do not force the oral secretions into the unprotected areas thereby making these areas more prone to caries.

It has been said[20] that man has the potential to mount the cellular and humoral immune responses to streptococcus mutans, but that under the conditions of natural immunisation these are usually inadequate. It may be that the natural immunisation to streptococcus mutans is adequate but because of the reduced masticatory forces the immune response is unable to reach these inaccessible areas.

15. FLUORIDES

The most widely discussed hypothesis of the effect of fluoride in enamel is that it reduces its solubility. Fluorides also have a similar effect on bone. They combine with the calcium salts because of their affinity for the calcium salts and make them less soluble. The reduced solubility of the calcium salts leads to their reduced availability for the mineralisation of enamel leading to its hypomineralisation.

When the teeth start erupting; the fluorosed bone does not resorb as easily as normal bone and retards the eruption of the teeth. During the process of eruption the fluoridated bone is resorbed, releasing fluoride which is absorbed by the enamel as the teeth are erupting. This explains the distribution of fluoride in the enamel, especially in the surface layer of enamel.

In short, the more the fluoride in the water supply, the more the fluoride in the bone, which makes less calcium salts available to the enamel thus making the enamel hypomineralised. Thus the hypomineralised enamel being more permeable, picks up more fluoride as the teeth erupt. In general the demonstrable effect of fluoride ion administration is to produce a less mineralised enamel on a volume basis[21]. Enamel is brittle and more prone to wear and fracture even at one part per million fluoride concentration in the water supply. In a study[22] for the assessment of mottling in incisor teeth some teeth were excluded from the study which were either missing, crowned or fractured. 56 teeth were excluded from the fluoride area and 41 teeth were excluded from the non-fluoride area. When the figures of the teeth which were excluded from the study were analysed it was found that double the number of upper central incisors were excluded from the fluoride area as compared to the non-fluoride area on a percentage basis.

While the number of upper lateral incisors excluded from fluoride area was one third as compared to the teeth from non-fluoride area. Central incisors are more to prone to fracture and the lateral incisors are more prone caries.

16. ABSORPTION OF FLUORIDES

The fluorides are absorbed systemically and locally through the oral mucous membrane and the gingival crevice. During the process of the so called local application of fluorides the enamel absorbs much less fluoride compared to the absorption through the mucous membrane and the gingival crevice. The fluorides absorbed through the mucous membrance and gingival crevice are stored in the alveolar bone. The fluorides from the alveolar bone are released over a longer period contributing more fluoride to the plaque.

The effects of fluoride in reducing enamel caries are multifactorial. One of the ways through which fluorides work is by causing hypomineralisation, which makes the teeth more prone to attrition and the increased attrition helps to reduce the enamel caries.

Fluorides are effective where there is attrition such as approximal surfaces and are ineffective where there is least attrition such as pits and fissures.

The enamel surfaces which are exposed to attrition loose fluoride[23]. Therefore it suggests that attrition plays a major role in the reduction of enamel caries compared to the incorporation of fluorides into the enamel.

It has long been known that partially demineralised enamel takes up fluoride preferentially relative to sound enamel. This is the reason, that there are more fluorides in the decayed parts of a tooth. The maximum absorption of fluoride by the enamel is not under the thick plaque, but in the areas of least attrition and least plaque. These are the areas which are usually prone to caries.

17. ATTRITION AND MOTTLING

Mottling of the fluorosed enamel is usually confined to the areas of least attrition and least plaque. Fluorosed teeth are more susceptible to attrition or abrasion, as well as being smaller, more rounded in contour and the pits and fissures shallower. This change in the morphology of the teeth is probably related to the increased attrition of the teeth. The tooth surfaces least exposed to attrition show more hypoplasia and mottling. Distribution of mottling in fluorosed teeth has no relationship to the choronologic development of the teeth.

18. FLUORIDES AND PLAQUE

Fluorides in the dental plaque are of a higher concentration than any other structure in the human body other than mineralised tissue. Distribution of fluorides in the plaque is not uniform. Thick or heavy plaque usually has a lower fluoride concentration than thin plaque[24, 25].

It has been found that the dental plaque acts as a reservoir not only of fluorides but also of calcium and phosphorus salts and other remineralising agents which help in the remineralisation of the initial carous lesion.

19. FLUORIDE AND BONE

The concentration of fluoride is highest in the bones of the human body and its effect on bone is cummulative. Fluorides have an affinity for the calcium salts and it slows the alveolar bone turnover rate. It combines with calcium salts and produces a relatively insoluble calcium fluoride. In this form, fluorides lock up some of the calcium salts so that the body cannot use it for the developing teeth and bone. With the result there is poor mineralisation of teeth and bone.

There will be probably more movement of the teeth because of the poorly mineralised bone. Increased movements of teeth combined with hypomineralised enamel leads to excessive wear of teeth under normal masticatory forces. This increased wear helps in the prevention of caries especially in the region of the contact area.

20. BITEWING RADIOGRAPHS AND APPROXIMAL CARIES

The contact area is a dynamic relationship and enamel caries is a dynamic disease and as such it is very difficult to relate the two. The initial carious lesion starts at the perimeter of the contact area and spreads into the contact area, but many radiologists and clinicians assume that the initial carious lesion starts below the contact area. The approximal surface of a tooth may be divided into three regions i.e. occlusal embrasure, contact area and cervical embrasure. If an analysis is carried out of the occurence of the initial carious lesion on the approximal surface, it is found that the lesion occurs in the region of the contact area.

The initial carious lesion starts at the cervical part of the contact area and not below it. Once the cervical part of the contact area is decayed, it gives an optical illusion that the carious lesion occurs below the contact area.

The thicker occlusal enamel and the thinner cervical enamel create an optical illusion that makes the lesion look as if it occurs below the contact area.

The carious lesion after piercing the enamel thickness spreads along the dentino-enamel junction. The lesion spreads occlusally and cervically. The spread in the cervical direction is clearly seen on a radiograph but the spread in the occusal direction is masked by the thickness of the occlusal enamel, this again creates an optical illusion that the enamel caries occurs beneath the contact area.

The maximum mesio-distal dimension of the crown is at the level of the contact area. After cavitation the contact area shifts occlusally because the dimensions of the crown are larger occlusally. This again creates an optical illusion and makes the lesion look as if it is below the contact area.

The relative radiolucency (density) of a carious lesion depends upon two factors, one the amount of tissue destroyed and two the bulk of the tooth structure overlying the lesion on the buccal and lingual sides. Most of the initial carious lesions cannot be seen on a radiograph because the amount of tissue destroyed is minimal. The lesions at the periphery of the teeth on a radiograph are also lost due to the umbra and penumbra effect.

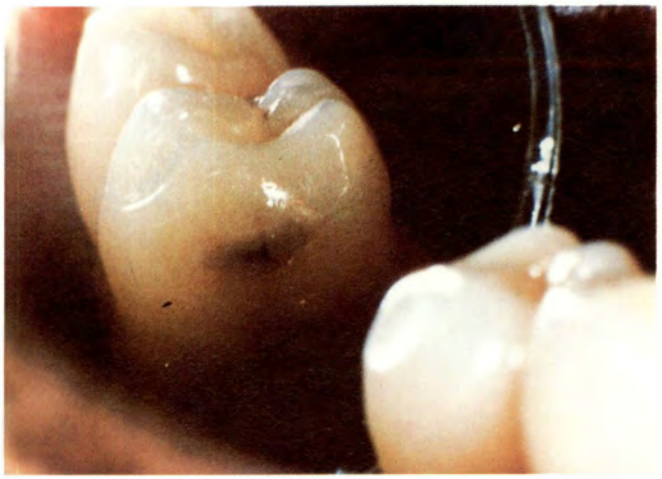
The lesion or part of the lesion in the region in the contact area cannot be seen on a radiograph because the contact between the adjoining teeth is usually at the highest convexity and at the highest convexity the bulk of the tooth structure overlying the lesion is not much. The part of the lesion which is located cervical to the convexity can be seen because in this region the tooth surface is flatter and as such there is more tooth structure overlying the lesion. The above phenomenon also creates the feeling that the lesion occurs below the contact area.

Most of the lesions in the region of the contact area either progress too fast to be noticed in their initial stages or they are attritioned off. The lesions occuring in the cervical part progress slowly and thus are seen more often in the initial stages. Some of the carious lesions which move out of the contact area remineralise. During the process of remineralisation most of the calcium salts are precipitated on the enamel surface, leaving the rest of the lesion as scar tissue. These remineralised lesions are often seen on the radiographs as initial carious lesions.

From the above discussion it can be concluded that the initial carious lesion starts at the perimeter of the contact area and spreads into the contact area. The feeling that the initial carious lesion occurs below the contact area is based on optical illusion.

It is of paramount importance that further research should be carried out in the field of approximal caries on the teeth of cadavers.

PART II



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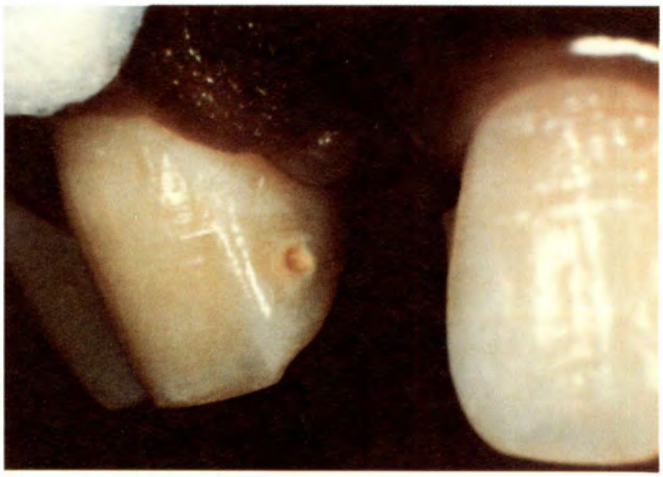

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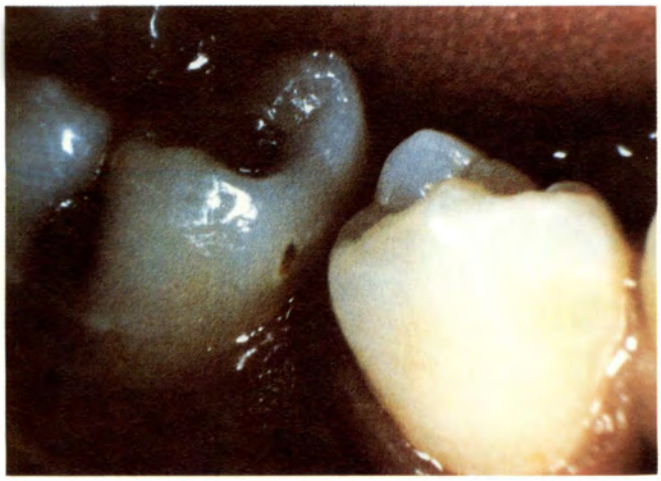

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21. Approximal enamel caries as seen, when the adjoining tooth is missing or fractured.

1. A carious lesion in the region of the contact area on the distal surface of a right lower second premolar.

2. A carious lesion on the distal surface of a left lower second premolar. Note the carious lesion is situated in the region of the contact area.

3. A carious lesion in the region of the contact area on the mesial surface of a right lower second deciduous molar.

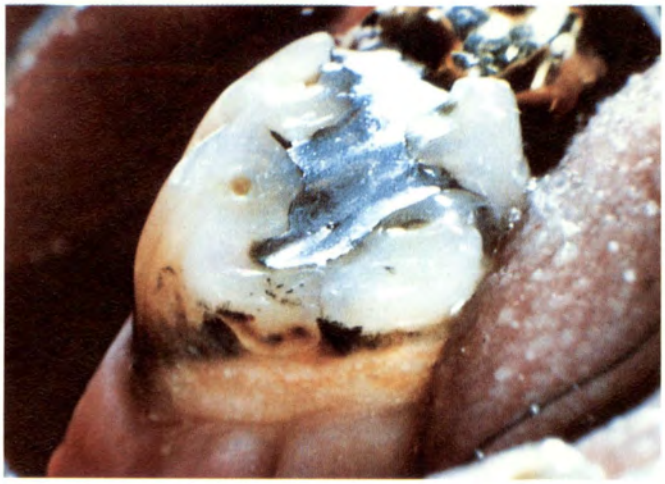
4. A carious lesion in the region of the contact area on the mesial surface of a left upper canine.

5. Right lower first molar showing a carious lesion on the mesial surface. The carious lesion probably started when the tooth was in contact with the deciduous second molar.

6. Carious lesion with definite cavitation is seen on the mesial surface of a right upper second premolar of a thirty eight year old male patient. This lesion has been observed over three years without any progression and the patient gives a history that the upper first premolar has been missing for more than fifteen years.

7. Left lower second molar showing a band of discoloration at the cervical part of the convexity of the crown. Note the location of the band is in the region of least attrition and least plaque. The part of the band which is related to the facet on the mesial surface is more prone to caries.

8. Mesial surface of a left lower second molar showing a band of discoloration of initial caries passing through the mesial and buccal restorations. Note the restoration on the mesial surface is in the region of the contact area.



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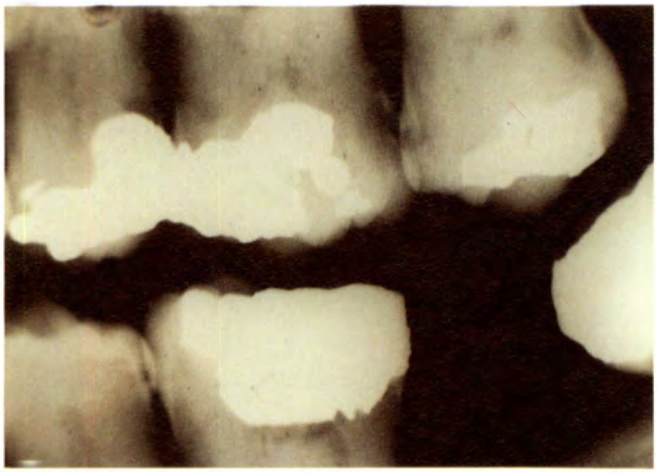

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9. Distal surface of the right lower first molar showing a band of discoloration which is higher lingually and lower buccally. Note the staining of initial caries is in the region of the facet. This band has no relationship to the chronological development of the tooth.

10. The distal wall of the cavity in the lower first molar is broken. Note that the carious lesion on the mesial surface of the lower second molar is in the region of the contact area.

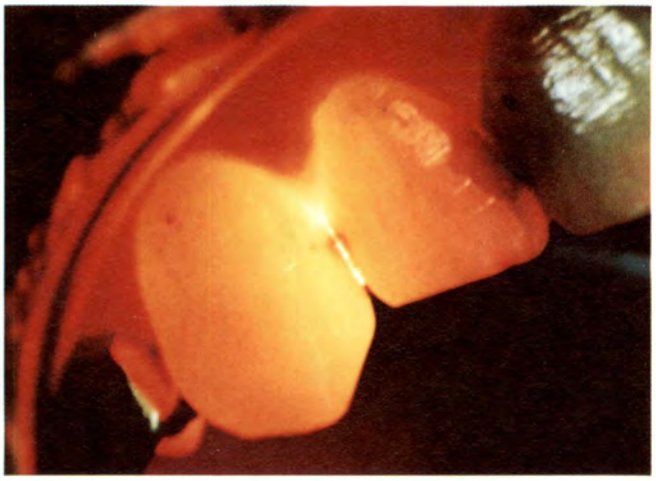
11. Carious lesion on the distal surface of the right lower first premolar of a twenty two year old patient. The carious lesion seems to be in the region of the contact area. This lesion was observed over seven years which did not progress. Enamel becomes protective with the action of oral fluids on it. With the loss of superficial layer of enamel, the deeper layer of enamel becomes the surface layer which again is made protective by the action of oral fluids on it.

12a. Bitewing radiograph of a thirty four year old patient showing approximal caries between the upper molars.

12b. Mesial surface of the left upper second molar after the removal of the first molar showing a carious lesion in the region of the contact area. Note there is a lot of plaque cervical to the lesion but there is very little plaque in the region of the lesion itself.

12c. Above tooth seen from the buccal side after prophylaxis. The carious lesion involves the perimeter of the facet. The lesion is advanced on the buccal border of the facet which was probably the site of the original contact area, as such the site of the initial carious lesion. The occlusal border of the facet seems to have escaped the lesion.

12d. The above lesion viewed from the palatal side. Note a band of discoloration extending from the facet to the palatal surface. This band is located at the site which is more prone to caries.



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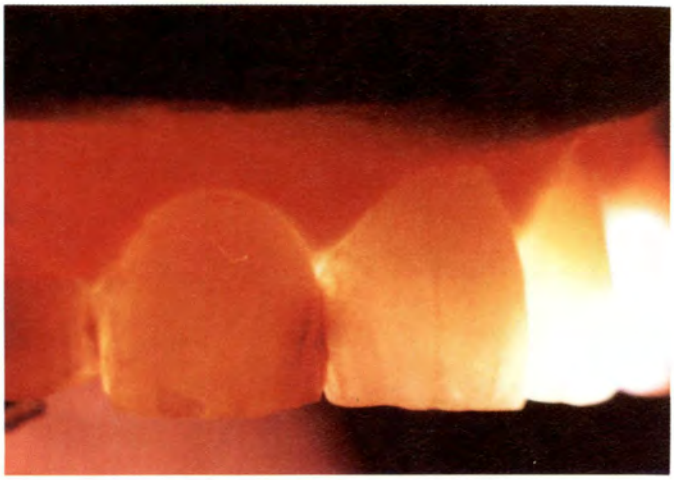

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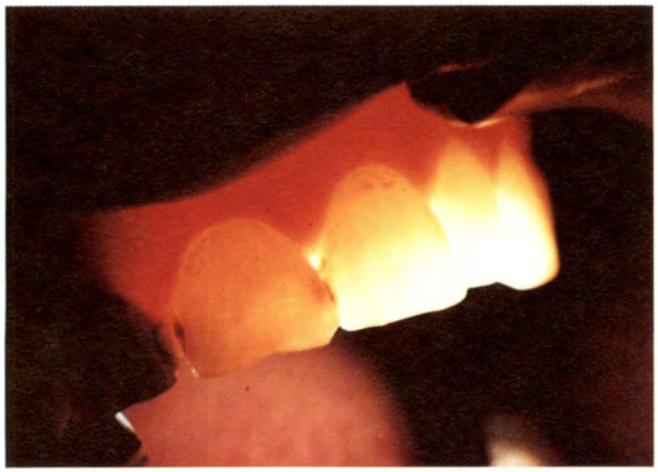

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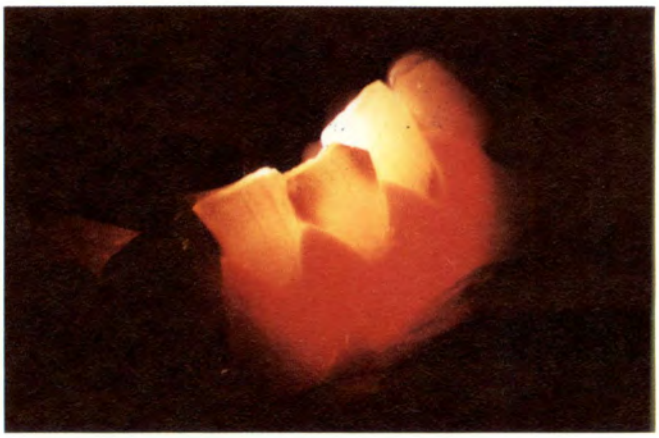

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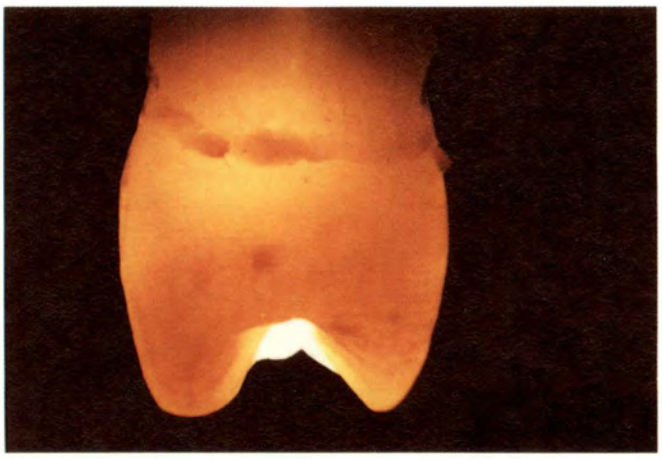

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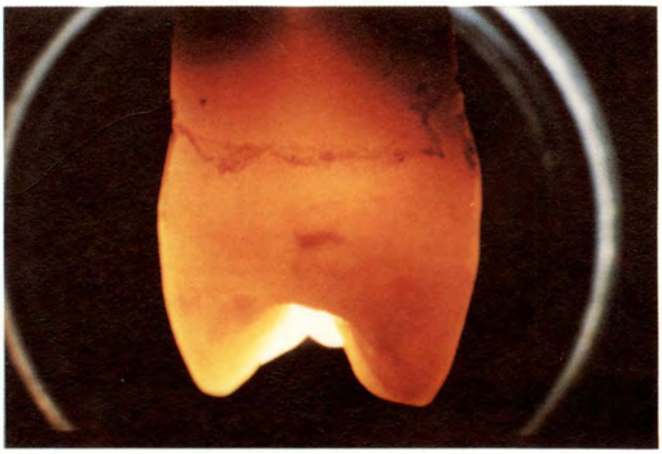


17d

23. Transillumination of Teeth

13. Transillumination of teeth showing an opacity of initial caries in the cervical part of the contact area. The opacity is in the region of the contact area and not below the contact area.

14 and 15. Transillumination of upper central incisors. Note the carious lesions on their mesial surfaces are located in the region of the contact area.

16. Transillumination of lower incisors. Note the carious lesions on both the approximal surfaces of the right lower central incisor are located in the region of the contact areas.

17a. Distal surface of the left upper first premolar of a sixteen year old female patient showing a barely visible carious lesion in the region of the contact area.

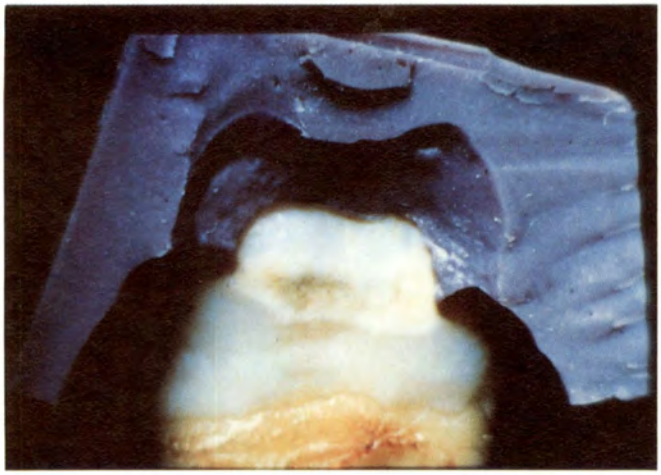
17b. Above tooth with transmitted light showing two carious lesions on the buccal and palatal borders of the contact area.

17c. Distal surface of the right upper first premolar showing a barely visible carious lesion in the region of the contact area.

17d. Above tooth with transmitted light showing a carious lesion involving the perimeter of the contact area, the lesion is advanced cervically.

18a

18b



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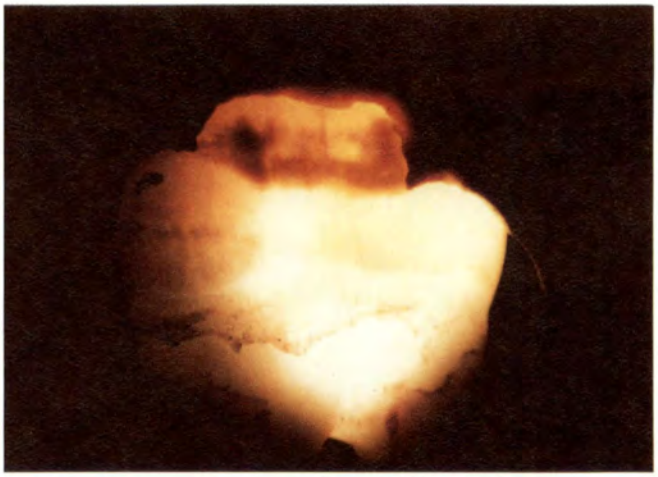

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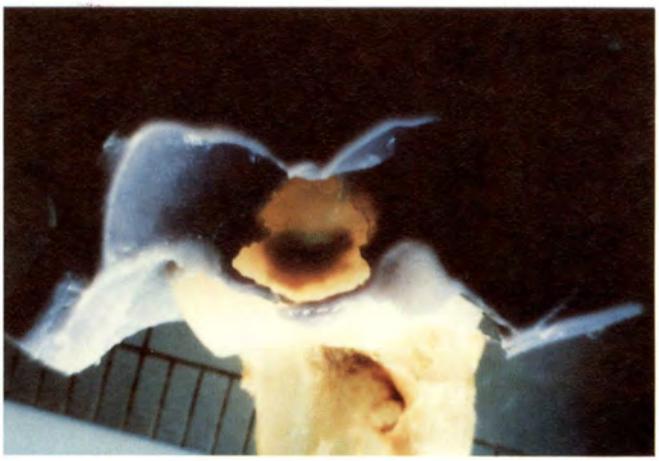

20b

18a. Distal surface of the left upper second deciduous molar of a ten year old patient showing a carious lesion in the region of the contact area.

18b. Above tooth seen with transmitted light. The carious lesion is surrounded by a halo and is located in the region of the contact area.

19a. Contact area on the approximal surface of a molar defined with the help of an impression. The impression was taken before the tooth was extracted. Note the carious lesion has involved the whole of the contact area.

19b. Contact area of the above tooth seen with transmitted light. Note the carious lesion has involved the perimeter of the contact area except on its occlusal border.

20a. Contact area on the approximal surface of a deciduous molar defined with the help of an impression. The impression was taken before the extraction of the tooth. Note the carious lesion is located within the confines of the contact area.

20b. Contact area of the above tooth seen with transmitted light. Note the carious lesion is located within the confines of the contact area.

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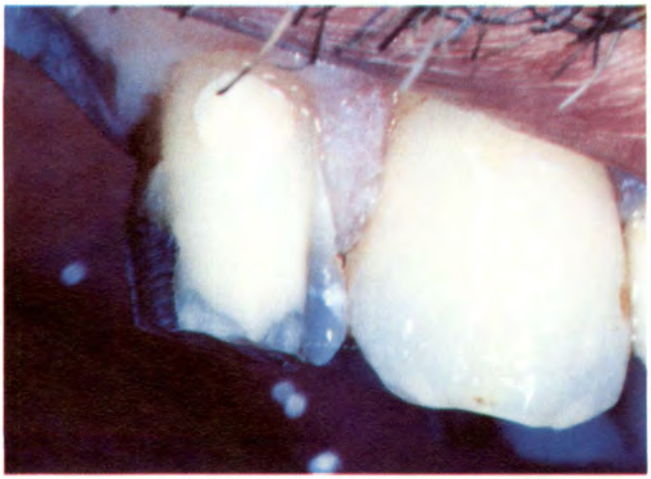

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23. Approximal enamel caries seen during the preparation of the teeth for restorations (vertical section of the carious lesion).

21, 22, 23, 24, 25 and 26. Approximal carious lesions seen during the preparation of the teeth for restoration. Note the carious lesions are located at the contact area.

27a

27b

27c

27d

27e

28a

28b

24. Study of approximal caries of carefully removed fragments of teeth.

27a. Radiograph showing a carious lesion in the region of the contact area on the distal surface of right lower first molar.

27b. Carious lesion on the gingival wall of the right lower first molar seen during its preparation for a restoration. The contact between the first and second molars is still intact.

27c. Mesial surface of the second molar showing a carious lesion in the region of the contact area.

27d. Slice from the distal part of the right lower first molar removed carefully during cavity preparation. Note the carious lesion is within the confines of the facet.

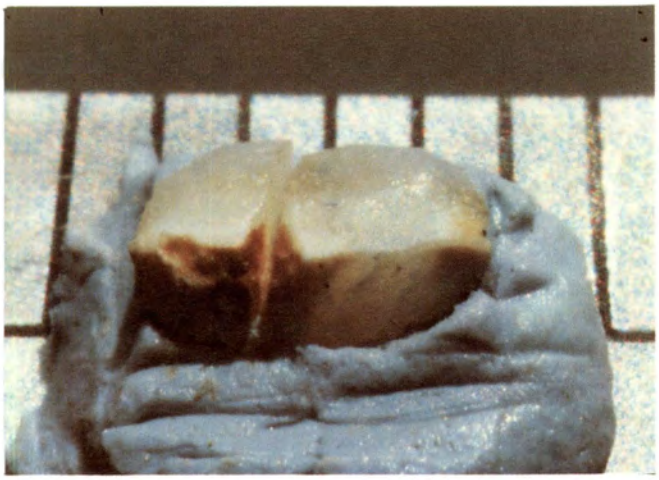
27e. Gingival view of the above slice, note the carious lesion is in the region of the facet.

28a. Carious lesion seen on the gingival walls between the right lower first and second molars. Contact between the teeth is still intact.

28b. Fragments removed from the approximal surfaces showing the carious lesions to be located at the facet. Also note the lesion on the gingival surface of the fragments.

29a

29b



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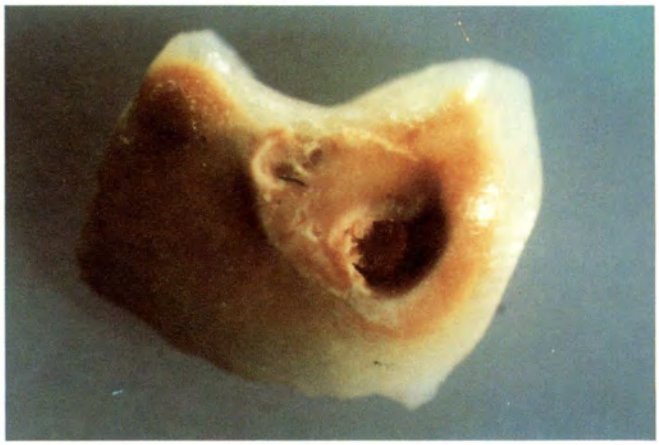

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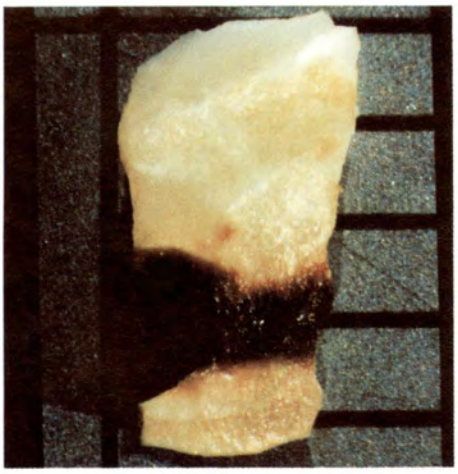

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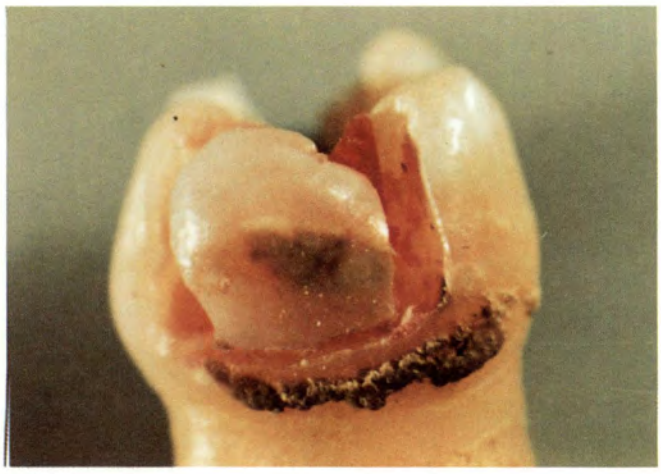


32

29a. Bitewing radiograph of a seventeen year old patient showing an initial carious lesion on the distal surface of the right lower first molar. The carious lesion seems to be in the region of the contact area.

29b. The right lower first molar being prepared for a restoration. During the preparation, distal slice of the tooth was carefully removed. Note the two carious lesion on the gingival wall of the cavity, one at the lingual border and the other at the buccal border of the contact area. The lingual lesion was probably the site of the original contact area, as the enamel in this region fractured, a new contact area probably established. The buccal lesion probably started at a later time at the buccal border of the new contact area.

29c. A slice from the distal surface of the tooth. The gingival surface of this slice gives a mirror image of the gingival wall of the cavity.Note the two carious lesions are in the region of the contact area.

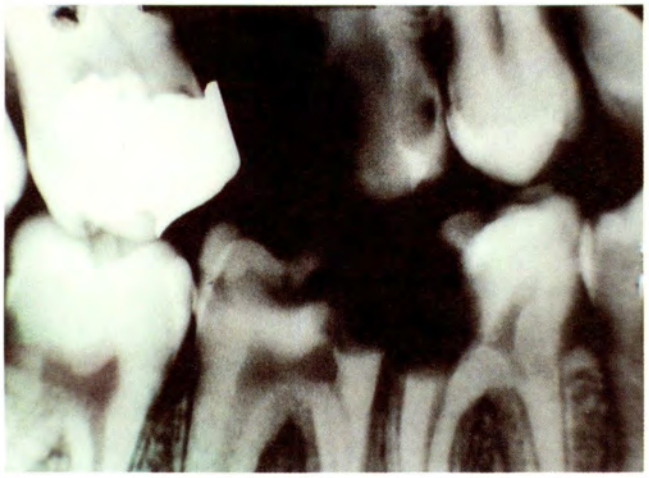
29d. Distal surface of the above slice shows two distinct facets and two carious lesions.

30a. Radiograph of the right side of a thirteen years old patient showing minimal caries on the distal surface of lower first premolar.

30b. Slice from the distal part of the above tooth removed carefully before the extraction of the tooth shows the carious lesion involving whole of the facet.

31. Slice from the distal part of a lower first molar shows a carious lesion in the region of the facet. The slice is about four millimetres in height and the distal marginal ridge is intact.

32. Slice from the distal part of a retained left lower deciduous second molar removed carefully. The slice was then re-assembled with the extracted tooth. Note the carious lesion is in the region of the contact area and the calculus deposit is further lower down. The tooth surface between the carious lesion and the calculus deposit must have been covered with plaque in vivo, but it does not seem to be carious.



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33a. Bitewing radiograph of the right side of an eighteen year old patient showing approximal caries.

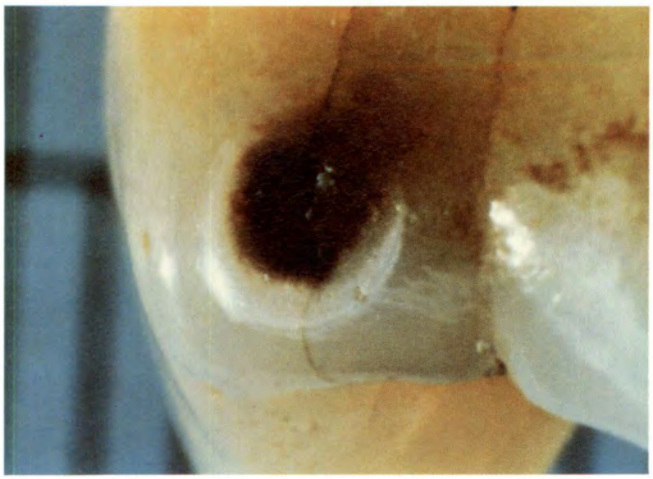
33b. Mesial surface of the right lower first molar seen with reflected light. Note a carious lesion in the region of the facet. Part of the tooth including the mesial surface was removed carefully without disturbing the details on the mesial surface before the extraction of the tooth. The removed part and the extracted tooth were then reassembled.

33c. The tooth seen with transmitted light. Note the carious lesion is located in the region of the facet.

33d. Shows the features on the original tooth surface along with the features on the ground surface of the fragment. The light enters the fragment from the original tooth surface. Note the carious lesion on the ground surface is dark and on the original tooth surface is white.

33e. The fragment seen from the same angle but the light in this illustration enters the fragment from the cut surface. Note the carious lesion on the cut surface is white and on the original tooth surface is dark.

33f. Vertical section of the fragment. Note the straight part of the mesial border of the fragment, this represents the facet. The carious lesion is located in the region of the facet.



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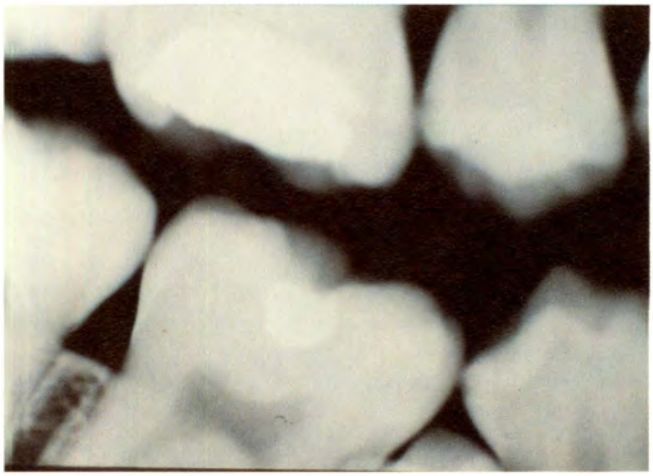

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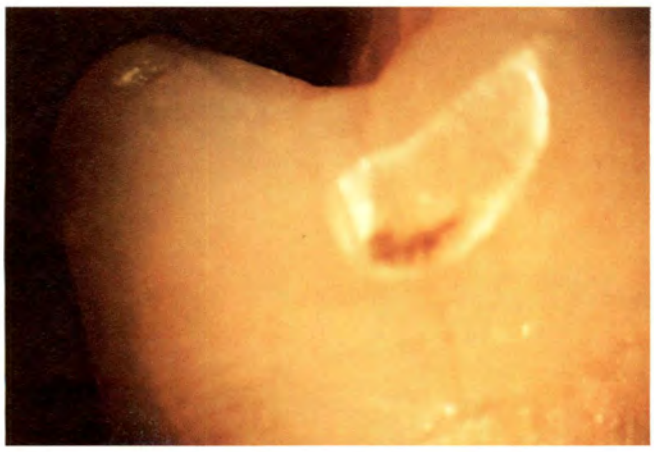

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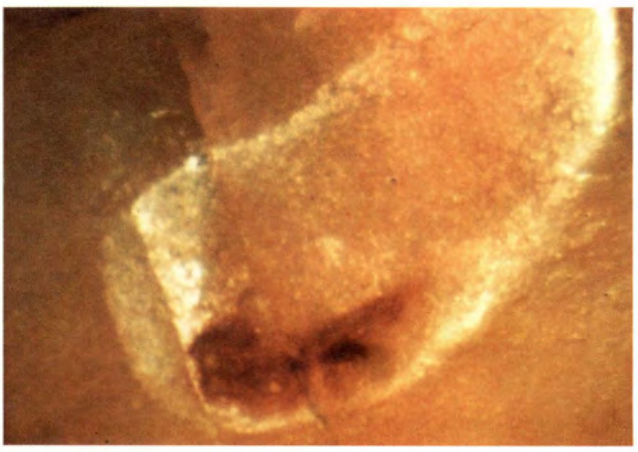


39b

25. Study of approximal caries in extracted teeth.

34. Mesial surface of an upper first premolar showing a facet and a carious lesion within it. Note the carious lesion is confined within the borders of the facet and does not extend below the facet.

35. Mesial surface of left upper third molar showing a carious lesion near the occlusal border of the facet. This carious lesion probably started at the contact area when the tooth was in proper alignment. After the extraction of lower third molar, the upper third molar supra-erupted, thereby increasing the size of facet cervically. This led to its present appearance of the carious lesion being placed near the occlusal border of the facet.

36. Distal surface of right lower second deciduous molar showing three carious lesions. One at the buccal convexity, second at the lingual convexity and the third in the middle of the facet. The third lesion probably started at the contact point and kept on enlarging as the contact area enlarged in size, this lesion consists of two parts, occlusal part and cervical part, the cervical part of the lesion is more advanced.

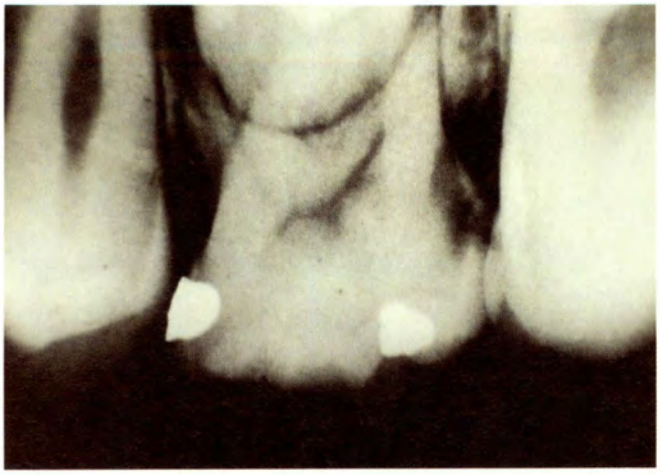
37. Distal surface of a right lower second molar showing a carious lesion within the confines of the facet.

38a. Bitewing radiographs of the right side showing the contact of right lower first premolar, with the mesial surface of the first molar, as the second premolar is impacted.

38b. Mesial surface of the first molar after it was removed shows initial caries in the region of the contact area.

39a. Approximal surface showing a facet and an initial carious lesion in it. Note the carious lesion is within the confines of the facet.

39b. Higher magnification of the above carious lesion. Note the carious lesion is in the region of the facet.



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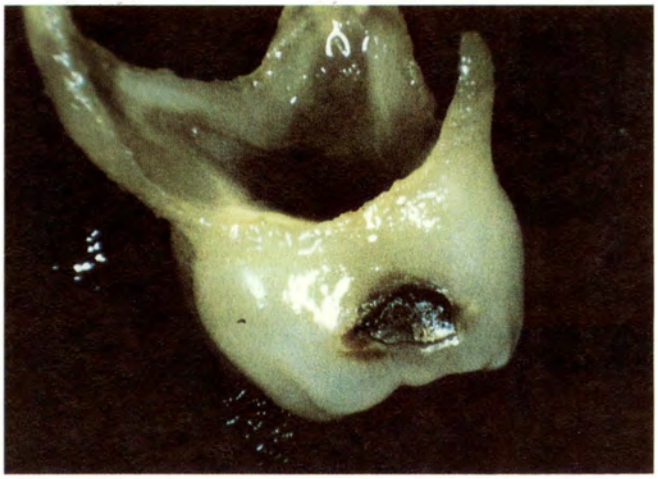

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41c

40a. Radiograph of the right side showing a carious lesion on the distal surface of the upper second deciduous molar and an amalgam restoration on the mesial surface.

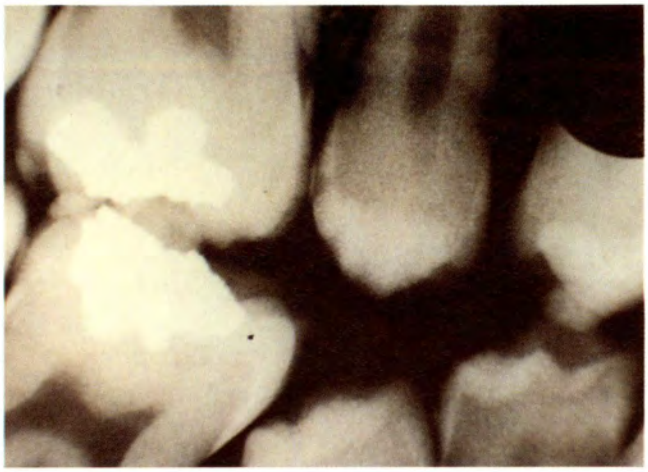
40b. Distal surface of the left upper second deciduous molar shows a yellow area surrounded by a white area. The enamel is intact and the carious lesion seems to be in the region of the contact area.

40c. Mesial surface of the above tooth shows an amalgam restoration in the region of the contact area.

41a. Mesial surface of the left lower first molar showing a band of discoloration due to enamel caries. The band of discoloration broadens in the region of the facet to occupy whole of the facet. The discoloration is located in the region of least plaque and it has no relationship to the development of the tooth.

41b. Distal surface of the above tooth showing similar discoloration.

41c. Hemisectomised above tooth showing carious lesions on the cut surface, seen with reflected light. Note the carious lesions are located at the highest convexities of the tooth or in other words the carious lesions are located at the contact areas.



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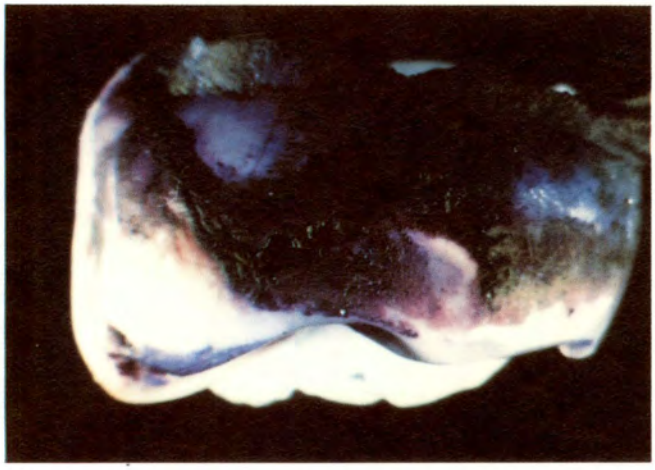

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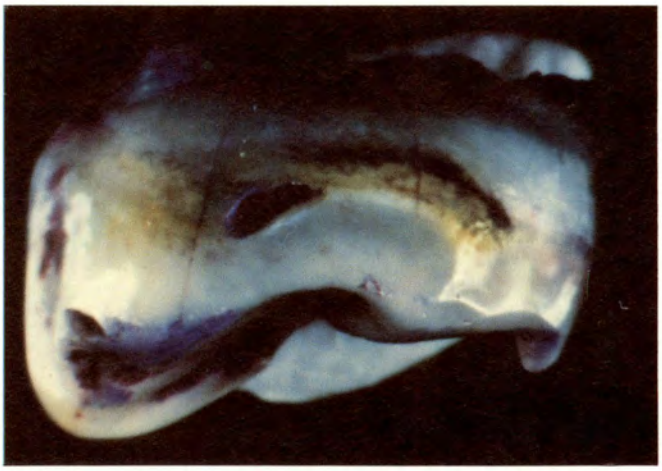

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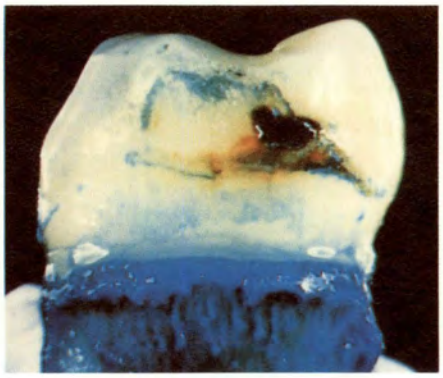

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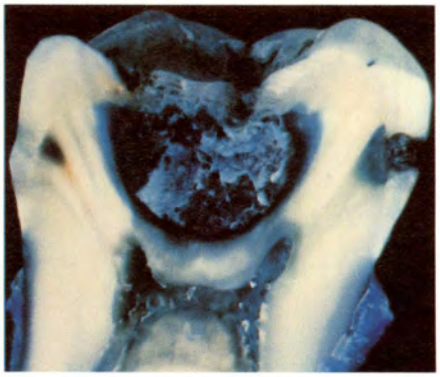


44c

42a. Bitewing radiograph of the right side of a twelve years old patient showing initial carious lesion on the distal surface of the upper second premolar. Note the carious lesion is in the region of the contact area.

42b. Horizontal section of the above tooth taken at the level of the contact area. Note the carious lesion consists of two parts. This appearance has probably been created due to the changes in the contact area.

42c. Photograph of the above tooth showing a dark carious lesion (transmitted light is obstructed by the lesion) on the tooth surface and a white carious lesion (light is reflected by the lesion) on the cut surface.

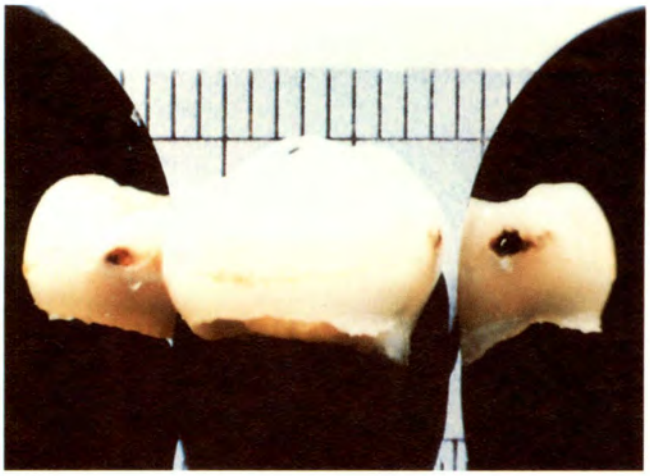
43a. Distal surface of left upper first deciduous molar. There is a cavitated carious lesion which along with the plaque is stained with the dye.

43b. Same tooth after the dye and the plaque has been removed. Note the cavitation of the carious lesion is located within the confines of the facet.

44a. Mesial surface of a right lower first molar of a twenty six year old female patient stained with a disclosing solution. The perimeter of the facet is stained and the bulk of the carious lesion seems to be located within the confines of the facet.

44b. The distal surface of the same tooth showing two carious lesions within the confines of the facet.

44c. Vertical section of the tooth passing through the mesial and distal carious lesions. Note the carious lesions are located in the region of the contact area.



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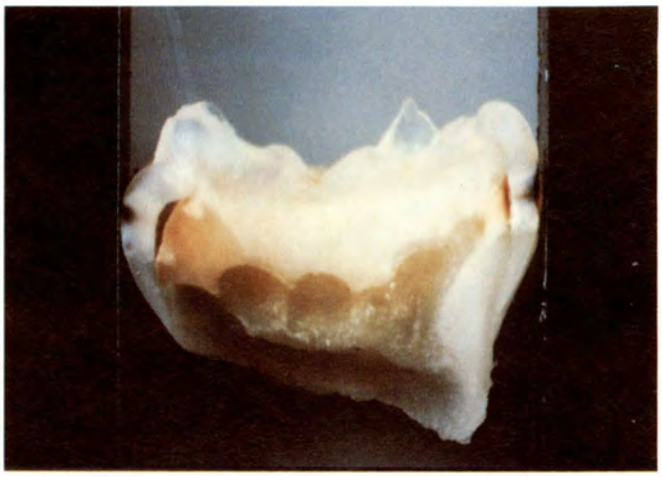

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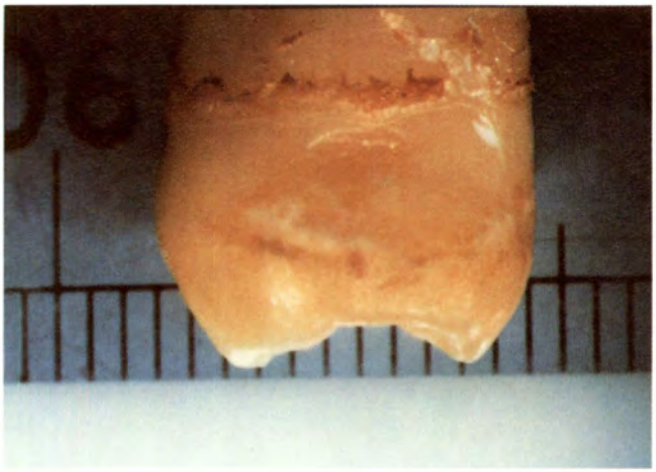

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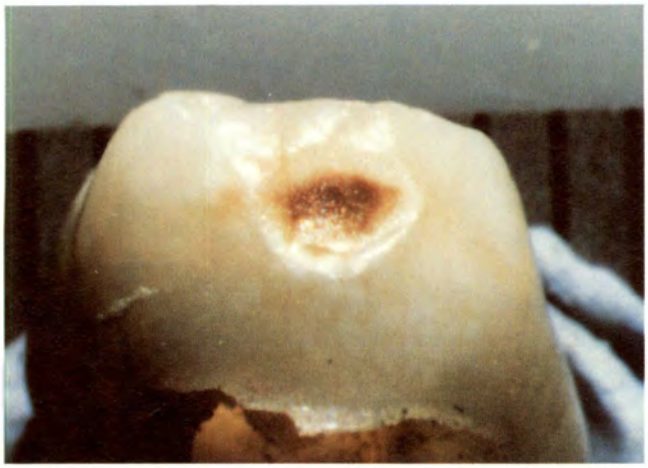

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48b

26. Study of the relation of approximal enamel caries and the contact area with the help of vernier callipers.

45a. Left lower second deciduous molar showing lingual surface along with the mirror images of the mesial and distal surfaces. The mesial and distal surfaces show carious lesions in the region of the contact areas.

45b. Ground section of the above tooth held by vernier callipers to locate the contact areas. Note the carious lesions are located at the convexities or the contact areas of the tooth.

46a. Ground section of a left lower second molar along with the mirror image of the mesial surface. Note the bulk of the carious lesion is located in the region of the facet.

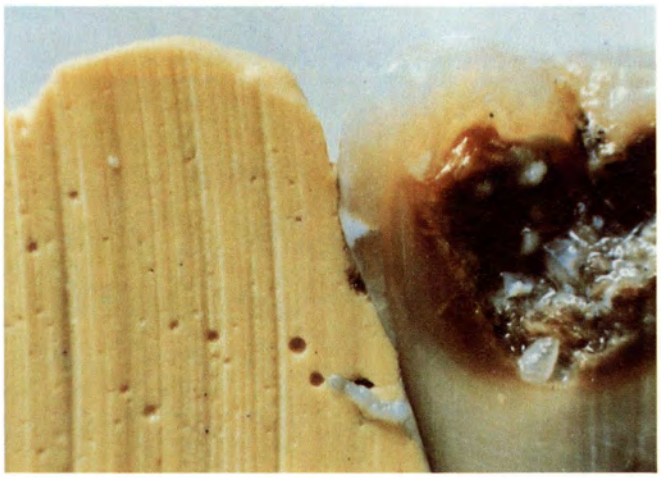
46b. The above ground section held by the vernier callipers to locate the contact area. Note the bulk of the carious lesion is located at the contact area.

47a. Mesial surface of an upper third molar of a twenty two year old patient showing a carious lesion in the region of the contact area.

47b. The ground section of the above tooth held in the vernier callipers. Note the carious lesion is located at the contact area.

48a. Mesial surface of a deciduous molar showing a carious lesion within the confines of the facet.

48b. The ground section of the above tooth held in the vernier callipers to locate the contact area. Note the carious lesion is at the contact area.



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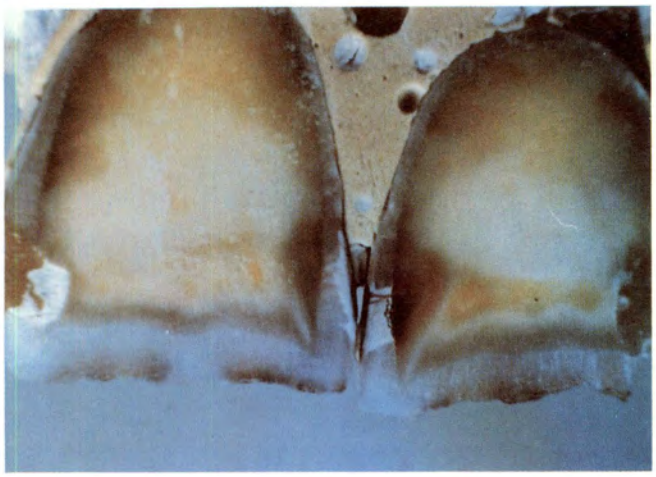

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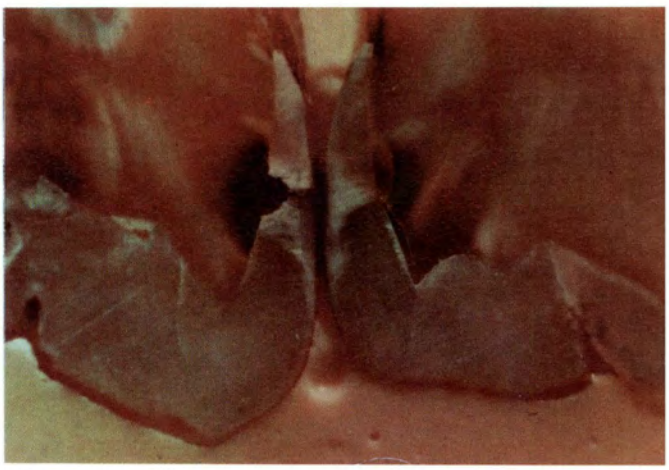

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27. Study of the relation of approximal enamel caries and contact area with the help of models.

49. Ground section of a model which consisted of a natural tooth and a tooth cast in stone. Note two carious lesions in the region of the contact area, one at the occlusal border of the contact area, which is small and the second on the cervical border of the contact area, which is large. Also note the calculus deposit lower down.

50a. Note a carious lesion within the confines of the facet and calculus deposit lower down. The enamel between the facet and the calculus deposit must have been covered by plaque in vivo, but there is no evidence of caries in this region.

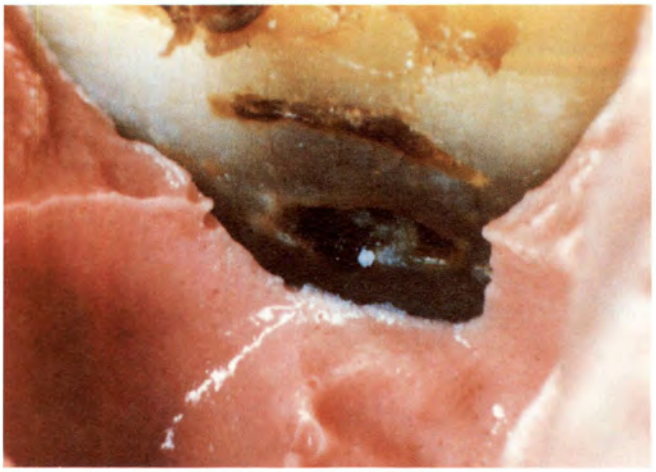
50b. The ground section of the model of the above tooth which consists of the original tooth and the stone model of the adjoining tooth. Note the carious lesion in the region of the contact area and calculus deposit lower down.

51. Central incisors reassembled with the help of impression taken prior to the extraction of the teeth and ground down to show the carious lesions on their mesial surfaces. Note the carious lesions involve the whole of the contact areas.

52. Two upper molars assembled and ground down to show the relationship of approximal caries and contact area. Note the carious lesions nearly involve the whole of the contact area cervico-occlusally.

53a. Mesial surface of a right upper third molar stained with disclosing tablet shows a facet and a carious lesion at its centre. The carious lesion probably started at the contact area when the contact area was small, as the contact area enlarged with attrition, the carious lesion got further away from the perimeter of the facet and got arrested. Two crack lines are seen passing through the facet.

53b. The above tooth after the plaque has been brushed off.



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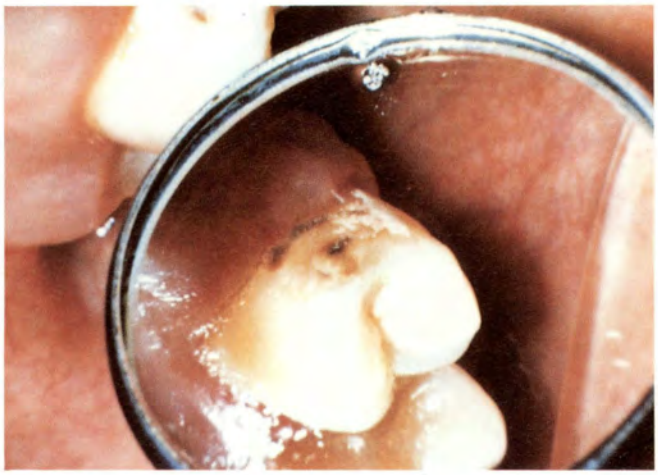

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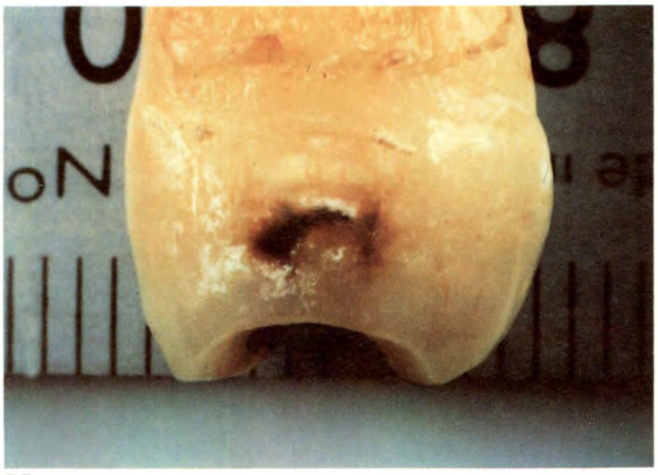

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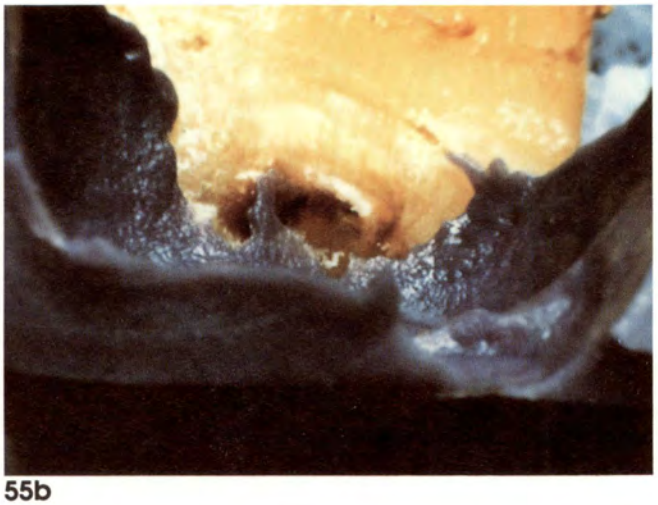

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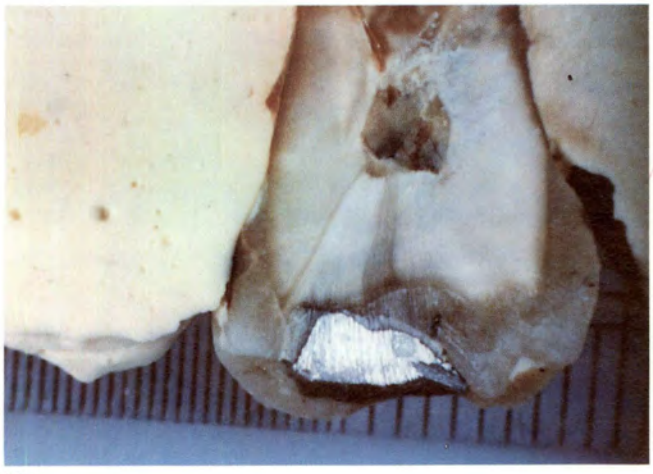

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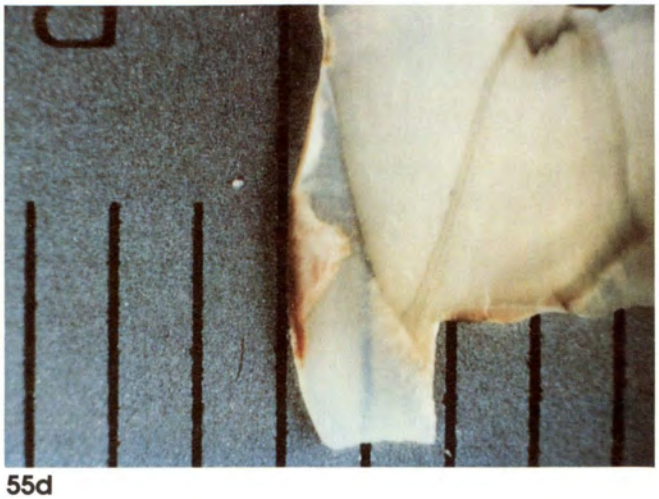


55d

28. Location of contact area with the help of impressions and its relationship with the approximal carious lesion without the use of disclosing solution.

54a. Contact area on the mesial surface of a left upper first molar defined with the help of the impression of the teeth. The occlusal, buccal and the palatal borders of the contact area are defined with the help of the impression material. The carious lesion seems to be at the centre of the contact area.

54b. Ground section of the above tooth along with the ground section of the stone model of the adjoining tooth. The carious lesion seems to be located at the centre of the contact area cervico-occlusally.

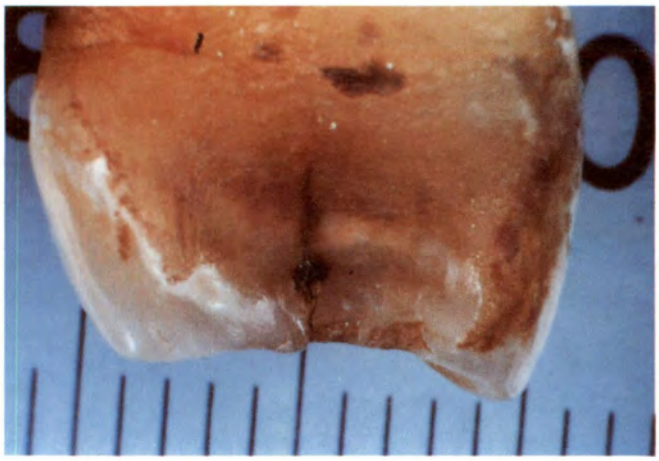
54c. Distal surface of the adjoining tooth (left upper second premolar) showing a carious lesion within the confines of the facet. Note the calculus deposit is outside the limits of the contact area.

55a. Mesial surface of the right upper second molar showing a U shaped carious lesion. The lesion is located at the buccal, palatal and cervical borders of the facet, the lesion being more advanced on the buccal border which was probably the site of original contact area.

55b. Contact area of the above tooth defined with the help of an impression. The carious lesion seems to be within the confines of the contact area. Some of the impression material has reached where the carious lesion is advanced, this probably happened due to the loss of tooth substance in this region because of the carious lesion.

55c. Ground section of the above tooth along with the stone model of the adjoining tooth. Note the carious lesion seems to be in the region of the contact area.

55d. Thin ground section of the above tooth with the vertical lines of a millimeter scale in the background. The external border of the bulk of the lesion is straight. This shows that the lesion is situated at the contact area.



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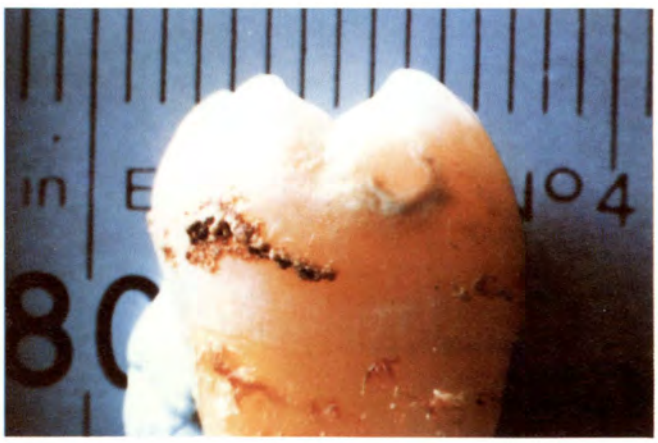

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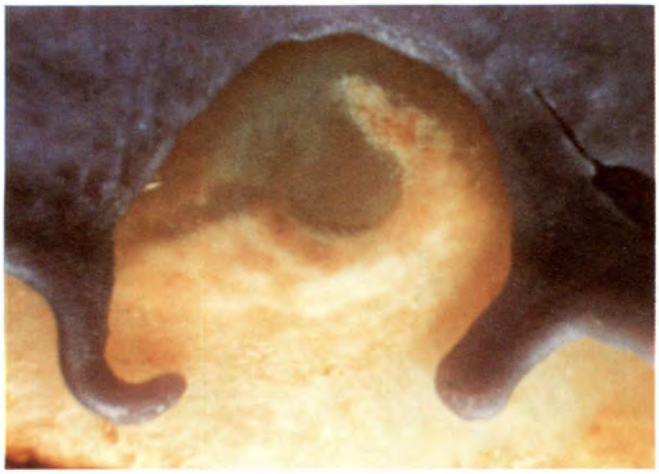

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56a. Mesial surface of the right upper first molar showing a large facet and a carious lesion on its palatal border. The carious lesion probably started in the region of original contact area which enlarged to its one side.

56b. Ground section of the above tooth along with the stone model of the adjoining tooth shows the extent of the lesion and its relationship to the adjoining tooth. The carious lesion seems to be at the contact area and does not seem to extend into the occlusal or cervical embrasures.

56c. The contact area of the above tooth has been defined with the help of an impression which was taken prior to the extraction of this tooth. The carious lesion seems to be at the contact area and does not seem to extend into the occlusal or cervical embrasures.

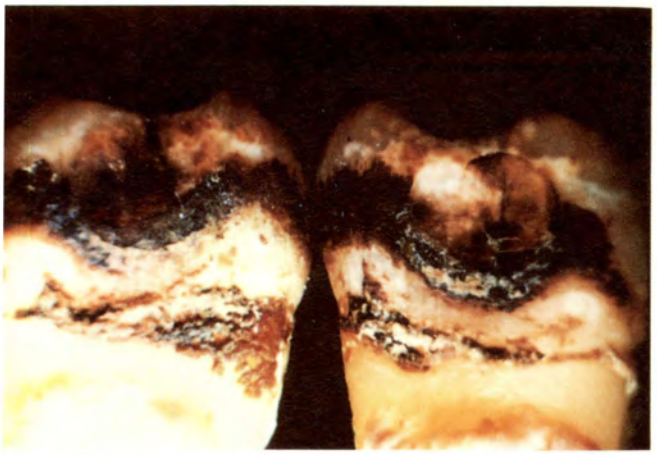
56d. The above tooth ground down and then placed in the impression to relate the internal structure of the carious lesion and the contact area. Note the carious lesion seems to be at the contact area.

57a. Mesial surface of the left lower second molar of a nineteen years old patient seen under reflected light. Note the calculus deposit and the facet, the enamel in between the two seems to be healthy, there is some evidence of a carious lesion at its perimeter.

57b. Above tooth seen with transmitted light. Note the facet and the carious lesion involving its cervical, buccal and lingual borders. It looks that the carious lesion is outside the facet. But if the facet in this figure is compared with the facet in (57a) it can be seen that the carious lesion forms part of the facet and is not located outside. Magnification in both the figures is the same.

57c. Contact area of the above tooth defined with the help of an impression which was taken prior to the extraction of this tooth. Note the carious lesion is within the confines of the contact area. The calculus deposit is outside the confines of the contact area.

57d. The above tooth partially ground to show the relationship of the carious lesion on the tooth surface to the carious lesion on the ground surface.



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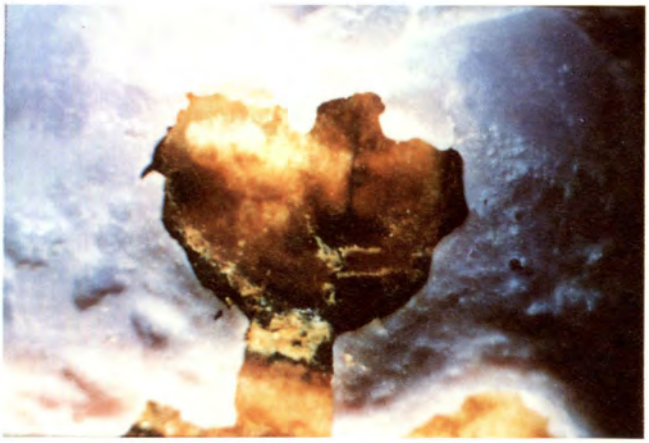

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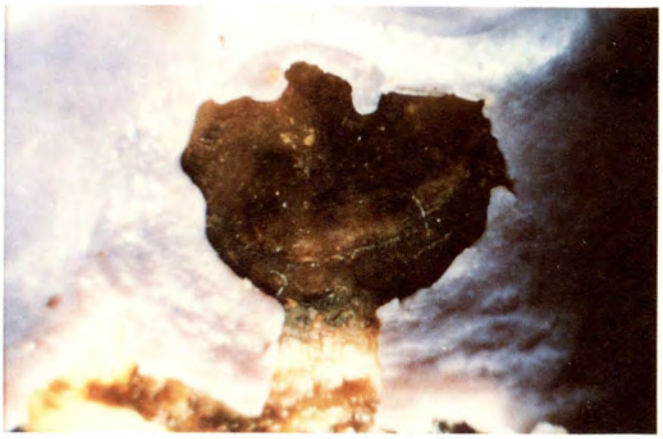

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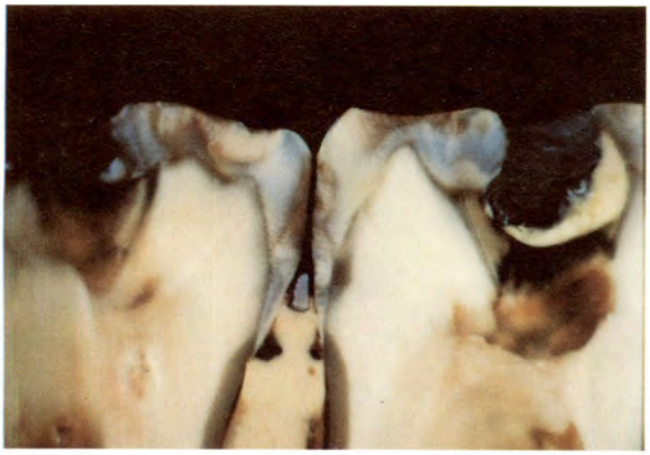

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58a. A pair of approximal surfaces between the second and the third molars. Convexities of the teeth including the facet are stained. There is evidence of caluclus deposit below the facet and the enamel surface between the facet and the calculus deposit seems to be healthy.

58b. The above teeth assembled with the help of an impression. Note the location of the contact area and the staining on the buccal surfaces. The staining seems to be in the region of the buccal convexities which is the region with least attrition and least plaque.

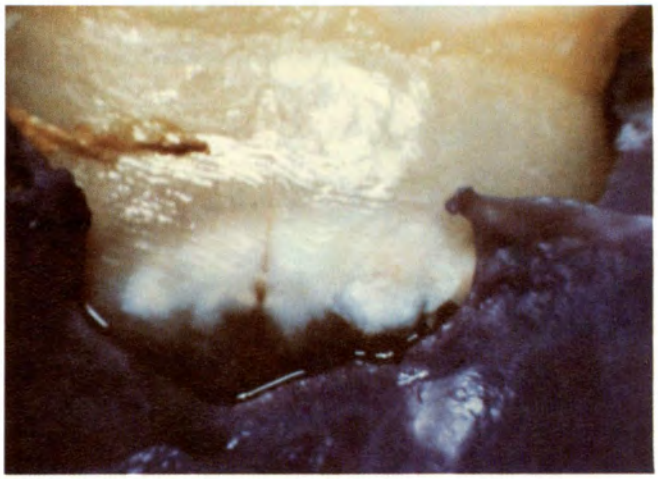
58c. Distal contact area of the second molar defined with the help of the impressions. Note the carious lesion and the crack line in the region of the contact area.

58d. Mesial contact area of the third molar defined with help of the impressions. There is evidence of caries in the region of the contact area.

58e. The assembled teeth from (58b) ground down to show the relationship of the contact area and the carious lesion. Note that the carious lesion involves whole of the contact area.

58f. The above teeth ground down further to show the carious lesion at a different plane. Note that the deepest part of the carious lesion and the cavitation are located at the contact area.

59a



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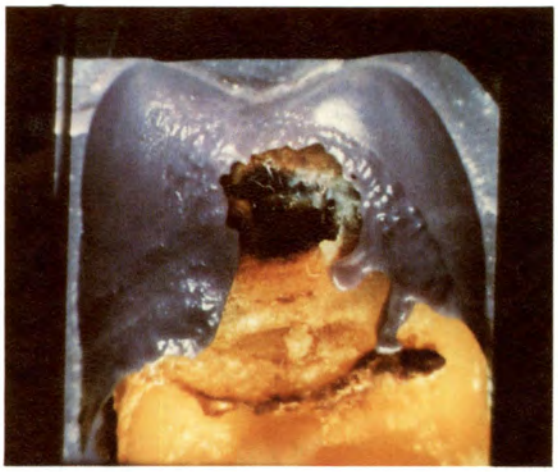

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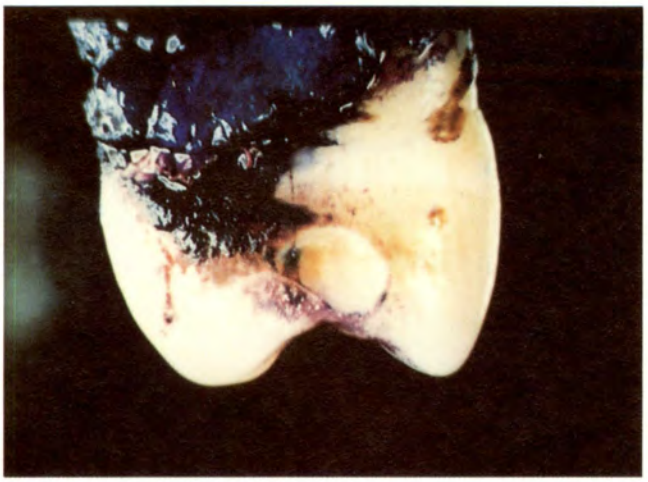
59a. Distal surface of an upper first molar of a nineteen year old patient showing two facets. Initially there was probably one facet, the loss of tooth substance due to a carious lesion probably helped in the formation of the second facet. One facet seems to be fully covered by the carious lesion while the other seems to be partially involved.

59b. The contact area of the above tooth has been defined by the impression taken before its removal. Note the carious lesion seems to be in the region of the contact area and not beneath it.

60, 61, 62, 63, 64 and 65. Show examples of the location of the contact areas with the help of impressions and their relationship with the approximal carious lesions.



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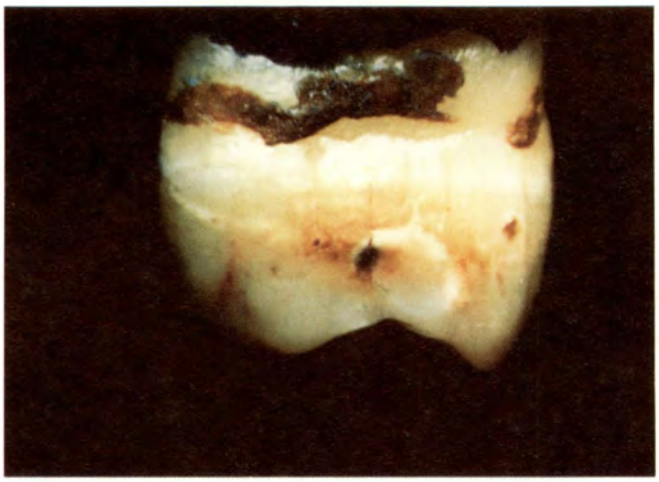

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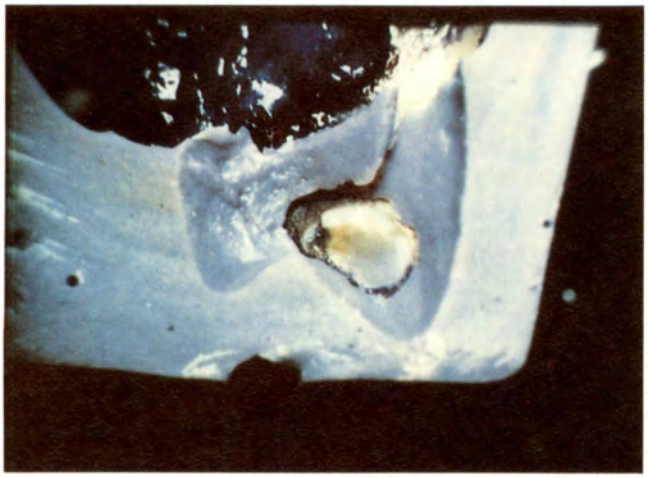

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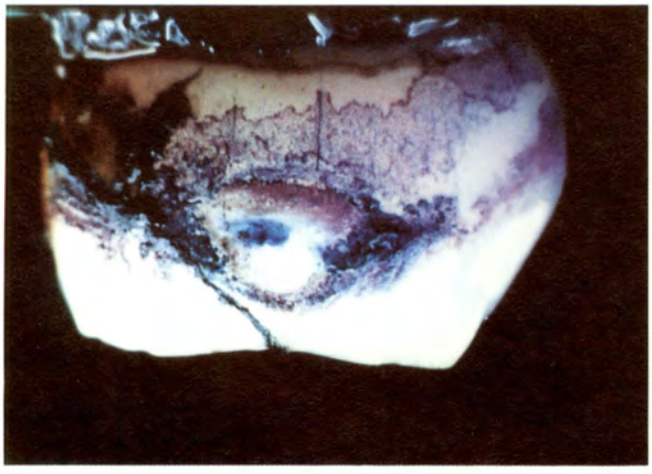

68a

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29. Location of the contact area with the help of impressions and its relationship with the approximal carious lesion with the use of disclosing solution.

66a. Mesial surface of left upper first molar of a twenty eight year old patient. Disclosing solution has stained the plaque, the perimeter of the contact area and the carious lesion. The carious lesion is within the confines of the contact area.

66b. Plaque has been brushed off. Note the carious lesion is located within the confines of the facet.

66c. Contact area of the above tooth defined with the impression. Note the carious lesion is within the confines of the contact area.

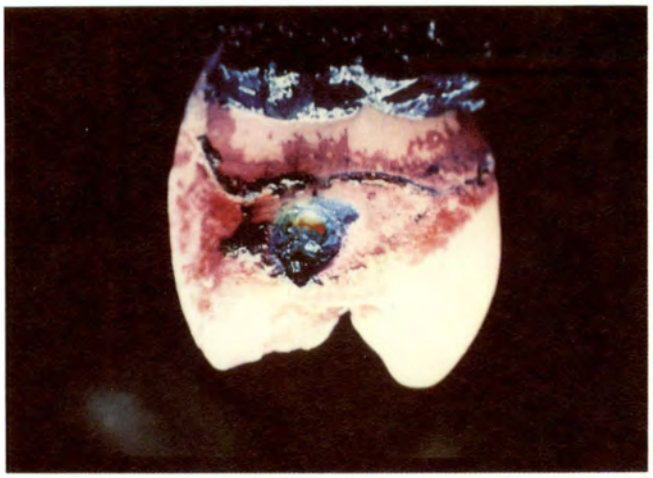
66d. Ground section of the above tooth along with the stone model of the adjoining tooth. Note the carious lesion is located in the region of the contact area.

67a. Right upper second premolar of a thirteen years old patient. This tooth was palatally placed, as such the contact area was in the cervical third of the labial surface. Note the carious lesion.

67b. Contact area defined with the impression. Note the carious lesion is at the contact area.

68a. Approximal surface of a deciduous molar stained with disclosing solution. Note the carious lesion is at the contact area.

68b. Contact area defined with the impression, note the carious lesion is at the contact area.



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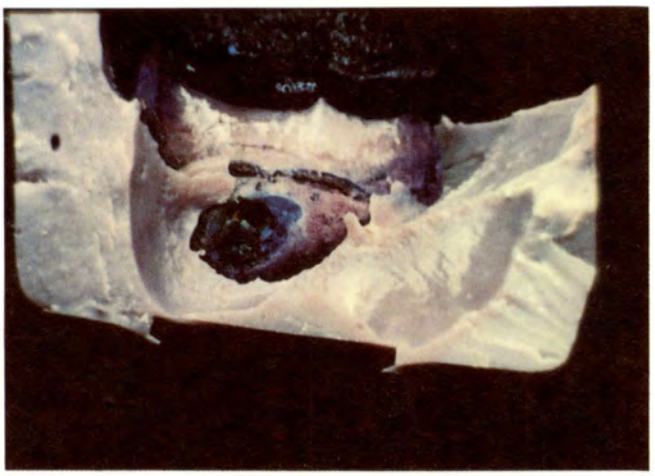

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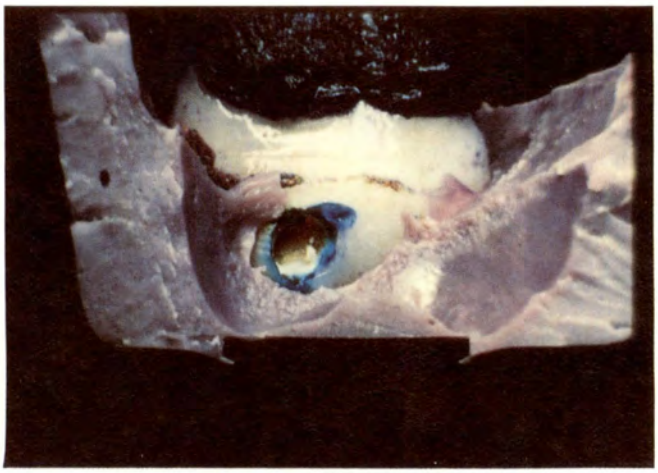

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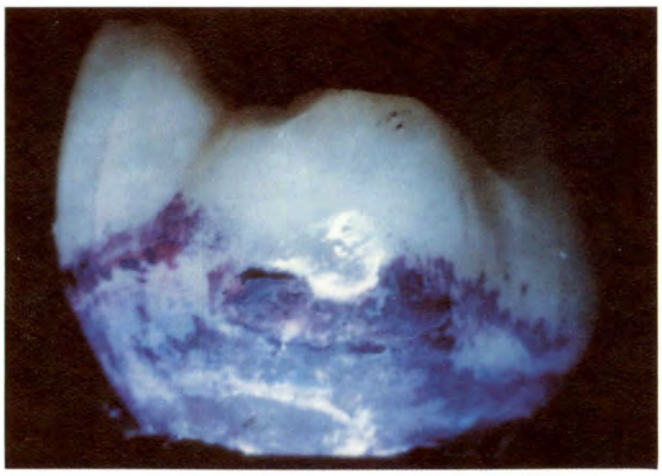

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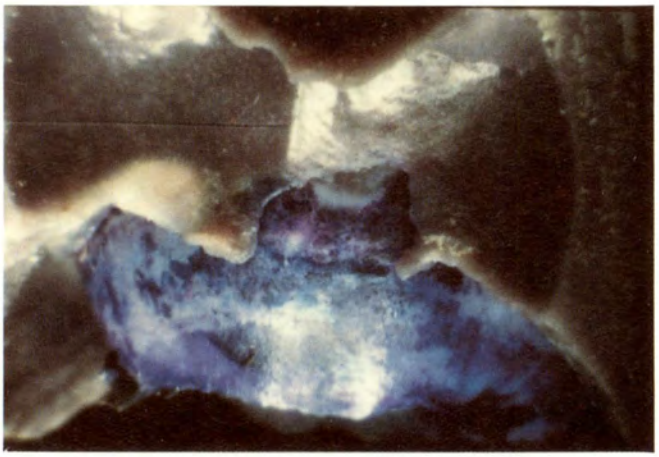

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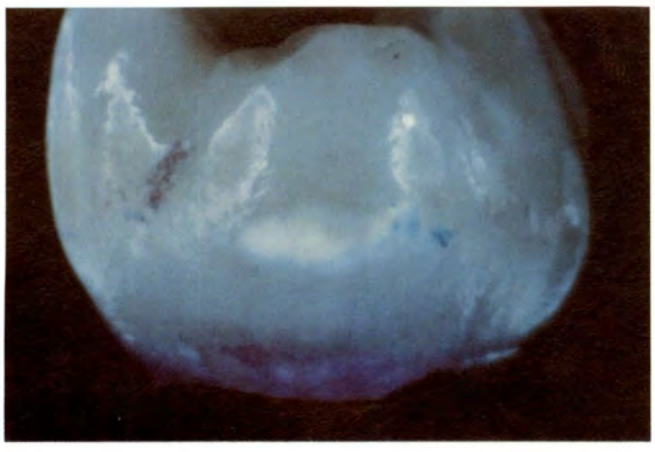

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69a. Distal surface of left upper second premolar of 16 year old patient stained with disclosing solution. Note the carious lesion is stained blue and is in the region of the contact area.

69b. Contact area defined with the help of impression, note the carious lesion is in the region of the contact area.

69c. Plaque brushed off, note the cavitation and the calculus deposit, the enamel surface between the two seems to be healthy.

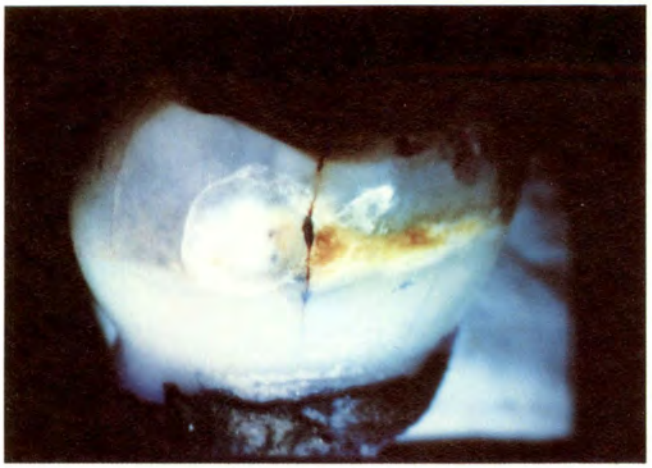
69d. Plaque brushed off and the contact area defined with the help of impression, note the carious lesion is in the region of the contact area.

70a. Approximal surface of a deciduous molar stained with disclosing solution. The carious lesion gives an appearance as if it is below the facet.

70b. Contact area defined the impression, note the carious lesion is at the contact area.

70c. Plaque brushed off, note the carious lesion gives an optical illusion that it is beneath the contact area.

70d. Plaque brushed off and the contact area defined with the help of impression, note the carious lesion is in the region of the contact area.



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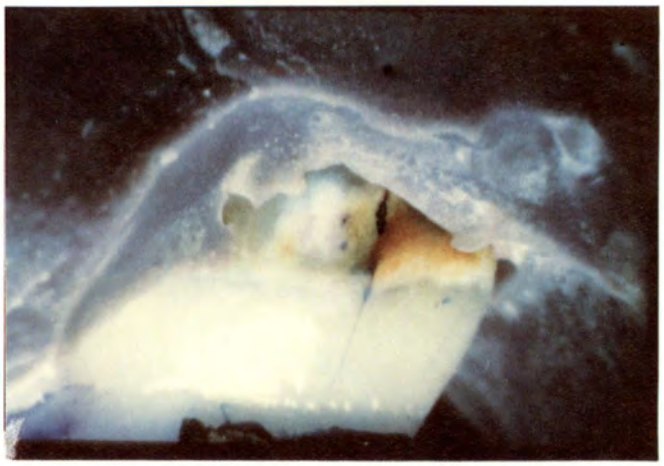

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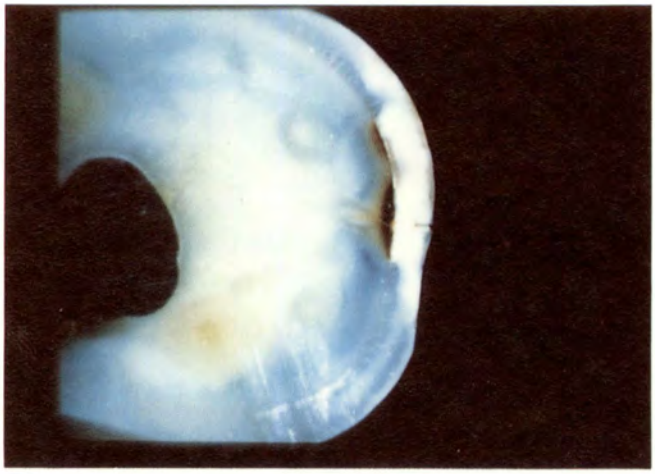

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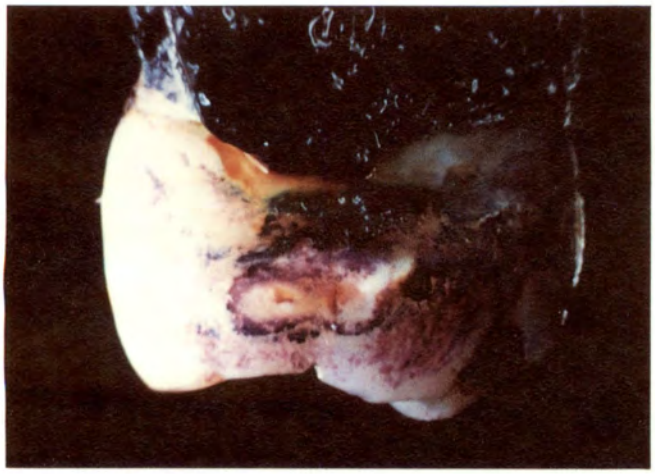

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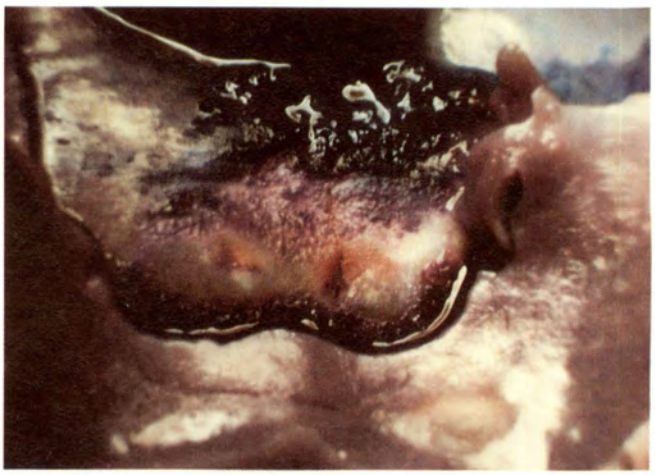

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71a. Approximal surface of a deciduous molar. Note the carious lesion is at the facet and it extends on to the lingual convexity. Also note the crack extending from the marginal ridge to the facet.

71b. Contact area defined with the impression, note the carious lesion is at the contact area.

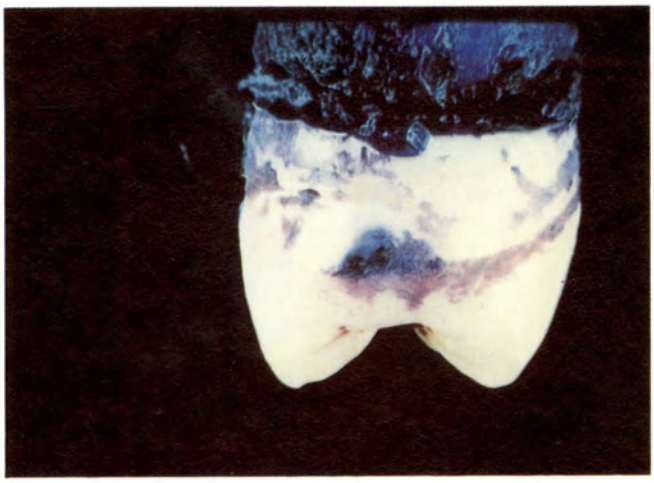
71c. Horizontal section showing the carious lesion, note the maximum depth of the lesion is in the region of the crack. There is no evidence of cavitation.

72a. Mesial surface of right upper first molar of a twenty two year old patient stained with disclosing solution. Note two carious lesions in the region of the contact area.

72b. Contact area defined with the help of impression, note the carious lesions are in the region of the contact area.

72c. Contact area defined with the impression but the plaque has been brushed off. Note the white lesion seems to be located below the contact area, which is actually an optical illusion.

72d. Tooth sectioned vertically to show the relationship of the lesion on the tooth surface to the lesion on the cut surface. The external border of the lesion is straight, the straight part of the external border denotes the facet, thereby showing that the bulk of the lesion is located in the region of the facet. Also note the healthy enamel below the lesion and calculus deposit further lower down.



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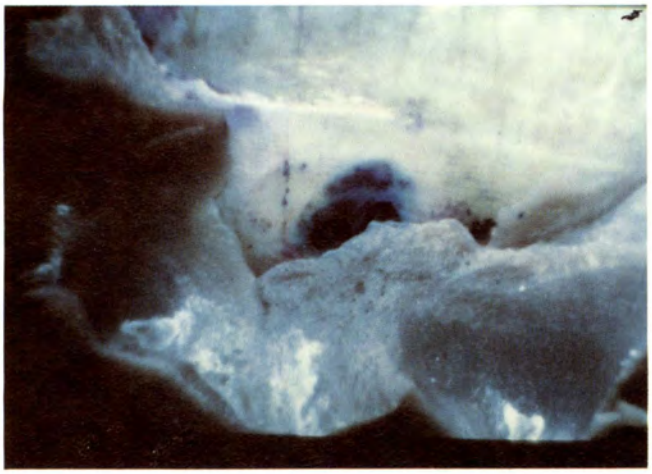

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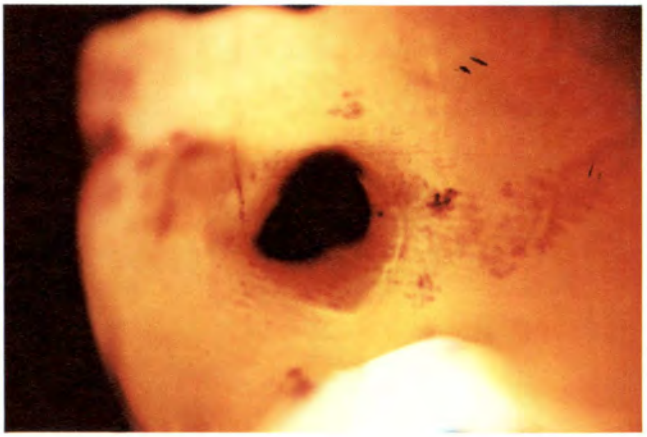

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73a. Distal surface of the left upper second premolar of a thirteen year old patient stained with the disclosing solution. Note that most of the contact area is stained, the occlusal part of the contact area is stained purple but the cervical part is stained blue. Occlusal part is mostly plaque while the cervical part is mostly the carious lesion.

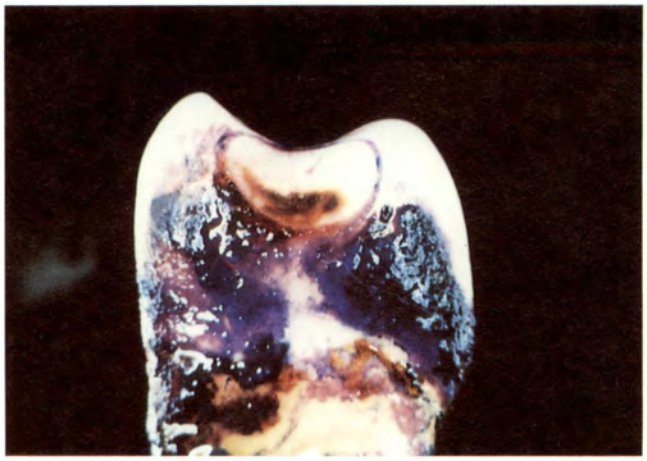
73b. The plaque has been removed, note the carious lesion is stained and seems to be in the region of the contact area.

73c. Contact area defined with the impression, note the carious lesion is located at the contact area.

73d. The tooth has been transilluminated with fibre-optic flash light, note the outline of the facet and its relationship to the carious lesion. The carious lesion is located in the facet.

73e. The tooth ground down to show the relationship of the lesion on the tooth surface to the lesion on the cut surface. The ground tooth is placed in the impression to show its relationship to the contact area. Note the carious lesion is located at the contact area.

73f. The above tooth without the impression. Note the extent of the carious lesion.



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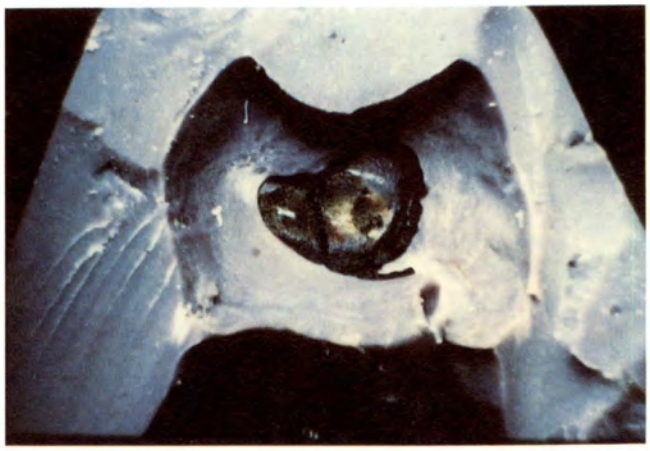

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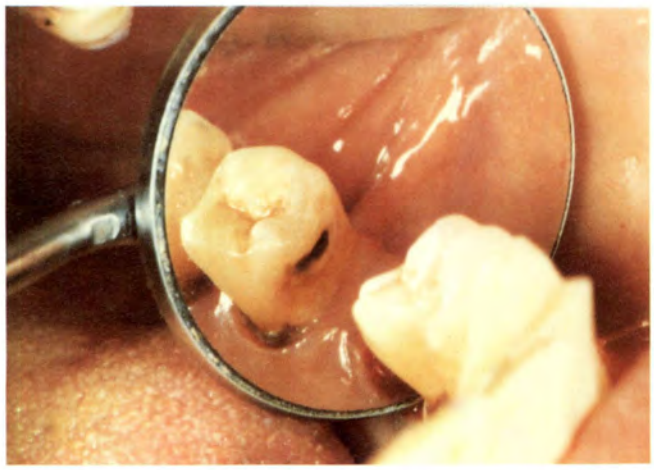

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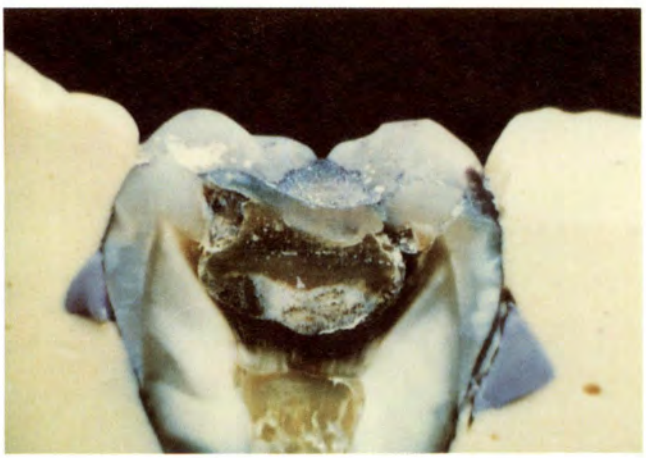


74g

74a. Mesial surface of the left lower first molar of a 38 year old patient stained with disclosing solution. Note the outline of the facet is stained and the carious lesion is within the confines of the facet.

74b. Distal surface of the same tooth, note the carious lesion is located at the facet.

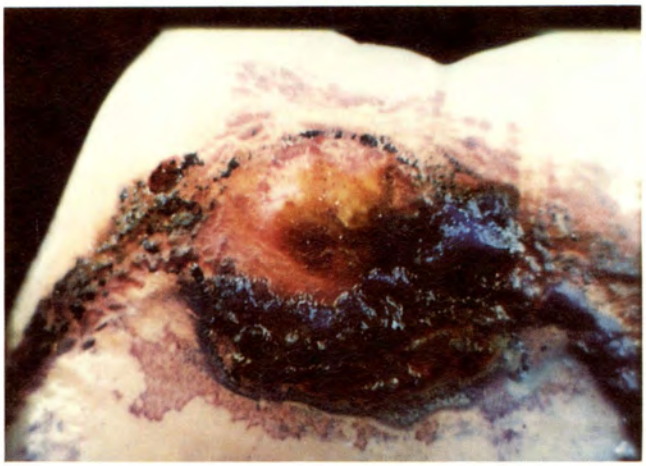
74c. Contact area on the mesial surface defined with the impression, note the carious lesion is located at the contact area.

74d. Contact area on the distal surface defined with the impression, note the carious lesion is located at the contact area.

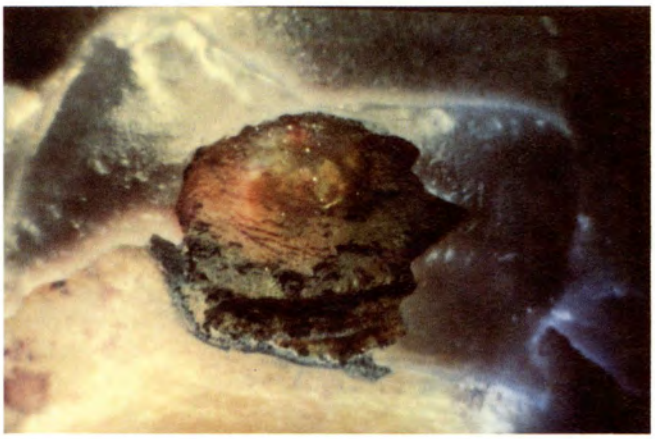
74e. Distal surface of the left lower second premolar (adjoining approximal surface of the above tooth). Note that the carious lesion is in the region of the facet.

74f. Mesial surface of left lower second molar (adjoining approximal surface of the above tooth). Note that the carious lesion is in the region of the facet.

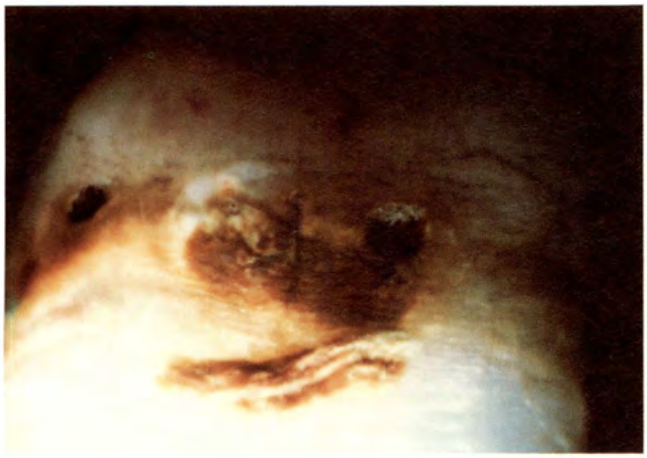
74g. Tooth along with the stone model of the adjoining teeth ground down to show the relationship of the carious lesion on the cut surface to the embrassures and the contact areas, note the bulk of the lesion is located at the contact area.



75a

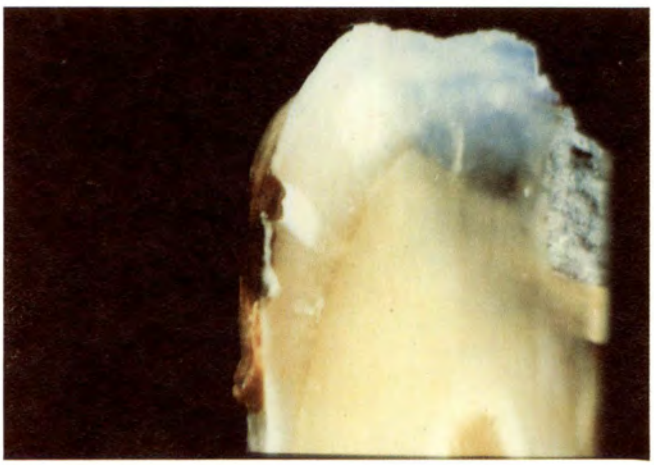


75b



75c

75d



75e

75f

75g

75a. Mesial surface of a left lower first molar of a twenty six year old patient stained with disclosing solution. Note the cavitation of a carious lesion on the occluso-buccal corner of the contact area.

75b. Contact area defined with the impression, note the carious lesion is in the region of the contact area.

75c. Plaque brushed off, note the carious lesion seems to be in the region of the contact area.

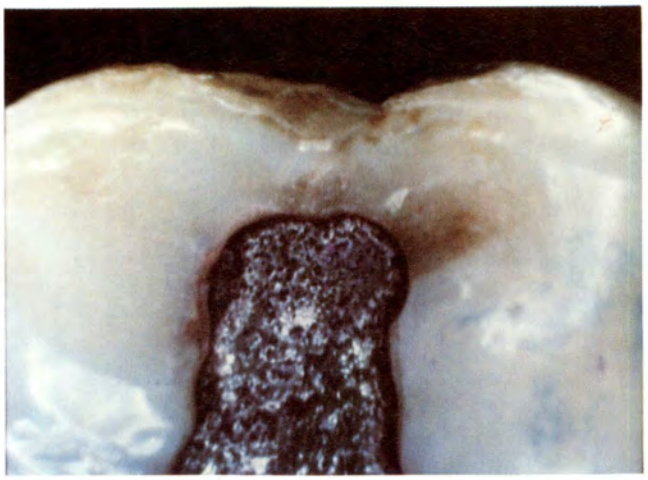
75d. Contact area defined with the impression after the removal of the plaque, note the carious lesion is located at the contact area.

75e. Tooth ground down, note the maximum depth of the lesion is in the region of the cavitation.

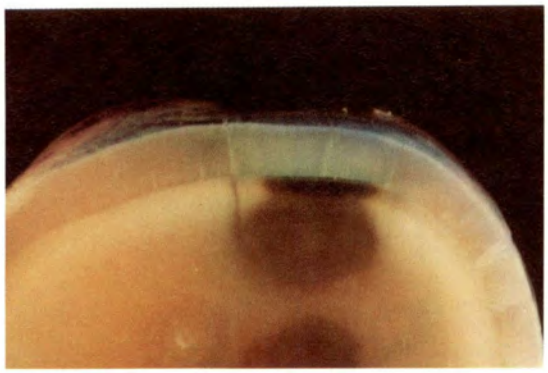
75f. Ground tooth placed in the impression to show the relationship of the carious lesion and the contact area, the light entering the tooth from the cut surface. Note the carious lesion is at the contact area, there is healthy enamel beneath it and there is calculus deposit lower down.

75g. Same view but the light passing from the tooth surface to the cut surface, note the carious lesion is in the region of the contact area.

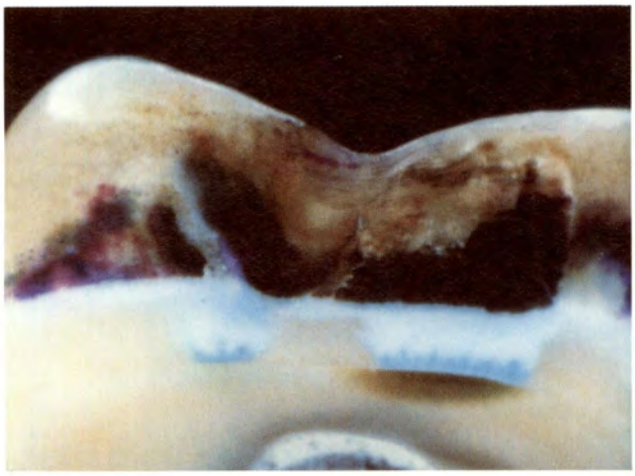
76a



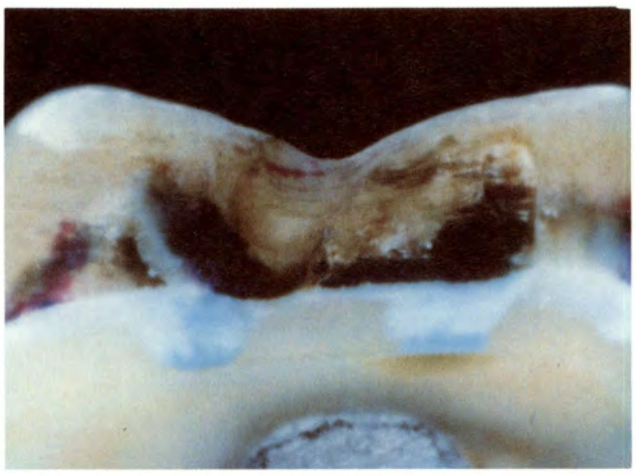
76b



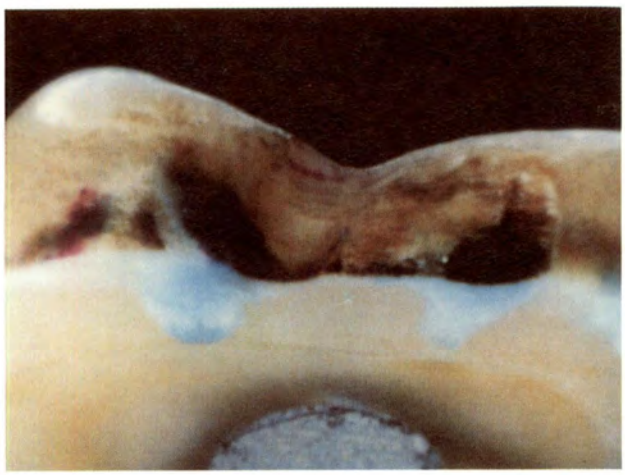
76c



76d



76e



76f

76g

30. Bur marks on the approximal surfaces and approximal caries.

76a. Mesial surface of the right lower second molar of a seventeen year old patient, note some bur marks on this surface. These were probably produced while the adjoining tooth was being prepared for restoration two years ago.

76b. Occlusal view of the above tooth showing the bur marks.

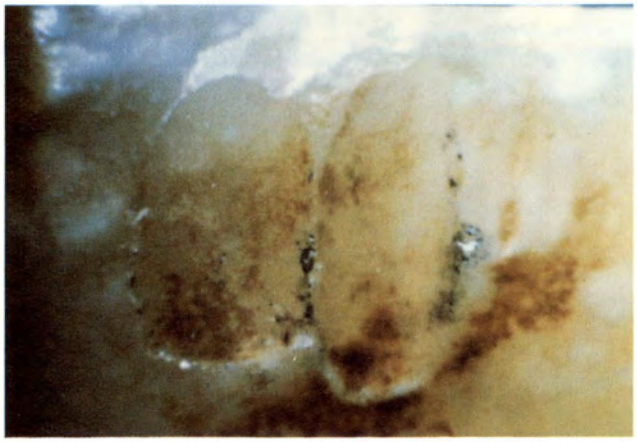
The above tooth was ground to see the appearance of the carious lesion in the horizontal plane.

76c. The carious lesion is seen at the cervical part of the contact area. The carious lesion is seen involving the whole thickness of the enamel and extending into the dentine without any evidence of the bur marks.

76d. Shows the features on the tooth surface along with the features on the cut surface. On the tooth surface there are bur marks and either side of the bur marks there are two facets. On the cut surface two lesions can be seen on either side of the bur marks.

76e, 76f and 76g. Series of sections of the above tooth showing features on the original tooth surface along with the features on the cut surface. Note that the bulk of the carious lesion is located in the region of the facets and not in the region of the bur marks.

This case shows that the carious lesion is found at the facets and not at places where the surface enamel has been destroyed by the bur.



77a

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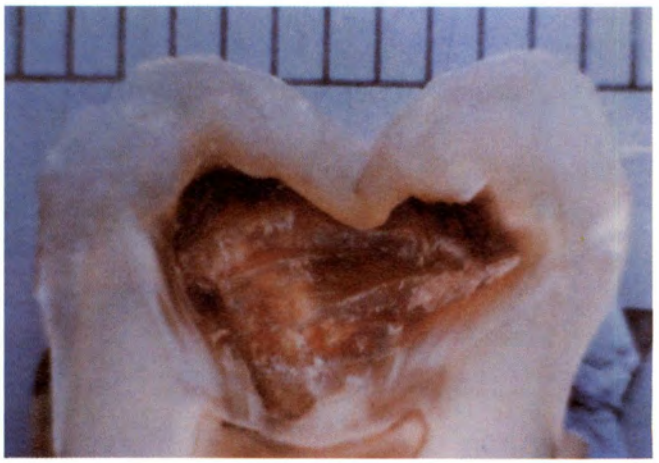
77d

77e



77f

77a. Distal surface of the right lower first molar of a fifteen year old patient showing two bur marks. These bur marks were probably produced three years ago while the mesial surface of the second molar was being restored. Note the carious lesions at the borders of the bur marks.

77b. Occlusal border of the distal contact area of the above tooth defined with the help of an impression.

77c. Vertical section of the above tooth to show the relationship of the carious lesion on the tooth surface to the lesion on the cut surface. The plane of the section is at the buccal border of the bur marks. Note a typical approximal carious lesion is seen.

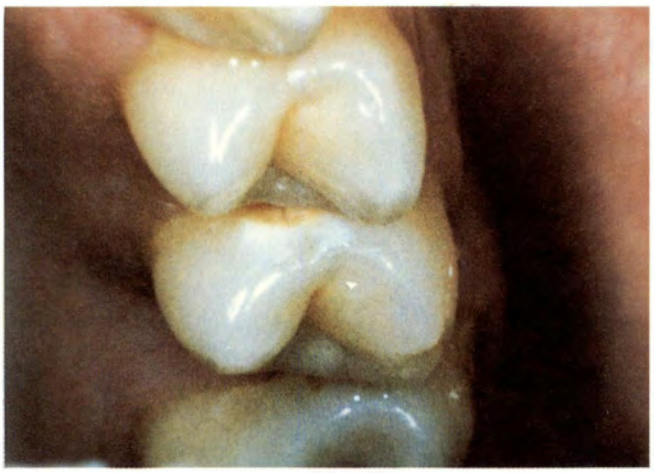
77d. Vertical section of the above tooth through the deepest part of the bur mark. In this section barely the surface of the enamel seems to be involved. The lesion is increasing in depth near the cervical border of the bur mark.

77e. Above tooth further ground down to show the carious lesion at a different plane. Note cervical part of the contact area is involved.

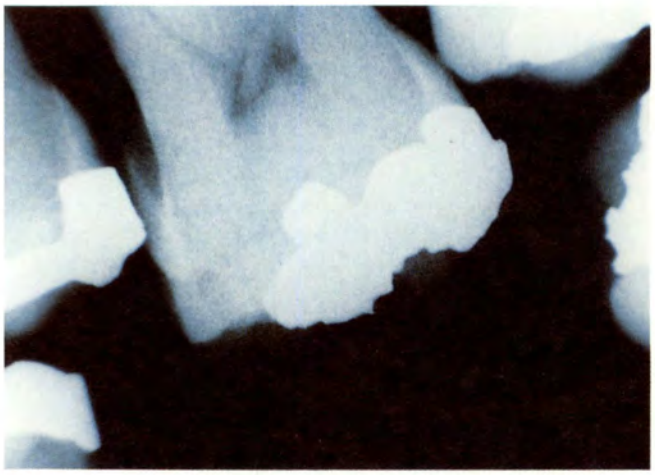
77f. Vertical section of the above tooth showing features on the mesial and distal borders. Distal border is flattened due to the bur mark. There is evidence of initial caries at the occlusal and cervical ends of the bur marks. A typical carious lesion is seen on the mesial border of the tooth.

This case shows that the carious lesion is located at the contact area and not at the place where the bur marks are present.

78a



78b



79a

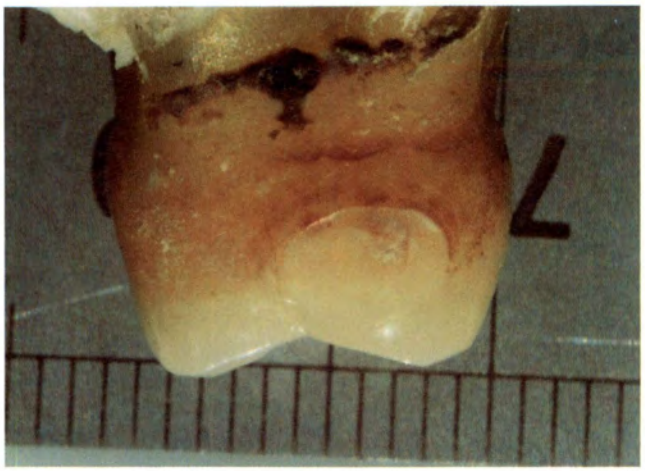
79b

31. Changes in contact area relationship due to movements of teeth and approximal caries.

78a and 78b. Upper second premolars of an eighteen year old patient showing yellow and white patches of initial caries on the mesial surfaces in the region of the contact areas. First molars were extracted and the second premolars were moved distally exposing the mesial surfaces of these teeth. The patches of initial caries seen on the mesial surfaces were probably present in the region of the contact areas prior to the movement of the teeth.

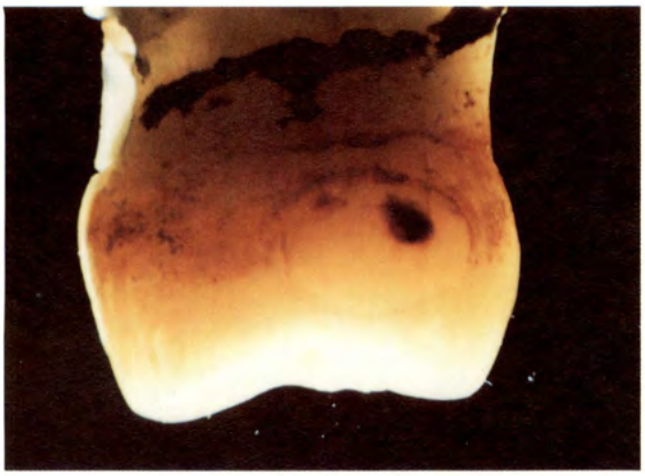
79a. Bitewing radiograph of the right side showing a supra-erupted upper first molar with evidence of initial caries on the mesial surface.

79b. Clinical photograph of the above patient showing arrested carious lesion in the region of the facet on the mesial surface of the upper first molar. The lesion probably got arrested as it moved out of the contact area.



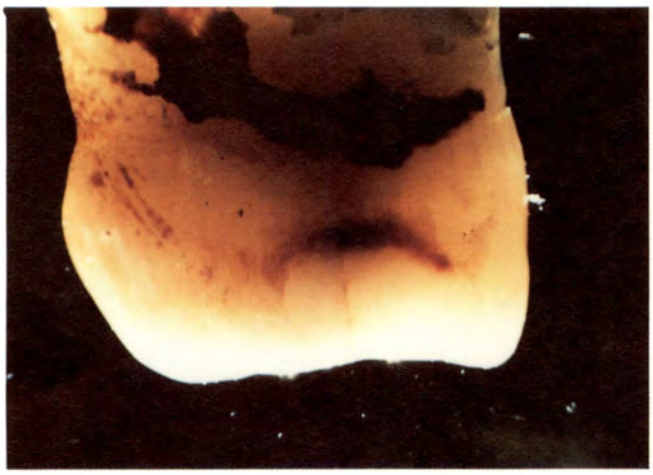
80a

80b



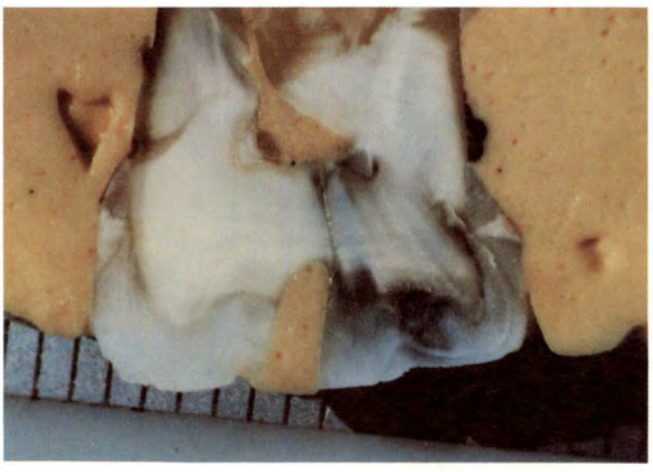
80c

80d



80e

80f



80g

32. Miscellaneous cases of approximal enamel caries.

80a, 80b and 80c. Distal surface of left upper first molar with different light arrangements. Note a carious lesion within the confines of the facet.

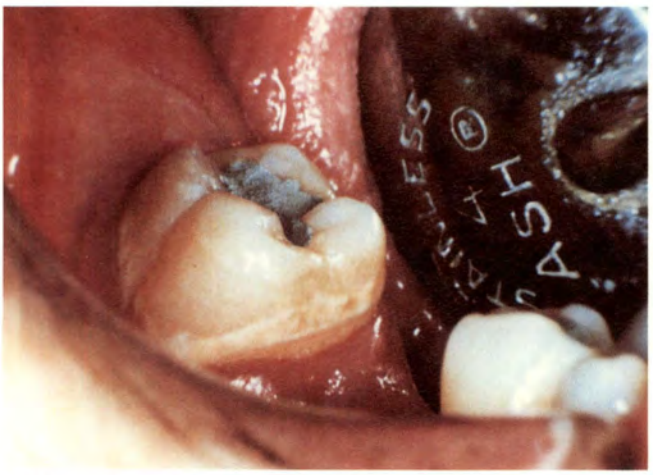
80d. Mesial surface of the left upper second molar showing a carious lesion within the confines of the facet. Note this lesion is very similar to the lesion on the adjoining surface (above figure).

80e. Mesial surface of the left upper first molar showing a carious lesion at the cervical border of the contact area. This photograph was taken with transmitted light.

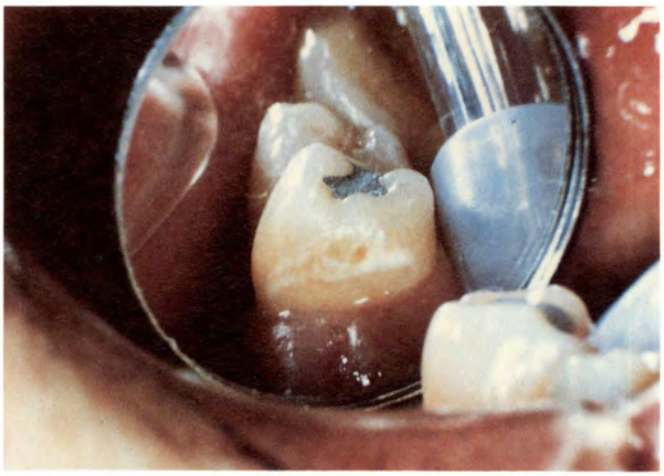
80f. Distal surface of the left upper second premolar showing a carious lesion located at the cervical border of the facet. Note this lesion is very similar to the lesion on the adjoining surface (above figure).

80g. Left upper first molar along with the stone models of the adjoining teeth ground down to show the internal structure of the carious lesions and their relationship to the adjoining teeth. The distal lesion is bigger and is within the confines of the contact area. The mesial lesion is smaller and seems to be beneath the contact area. Both the lesions probably started when the contact areas were small. With mesial drift the distal lesion moved into the contact area while the mesial lesion moved cervical to the contact area. Both the lesion depth and enamel thickness on the distal surface are smaller than the lesion depth and enamel thickness on the mesial surface. The lesion on the distal surface probably lead to increased attrition of the distal surface.

81a

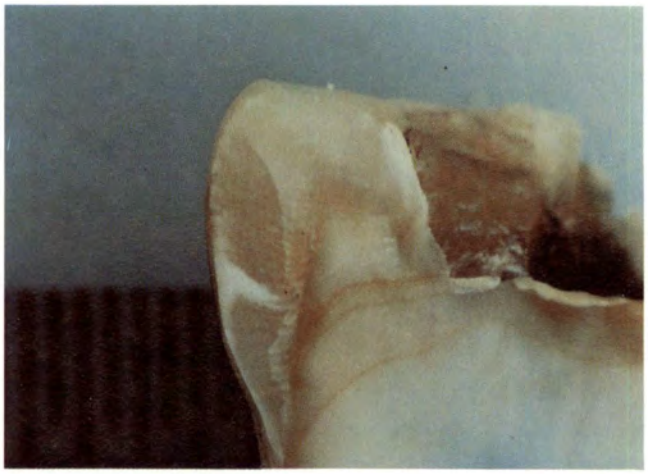


81b

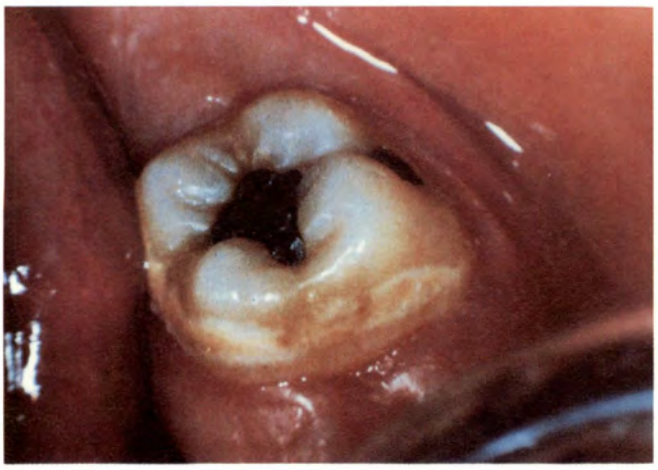


81c

81d



81e



81f

81g

81a. Lingual surface of the right lower first molar of a nineteen year old patient along with the mirror images of the mesial and distal surfaces showing a band of brown discoloration. The band of discoloration is located at the convexities of the tooth. This band has no relationship to the development of the tooth. The buccal and lingual borders of the contact areas on both the approximal surfaces seem to have suffered increased carious attack compared to the rest of the band of brown discoloration.

81b. Mesial surface of the right lower second molar of the above patient showing a band of white discoloration. There are two yellow spots which are located at buccal and lingual borders of the facet indicating increased caries activity. The band of white discoloration with the yellow spots on this tooth is very similar to the band on the distal surface of the first molar.

81c. Distal surface of the right lower second premolar of the above patient showing a band of white discoloration. This band is wide in the region of the facet and involves whole of it.

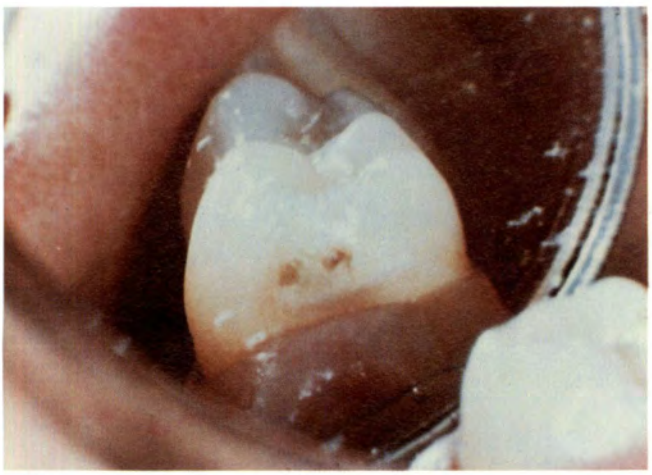
81d. Distal surface of the extracted left lower first molar of the above patient shows a band of white discoloration with two yellow spots showing increased caries activity.

81e. Ground section of the above tooth seen under reflected light. Note the carious lesion is seen where the distal outline of the section is straight. The straight part of the outline shows the location of the facet. This specimen shows that the carious lesion is located at the facet and not below it.

81f. Mesial surface of the left lower second molar of the above patient shows a band of white discoloration. The lingual extension of the discoloration is in the occlusal third, and the buccal extension is in the occlusal third of the crown. Note the yellow staining of the buccal and lingual borders of the facet. This band of discoloration is probably due to the demineralisation of initial enamel caries. This band has no relationship to the choronologic development of the tooth and is very similar to the band on the distal surface of the lower first molar (81f).

81g. Distal surface of left lower second premolar of the above patient showing a band of white discoloration and a carious lesion in the region of the contact area.

82a

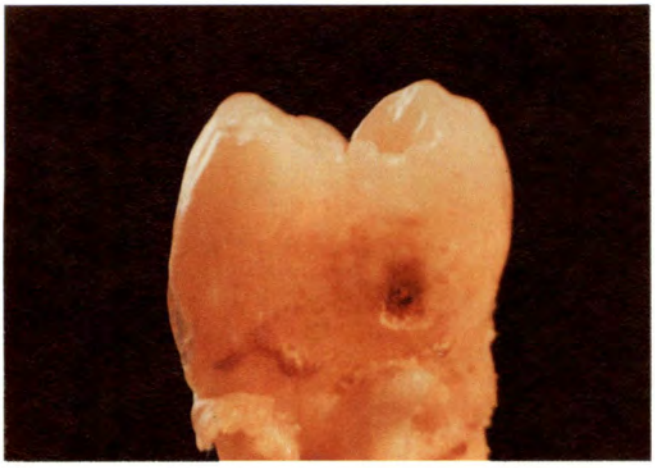


82b

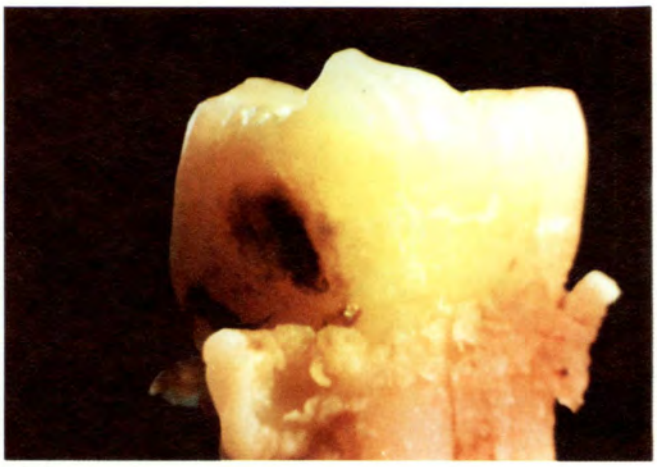
82c

83a

83b



83c



83d

82a. Periapical radiograph of a nineteen year old patient showing approximal carious lesions in the regions of the contact areas.

82b. Distal surface of the right lower second premolar after the extraction of the first molar of the above patient. Note the white discoloration in the region of the contact area and two yellow spots of discoloration within the buccal and lingual confines of the white discoloration.

82c. Mesial surface of the right lower first molar of the above patient showing a carious cavity. Note the discolorations on the buccal and lingual borders of the cavity. These discolorations seem to correspond to the two yellow discolorations seen on the distal surface of the second premolar of the above patient.

83a. Bitewing radiograph of a nineteen year old patient showing the occlusal surface of the right lower second premolar impacted against the mesial surface of the first molar.

83b. Occlusal surface of the right lower second premolar of the above patient showing carious lesion on the cusp tips. The lesion probably started because of its contact with the mesial surface of the first molar. It has been experienced that any surface of a tooth which forms part of a contact area is more prone to caries.

83c. Mesial surface of the extracted right lower first molar of the above patient showing a break in the enamel surface. The break in the enamel surface is in the cervical part of the contact area where the interproximal forces are maximum and the enamel is thin. Also note the calculus deposit lower down.

83d. Above tooth seen under transmitted light. Note the subsurface demineralisation. The subsurface demineralisation is in the region of the contact area and is located occlusal to the carious cavity.

84a

84b

84c

84d

84e

84f

85a

85b

84a and 84b. Bitewing radiographs of a twelve year old patient showing evidence of caries on the distal surface of left lower second deciduous molar, on the distal surface of right upper second deciduous molar, and on the mesial surface of right upper first molar.

84c. Photograph of the above patient showing a carious lesion on the mesial surface the left lower first molar. Note the lesion is in the region of the contact area.

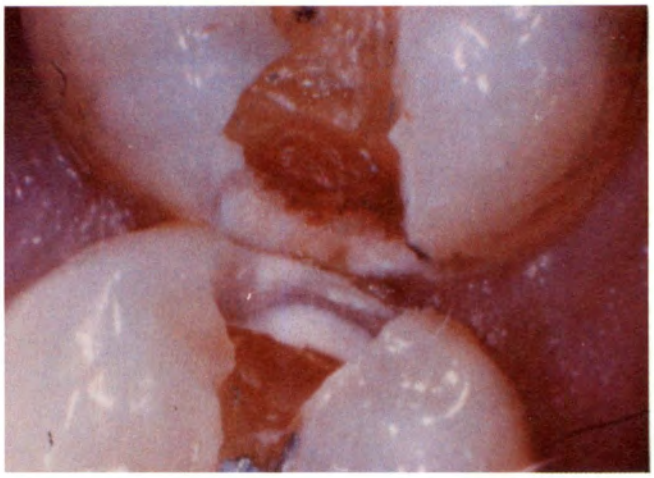
84d. Photograph of the above patient after the extraction of the left lower second deciduous molar. Note the carious lesion is in the region of the contact area.

84e. Mesial surface of the right upper first molar of the above patient. Note the carious lesion is in the region of the facet.

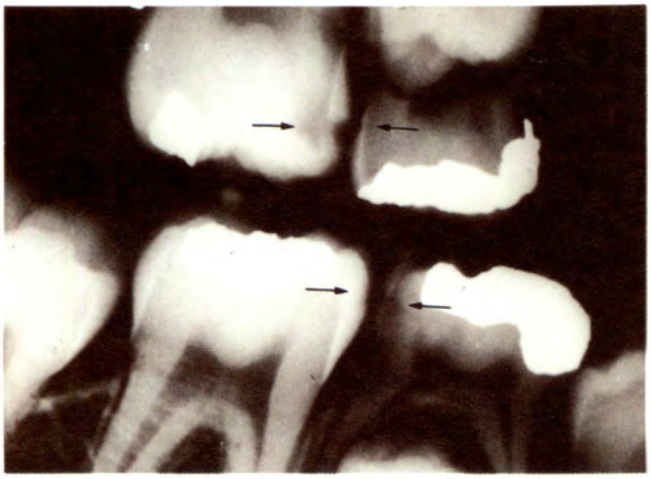
84f. Distal surface of the right upper second deciduous molar showing a facet and a carious lesion located within the confines of the facet. Also note the calculus deposit lower down.

85a. Distal surface of a right lower first molar of a sixteen years old patient showing a carious lesion. Also note a fracture line extending from the distal marginal ridge to the carious lesion.

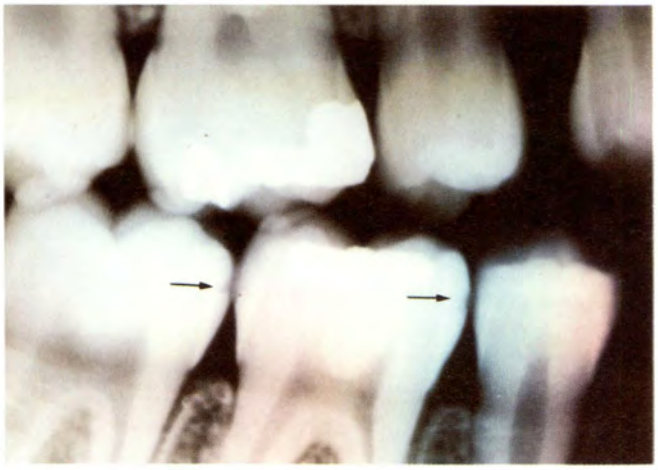
85b. Horizontal section of the above tooth. Note the fracture line and three almost separate carious lesions. The central carious lesion was probably the initial or the first carious lesion, the size of the contact area increased with the wear and fracture in this region. The other two carious lesions probably started at the borders of the enlarged contact area.



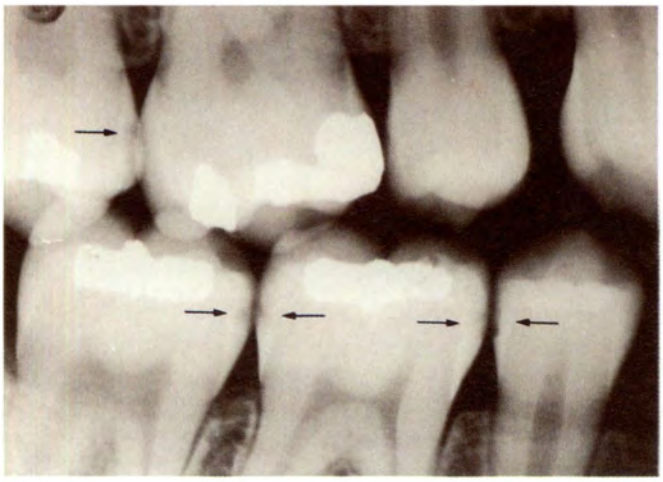
86a



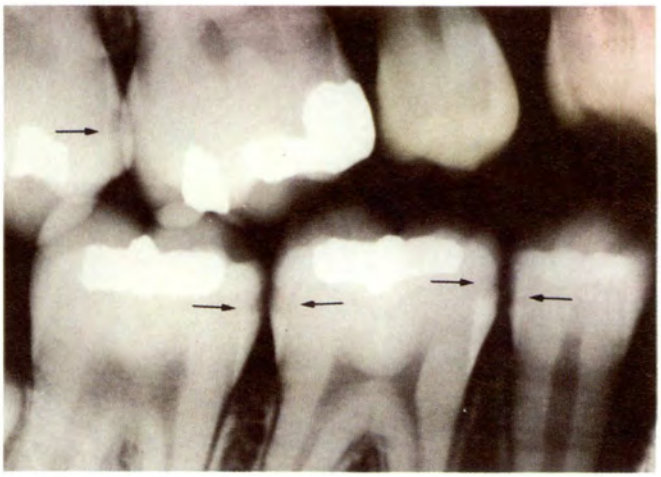
86b



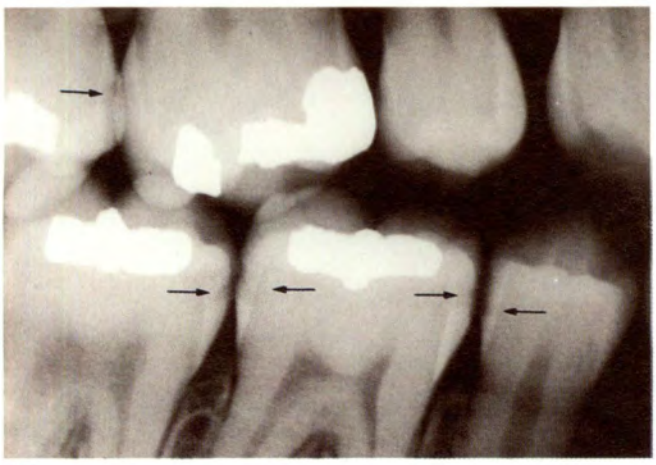
86c



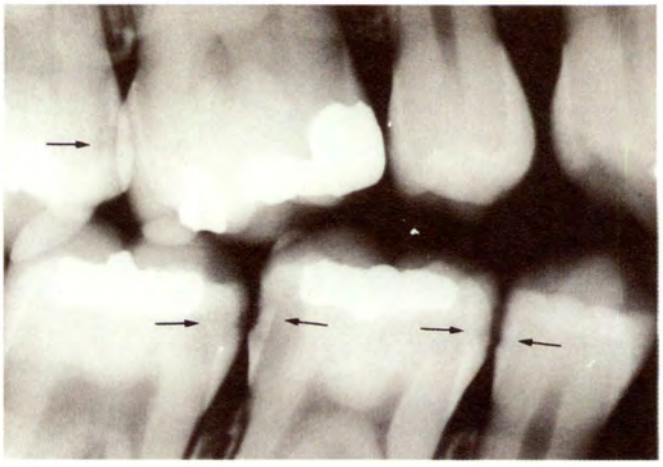
86d



86e



86f



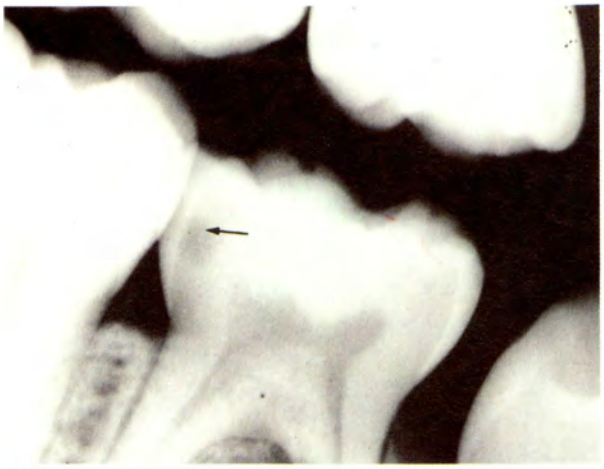
86g

86a. Carious lesions seen on the gingival walls of right lower first and second molars. Two lesions can be seen in the enamel thickness on the gingival wall of the second molar. The surface lesion seems to be smaller as compared to the deeper lesion (the lesion at the dentino-enamel junction). The deeper lesion probably started earlier and is part of a lesion which started at the contact area. After piercing the enamel thickness, the lesion spread gingivally along the dentino-enamel junction. After cavitation of the distal surface of the first molar, the contact area enlarged and the surface lesion started at the cervical perimeter of the enlarged contact area. It is also interesting to note that the enamel on the gingival wall of the second molar is thicker than the first molar.

86b, 86c, 86d, 86e, 86f and 86g. Bitewing radiographs of the right side of the above patient taken in December 79, May 82, April 84, January 85, February 86 and January 87. Note the carious lesions indicated by arrows. The carious lesion on the mesial surface of lower second molar started earlier than the lesion on the distal surface of lower first molar, but the lesion on the distal surface of lower first molar progressed faster. The lesion on the mesial surface of lower first molar can be seen slowly progressing over seven years.

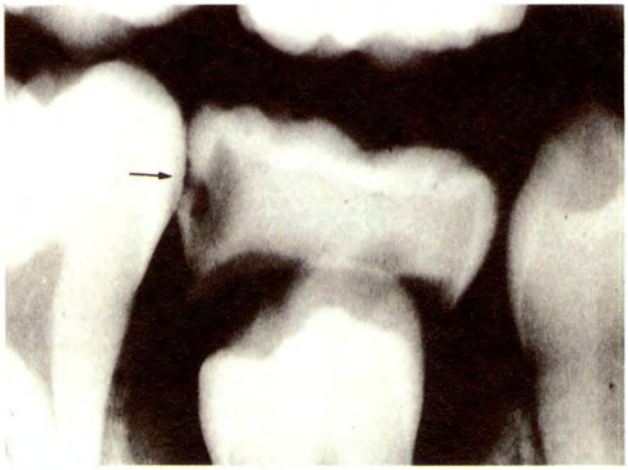
Note the thickness of enamel on the two approximal surfaces of lower second premolar. The thickness on the distal surface has gradually reduced over the years due to carious lesion and wear.

87a



87b

87c



87d

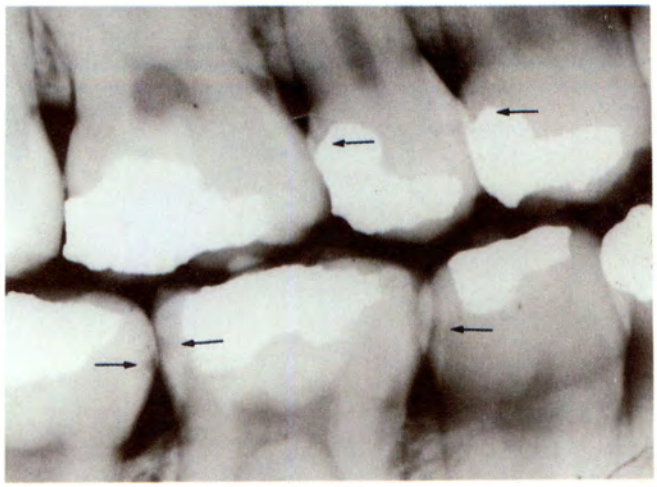
88a

88b

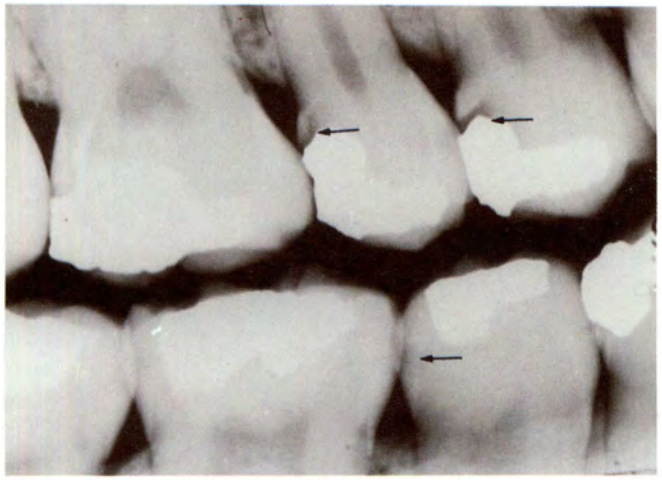
87a, 87b, 87c and 87d. Bitewing radiographs showing the progression of a carious lesion on the distal surface of a lower second deciduous molar. Note that the carious lesion started at the cervical border of the contact area and progressed occlusally into the contact area.

88a. Bitewing radiograph of the right side showing approximal carious lesions on the distal surface of the lower first molar and on the mesial surface of the lower second molar. Both the lesions are nearly of the same size.

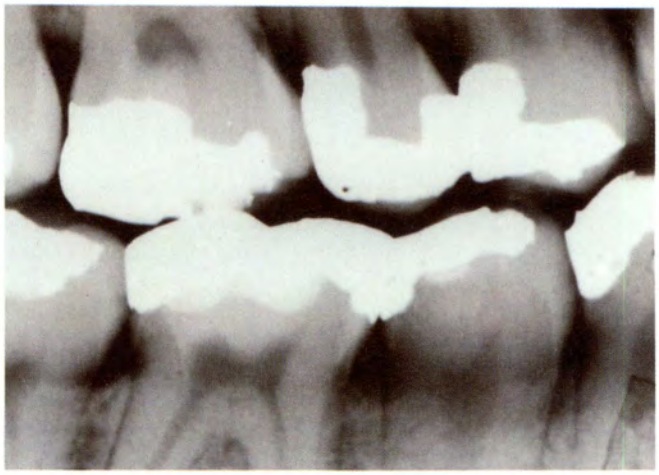
88b. Bitewing radiograph of the above patient taken after four years. Note the carious lesion on the distal surface of lower first molar has progressed and the lesion on the mesial surface of the second molar has probably remineralised. This case shows that due to the changes in the contact area relationship, the lesions which move out of the contact area probably remineralise while the lesions which move into the contact area progress.



89a



89b



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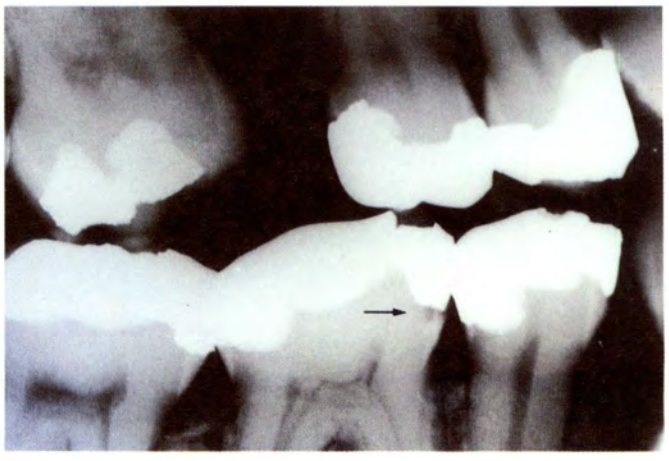


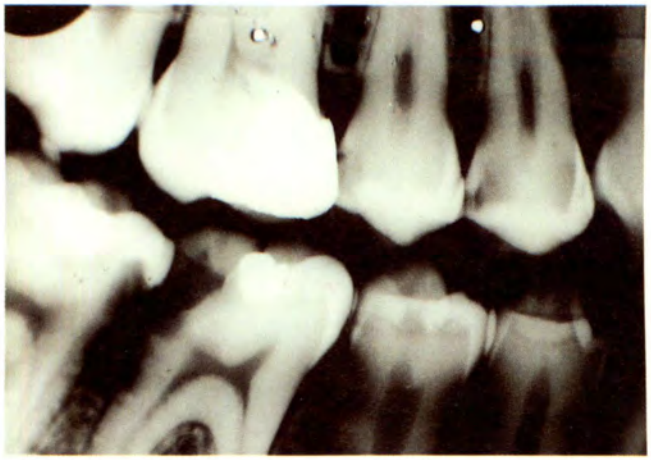
90d

89a. Bitewing radiograph of the right side of a twenty year old female patient, note the distal restorations in the upper premolars are properly condensed but the contact has not been broken cervically.

89b. Radiograph of the above patient taken after two years of the restoration, note the recurrent caries at the cervical margins which gives the appearance as if the restorations were not condensed properly.

89c. Radiograph of the above patient after four and a half years of repeating the restoration, note the cervical contact has been broken and the restoration extended cervical to the contact area and there is no evidence of recurrent caries. The margins of a restoration should be extended below the contact area not because the enamel beneath the contact area is self cleansing but because the contact area itself is more prone to caries. Contact area usually is the cleanest part of the tooth surface.

90a, 90b, 90c and 90d. Bitewing radiographs of the left side showing a leaky margin of an eight and a half year old restoration on the mesial surface of lower first molar. These radiographs were taken over a period of seven. There seems to be no change in the appearance of the leaky margin. It is generally believed that the approximal caries occurs beneath the contact area, but in this case the leaky margin in the so called prone site has not progressed.



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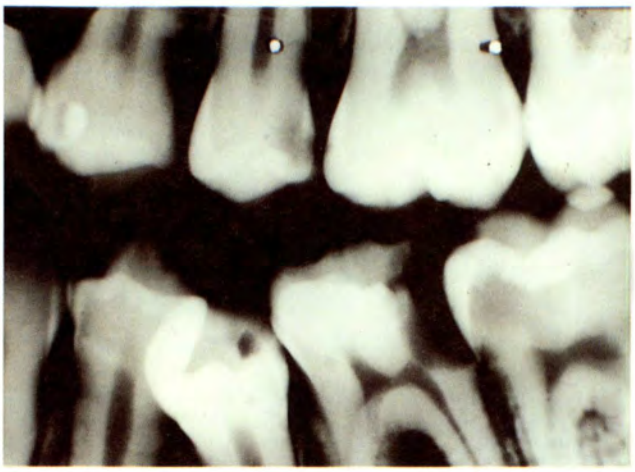
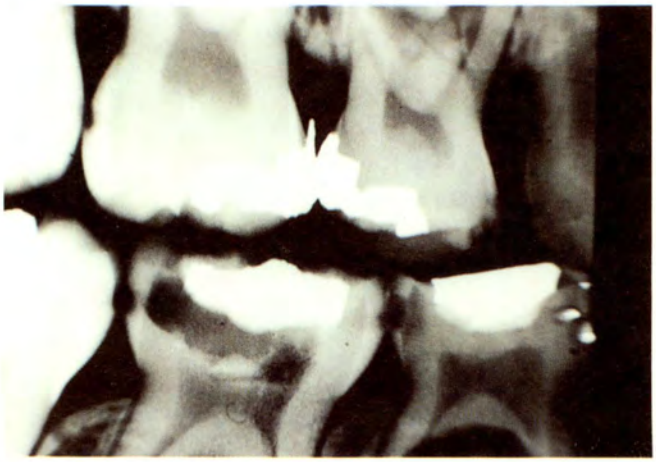


91b



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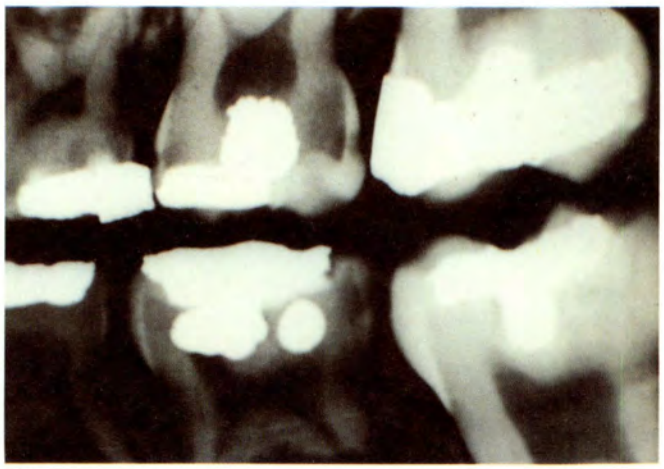

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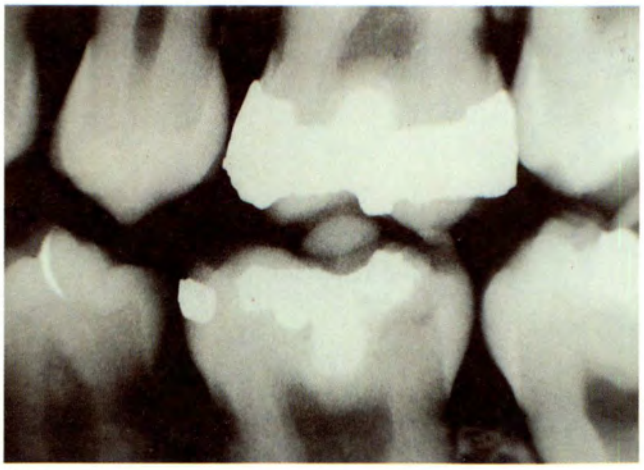

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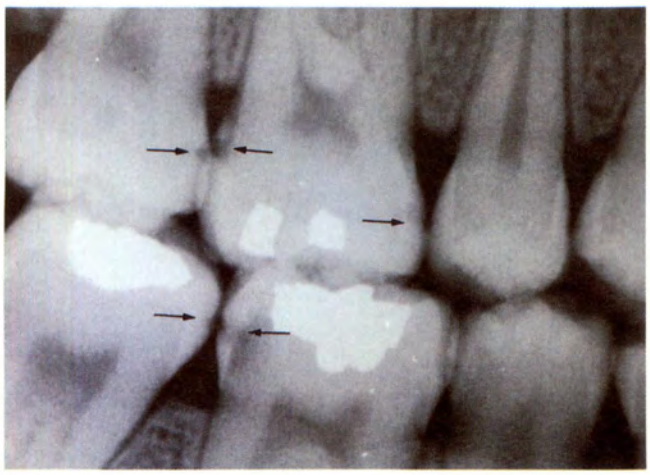

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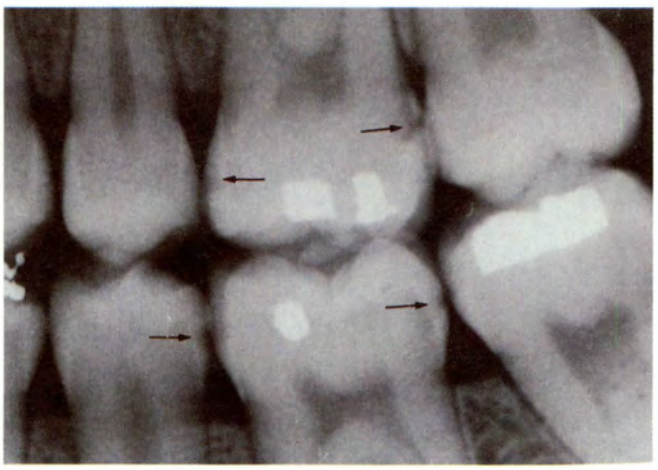

93b

91a and 91b. Bitewing radiographs showing approximal caries. Note the carious areas and more distal surfaces are involved.

92a and 92b. Bitewing radiographs showing approximal caries. Note the carious lesions are located in the region of the contact areas.

92c and 92d. Bitewing radiographs of the above patient with permanent dentition. Mesial surfaces of the lower first molars are restored and the restorations are in the region of the contact area.

93a and 93b. Bitewing radiographs showing approximal caries. Note the carious lesions are in the region of the contact area.

PART III

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100

33. Enamel caries of labial, buccal and lingual surfaces.

94. Shows carious lesions in the region of least attrition and least plaque. These lesions are related to the contact areas and cervical convexities.

95. Note the staining and the carious lesions are located at the cervical convexities and contact areas of upper anterior teeth. The staining and carious lesions have no relation to the development of the teeth.

96. Shows carious lesions in the region of least attrition and least plaque. These lesions are related to the contact areas and cervical convexities. These lesions are usually mistaken for hypoplasia.

97. Shows carious lesions in the region of least attrition and least plaque. These lesions are located in the region of contact areas and cervical convexities.

98. Shows a band of white discoloration of initial caries with cavitation in two places and an amalgam restoration. The band, the cavitations and the amalgam restoration are all located in the region of least attrition and least plaque.

99. Buccal surface of an upper molar, note the lesion is located at the convexity of the tooth and not below the convexity of the tooth.

100. Buccal surface of the left upper second molar showing two carious lesions in the region of least attrition and least plaque.

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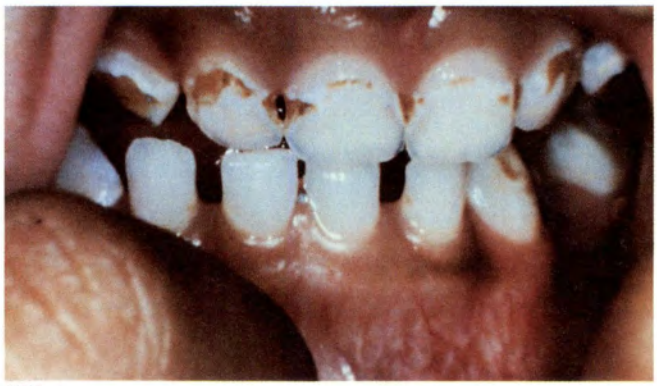

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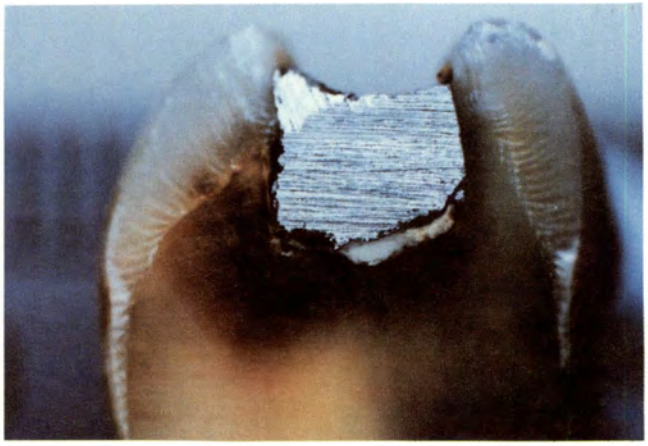

103b

101. Lingual surface of a lower first molar showing an amalgam restoration and a carious lesion in the region of least attrition and least plaque. Note the amalgam restoration is merging into the distal contact area sparing the enamel cervical to the convexity.

102a. Rampant caries seen in a three year old patient. Note the carious lesions are located on the cervical convexities and contact areas.

102b. Patient after two years showing arrested lesions. Most of the lesions seem to have been rubbed off through wear of the teeth.

103a. Buccal surface of the right lower first molar showing a band of brown discoloration at the cervical convexity. The band is extending towards the contact areas mesially and distally. This band of discoloration is a sign of initial caries.

103b. Ground section of the above tooth showing carious lesions on the buccal and lingual surfaces. The lesions are related to the cervical convexities of the tooth.

104

105a

105b

106

107

34. Distribution of enamel hypoplasia.

104. Linear hypoplasia is related to the choronological development of the teeth. The hypoplasia has no relationship to the convexities and the contact areas.

105a. Shows the enamel hypoplasia of the upper anterior teeth in a seventeen year old patient, note that the lower anteriors are not affected by the hypoplasia. The labial surfaces of the upper anteriors are not exposed to attrition while the labial surfaces of the lower anteriors are exposed to attrition. This probably indicates that tooth surfaces exposed to less attrition show more hypoplasia. The attrition probably helps to even out the developmental defects.

105b. Palatal surfaces of the upper anteriors of the above patient do not show any evidence of hypoplasia. The developmental defects have probably evened out with attrition.

106. Linear developmental defects seen in the deciduous lateral incisors. These defects have no relation to the convexities of the teeth.

107. Development defects of incisors of an eighteen year old female mentally handicapped patient. The developmental defects are more marked in upper lateral incisor, these defects are potential areas for plaque accummulation but there is little likelihood of carious lesions progressing on these sites.

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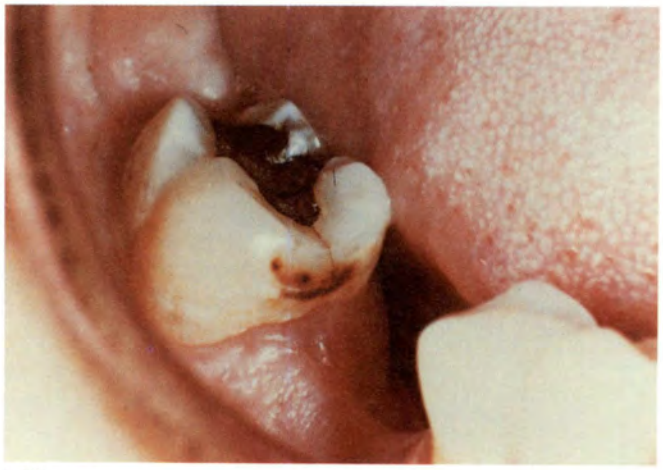
110a

110b



110c

35. Black stains, mottling and enamel caries.

108. Shows black stains on the buccal surfaces of the lower posterior teeth. These stains are located in the region of least attrition and least plaque. This patient had no carious lesions. The areas with least attrition and least plaque become white in individuals whose teeth are exposed to cariogenic environment, while in individuals whose teeth are not exposed to cariogenic environment these areas become black.

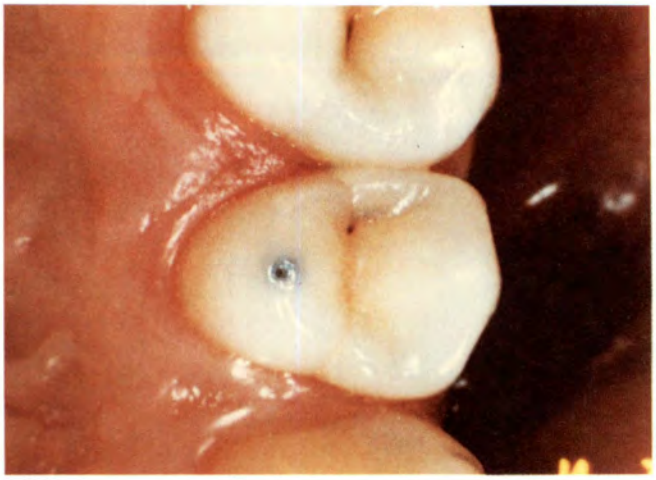
109a. Patient from a high fluoride area showing mottling of the labial surfaces of the upper anteriors but the lower anteriors seem to have escaped. Fluoride mottling occurs in the area with least attrition and least plaque. These are the areas which are usually more prone to caries in individuals whose teeth are exposed to cariogenic environment.

109b. Palatal surfaces of upper anteriors of the above patient. There is very little evidence of mottling. These surfaces are probably not mottled because they are exposed to attrition.

110a. Patient from a high fluoride area showing mottling of the labial surfaces of the upper anteriors but the lower anteriors seem to have escaped. Fluoride mottling occurs in the area with least attrition and least plaque. These are the areas which are usually more prone to caries in individuals whose teeth are exposed to cariogenic environment.

110b. Palatal surfaces of the upper anterior teeth of the above patient showing very little mottling. The mesial surface of the right upper central incisor is mottled as this surface is less exposed to attrition.

110c. Mesial surface of the right lower second molar of the above patient showing staining of the cervical perimeter of the facet. This is the area with least attrition and least plaque. This is also the area which is usually more prone to caries.



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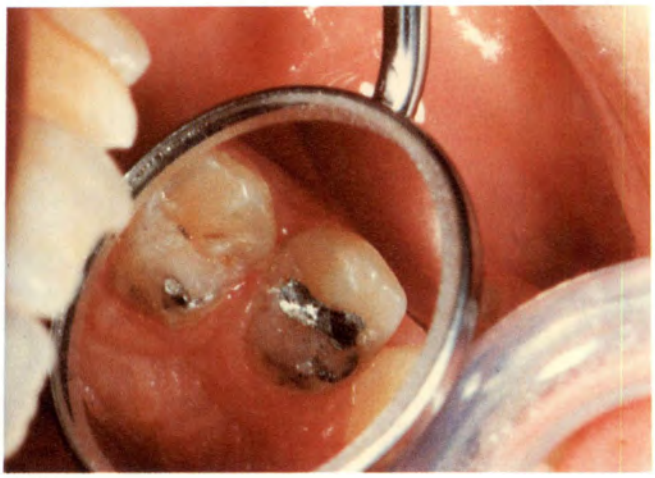

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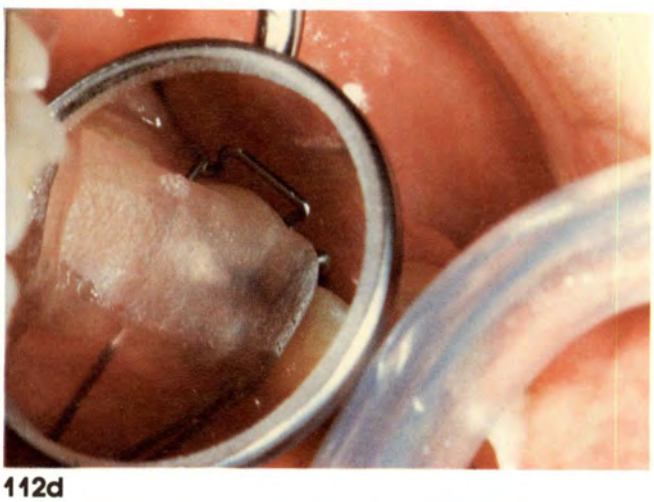


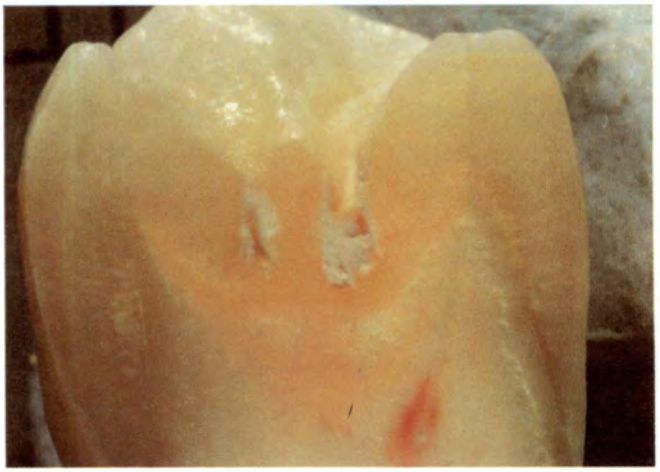
112d

36. Cusp tip caries.

111. Shows a carious lesion on the palatal cusp of the left upper first premolar. This is the region where there is least attrition and least plaque. Also note the discoloration of the distal marginal ridge of this tooth which is probably due to a carious lesion in the region of the distal contact area.

112a. and 112b. Show cusp tip caries in a patient undergoing orthodontic treatment. The patient was wearing a bite raising appliance and the lesions started at places where the appliance formed contact with the teeth.

112c. and 112d. The above patient with the orthodontic appliance in position.



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118a

118b

37. Occlusal caries

113a. Partially ground tooth showing fissure caries under reflected light. Fissure on the left is a simple fissure and carious lesion involves its walls. Fissure on the right is not a simple fissure and as such pattern of the lesion is different.

113b. Above tooth seen under transmitted light.

114. Partially ground tooth showing fissure caries under reflected light. Note the carious lesion starts where the two walls of the fissure meet.

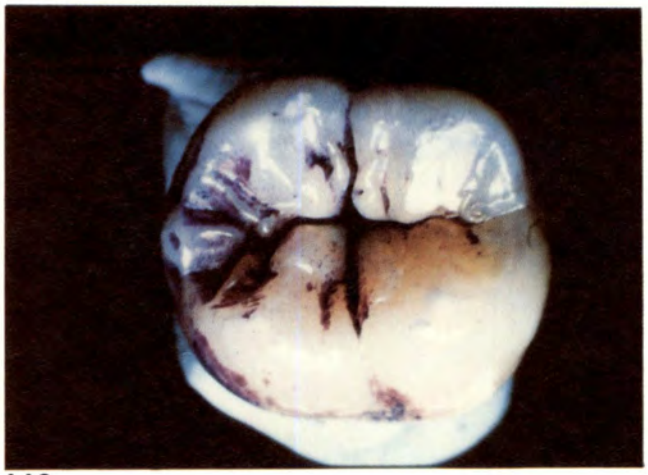
115. Partially ground tooth showing fissure caries under reflected light. The fissure on the left is smaller and narrower than the fissure on the right, but the lesion on the left is bigger. This specimen shows that the fissure with less plaque is more prone to caries.

116. Partially ground tooth showing two fissures. The fissure on the left is wide and deep while the fissure on the right is narrow and shallow. The carious lesion on the right is bigger. The depth of a fissure or the amount of plaque in it do not make a fissure more prone to caries. It is the narrowness of a fissure which makes the fissure more prone to caries. The use of fine probe in the diagnosis of the carious lesion helps in the detection of the narrow fissures.

117. Partially ground tooth showing fissure caries under reflected light. The fissure is 'V' shaped and the carious lesion is at its base where the two walls of the fissure meet.

118a. Fissure caries, note the carious lesion is located where the two walls of the fissure meet and not at the base where there is stagnant plaque.

118b. Above tooth after further grinding, there is space between the walls and the extent of the lesion is reduced. The carious lesion still involves the walls of the fissure and not the base.



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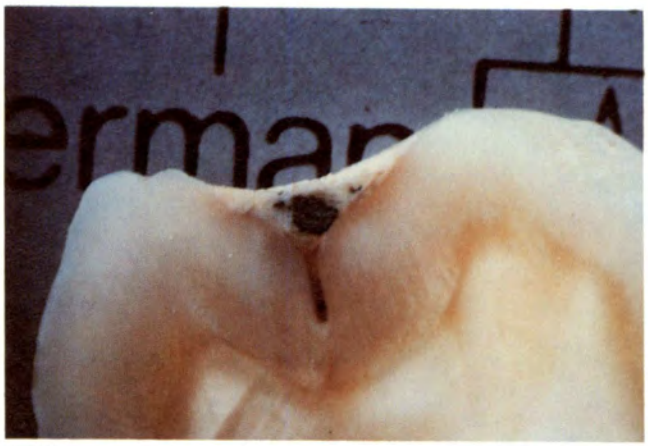


121

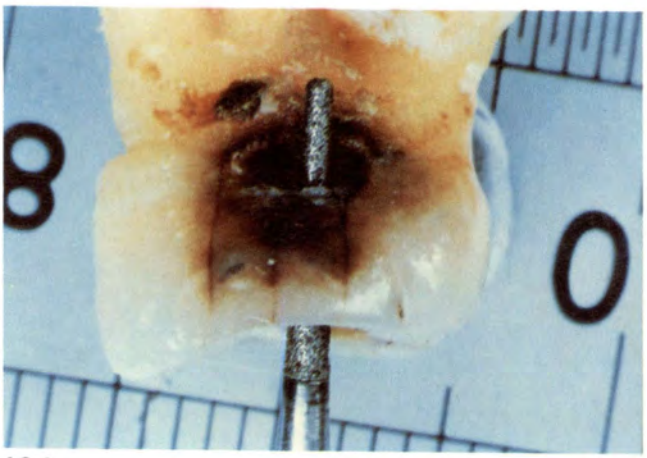
122

119 and 120. Show occlusal caries without any evidence of cavitation. These teeth had to be extracted as the lesions had exposed the pulp chambers.

121. Calculus deposit surrounding part of an amalgam restoration and sealing a fissure. Note the calculus does not extend into the fissure. This specimen shows that the calcium salts are available but they cannot reach where the two walls of a fissure come very close to each other.

122. Partially ground tooth shows fissure caries. The calculus deposit has blocked the carious lesion and sealed the fissure but it has not remineralised the carious lesion. Calcium salts are available but they cannot remineralise the lesion because they cannot penetrate into the deeper layers of the lesion.

123



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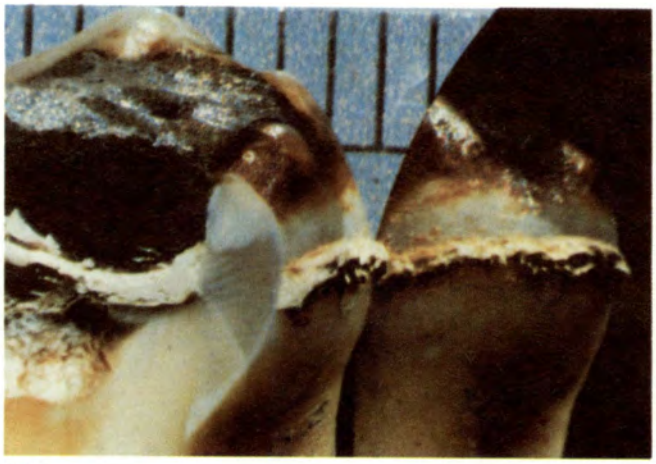

126

38. Cemental Caries.

123. Shows an arrested lesion in the region of the contact area facet and an extensive lesion in the region of the cemento-enamel junction. The carious lesions behave differently at the enamel surface and at the cemento-enamel junction. In other words enamel caries and cemental caries are two different diseases.

124. Cemental caries in this case has progressed along the dentinto-enamel junction to the occlusal surface without affecting the enamel on the approximal surface.

125. Ground section of a tooth showing three carious lesions, i.e. carious lesion in the occlusal fissure, carious lesion in the region of the contact area and a carious lesion in the region of cemento-enamel junction. The enamel surface between the lesion at the contact area and the lesion at the cemento-enamel junction must have been covered with plaque in vivo, but has escaped the carious lesion.

39. Calculus deposit and enamel caries.

126. Shows a partially ground tooth along with its mirror image.This figure shows the relationship of the enamel caries and the calculus deposit. Tooth surface around the cusps is discoloured and is carious. There is no evidence of caries in the region of the calculus deposit. There is very little evidence of caries on the enamel surface sandwiched between the discoloured enamel and the calculus deposit. Enamel caries even on the exposed surfaces is seen to occur in the region of least attrition and least plaque.

40. References

1. Leigh R W (1927) Studies of the enamel. J Am Dent Ass; 14: 592-600

2. Newman H N & Morgan W J (1980) Topographical relationship between plaque and approximal caries. Caries Res; 14: 428-33

3. Kotsanos N, Darling A I, Levers B G H (1986) A Model for the production of artificial caries in the mouth in man. Archs Oral Biol., Vol 31, No 7 pp 491-495.

4. Beust T B (1935) Contact-point caries. J Dent Res 15: 453-55.

5. Bandlish L K (1980) Attrition: A defence mechanism against caries. The Probe (London); 21: 419-22

6. Bandlish L K (1981) Attrition and plaque defence mechanism of teeth. The Probe (London); 23: 168-70.

7. Bandlish L K (1984) Topographical relationship between contact area and approximal caries. The Probe (London); 25: 287.88.

8. Bandlish L K (1984) Relationship of approximal caries and contact area. The Probe (London); 26: 59-60

9. Bandlish L K (1985) Dynamics of contact area and approximal caries. The Probe (London); 27: 48.

10. Ashley F P & Sainsbury R H (1981) The effect of school based plaque control programme on caries and gingivitis. Brit Dent J; 150: 41-5.

11. Levine R S (1985) The scientific basis of dental health education, A health education council policy document. Brit Dent J; 158: 223-226.

12. Sutcliffe P (1968) Chronic anterior gingivitis, an epidemiological study in school children, Brit. dent. J., 125, 47-55.

13. Axelsson P, Lindhe J, and Waseby J, (1976) The effect of various plaque control measures on gingivitis and caries in school children. Community Dent Oral Epidemiol; 4: 232-39.

14. Holmen L and Thylstrup A, Natural caries development and its arrestment, 'Factors Relating to Demineralisation and Remineralisation of the Teeth', IRL Press Ltd. (Oxford), 139-152.

15. Dowell T. The Diagnosis and Management of Early Carious Lesion, Meeting Report, Brit. dent. J. 1986 161, page 347.

16. Berman D S and Slack G L, Caries Progression and Activity in Approximal Tooth Surfaces, A Longitudinal Study, Brit. dent. J., 1973, 134, 51-57.

17. Billie J and Thylstrup A, Radiographic diagnosis and clinical tissue changes in relation to treatment of approximal carious lesions. Caries Res. 16: 1-6 (1982).

18. Thylstrup A, Bille J, Qvist V, Radiographic and Observed Tissue Changes in Approximal Carious Lesions at the Time of Operative Treatment. Caries Res. 20: 75-84 (1986).

19. Bandlish L K (1984) Sealants in prevention of caries. (L): Brit Dent J; 156: 386.

20. Roitt I.M and Lehner T., Immunology of oral diseases, Blackwell Scientific Publications Oxford London, Edinburgh, Melbourne; 1980, page 373.

21. Robinson C, Kirkham J, Weatherell J A; Control of crystal growth during enamel development; a possible role for fluoride, 'Factors Relating to Demineralisation and Remineralisation of the Teeth', IRL Press Ltd. (Oxford) 13-22, 1986.

22. Al-Alouis W et. al (1975) Enamel mottling in a fluoride and in a non-fluoride community parts I and II Brit Dent J; 101: 289-97, 329-41.

23. Weatherell J A, Robinson C, Schaper R, Kunzel W, Distribution of Fluoride in Clinically Sound Enamel Surfaces of Permanent Upper Incisors. Caries Res. 17: 118-124 (1983).

24. Hardwick J L and Leach S A 1963. The fluoride content of the dental plaque. Adv. F. Res. Dent. Caries Prev. 2: 151-58

25. Birkland J M, Jorkend L and von der Fehr F R (1971) The influence of fluoride rinses on the fluoride content of dental plaques in children. Caries Res. 5: 169-79.


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