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Assessment of occlusal fissure morphology in deciduous molar teeth

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Abstract

Aim: To study the complex anatomy of the pit and fissure system of human primary first and second molar teeth under stereomicroscope.

Background: The pit and fissure patterns on the occlusal surface of the human teeth represent vulnerable sites for initiation of dental caries due to their morphological complexity. However, the decision making for sealants is based on the personnel, tooth and surface at risk. Hence it is important to understand the pit and fissure patterns in the application of appropriate preventive measures.

Materials and methodology: 100 Maxillary and mandibular first and second primary molars were collected and stored in neutral 10% formalin, cleaned with slurry of pumice and water. The teeth were sectioned longitudinally (buccolingually), thickness ranging from 40µm to100µm with the help of carborundum disc. The ground sections of the teeth were fixed on the glass slide and examined under stereomicroscope with 10 X magnification for the fissure pattern. The results were tabulated and analyzed.

Results: The U-TYPE (56%) of fissure pattern was more prevalent in both the maxillary and the mandibular molar teeth followed by V –TYPE (37%) of fissure pattern.

Conclusion: The U and V types of fissure patterns were predominantly seen in the primary molars compared to the other fissure patterns.

Keywords: pits and fissures, u- type and v – type of fissure pattern in primary molars, occlusal surface of primary molars.

Introduction

Caries process involves a large number of interrelating factors affecting the tooth with changes in the environment. Literature shows that pits and fissures are areas which are more susceptible to carious attack compared to the smooth surfaces. Kraus Jordan and Abrams 1969 defined "A fissure is a cleft or crevicein a tooth surface thought to result from the imperfect fusion of the enamel of adjoining cusp or lobes" and "A pit is a sharp pointed depression usually located at the junction of 2 or more intersecting developmental grooves.(1)The researchers have all investigated the patterns of the occlusal surface of the teeth and explained the fissure pattern through their drawing as the invagination extending from the occlusal surface to the enamel and sometimes into the dentin which are quite common and these teeth also have areas at the base of pits and fissure where there is little enamel covering the dentine. The presence of deep invagination of the enamel is thought by many to be an important predisposing factor because decay often starts in pits and fissure. More over many clinical studies have demonstrated the susceptibility of these areas to caries and tooth type in the dentition has its own surface anatomy, and caries is usually always detected in relation to the same specific anatomical configuration in identical tooth types(Brekhus 1931, McCall 1934, Prime 1937, Brucker 1944, Paynter and Grainger 1962).(2-6)The pit and fissures in both primary and permanent dentition are areas which are highly liable to decay and act as a reservoir for the initiation and progression of the disease. The anatomy of pit and fissures of the teeth have been a subject of research as the recent trends focus more on prevention. In the 1970s research had focused on prevention of occlusal caries and as a result the number and intensity of caries involving pits and fissure and smooth surface have decreased. 80% of all carious lesions in young permanent teeth involve a fissure surface which makes up 13% of total tooth surface. (7) Prevention of pit and fissure caries has progressed from early treatment modalities like, mechanical fissure eradication and chemical treatment using silver nitrate to the development of more innovative and progressive materials and methods, such as micromechanical bonding of artificial resins to enamel substrate using acid etching techniques. The introduction of materials designed to seal pits and fissures so as to eliminate them as stagnation sites for microbial fermentation is a promising adjunct to existing measures. A contemporary approach for sealant placement includes an assessment of teeth judged „AT RISK FOR CARIES „and not necessarily directed to all teeth with deep pits and fissures. (8) The fissure patterns in the primary teeth was described by Mortimer (1970) as U and V type. (9) The permanent teeth fissure patterns were described by Nagano and Gustafson found that the prevalence of Vtype was34 %, IK-type 26 %, I- type 19 %, U- type 14 % and other as 7 %. Nagona also observed the relation between the localization of the primary carious lesion and form and depth of the fissure and he revealed that caries starts from the bottom in V type, it starts halfway down in the U- type, and from the top in the I-type and IK- type. A deep, narrow fissure may resist carious progression by hindering the impaction or even diffusion of considerable amounts of substrate which seems to be less liable to carious attack than one providing some space for plaque and debris to accumulate. Steepness of walls and ample space for retention above the entrance to the fissure appear to be the most important feature, with the depth of the fissure proper, being of secondary significance. (10,11) It is therefore mandatory to know about the pits and fissure patterns to preserve the teeth. The morphology of fissures and their relationship to enamel caries in permanent teeth have been investigated by many authors under ordinary light, polarized light and microradiography. (12) However, the literature related to deciduous tooth fissures pattern and its relationship to caries is scarce. Hence this study was aimed to investigate the pit and fissure pattern in the deciduous teeth using stereomicroscope.

Methodology

Armamentarium

(Figure 1 and 2)

• 100 extracted or normally exfoliated primary first and second upper and

• lower molar teeth

• Saline

• Disposable mask and gloves

• Cotton

• Pumice slurry and polishing cups/ brushes

• Mouth mirror, Probe and Tweezer

• Carborundum disc and mantle

• Glass slide

• Cover slip

• Stereomicroscope

Inclusion criteria

Extracted / exfoliated primary molar teeth with intact crown structure with or without root surface

Exclusion criteria

Teeth with caries, fracture, crack and malformed teeth were excluded. 100 primary molars (maxillary and mandibular) were selected after thorough examination. The teeth were cleaned with a slurry of pumice, rubber polishing cups and then with water, preserved in neutral 10% formalin, until the time it was sectioned and examined under stereomicroscope. The teeth were categorized as maxillary or mandi according to their anatomical surface at the time of sample preparation.

Figure 1: 100 extracted primary molar teeth.

Figure 2: Armamentarium

Specimen preparation

The tooth was first sectioned longitudinally in a buccolingual direction with the water-cooled carborundum disc. Then the serial sections were grounded and polished resulting in a final thickness of 40µm to 100µm. The prepared sections were mounted to the glass slide and cover slips (Figure 3) were placed. The examination of the specimen and photomicrograph was carried out using stereomicroscope with 10 X magnification. (Figure 4)

Figure 3: Sections mounted on slide

Figure 4: Stereomicroscope

Result

• Six maxillary first primary molar (40%) showed U – type. (Figure 5)

• Seven maxillary first molar (46.6%) showed V – type. (Figure 6)

• Two maxillary first molar (13.3%) showed liner depression.

• Thirteen maxillary second molar (48.1%) showed U-type.

• Thirteen maxillary second molar (48.1%) showed V-type.

• One maxillary second molar (3.7%) showed linear depression.

• Seventeen mandibular first molar (60.7%) showed U-type.

• Nine mandibular first molar (32.1%) showed Vdepression. (Figure 7)

• Twenty mandibular second (66.6%) showed Utype.

• Eight mandibular second (26.6%) showed Vtype.

• Two mandibular second (6.6%) showed linear depression.

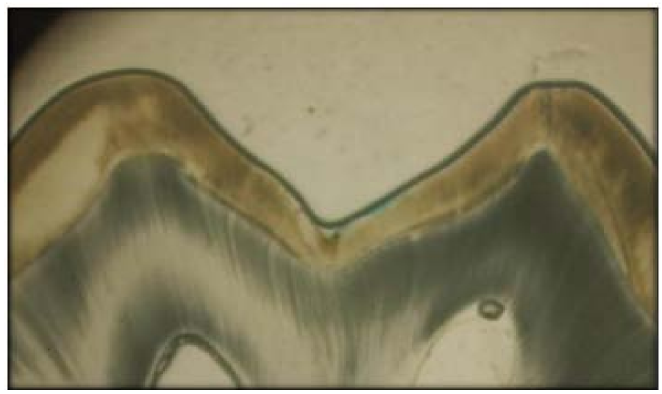

Figure 5: Maxillary molar teeth – V shape Fissure pattern

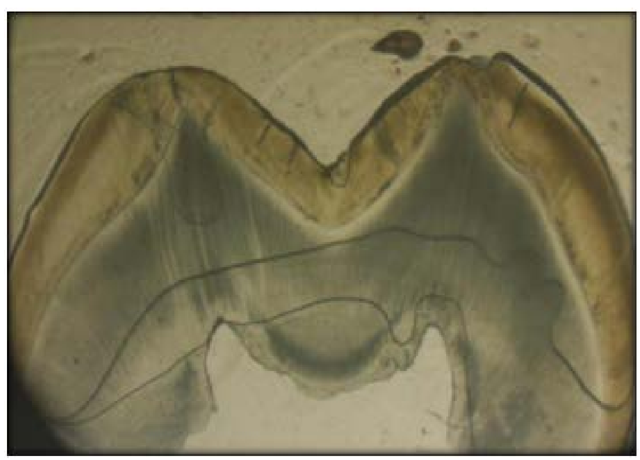

Figure 6: Mandibular molar teeth – V shape Fissure pattern

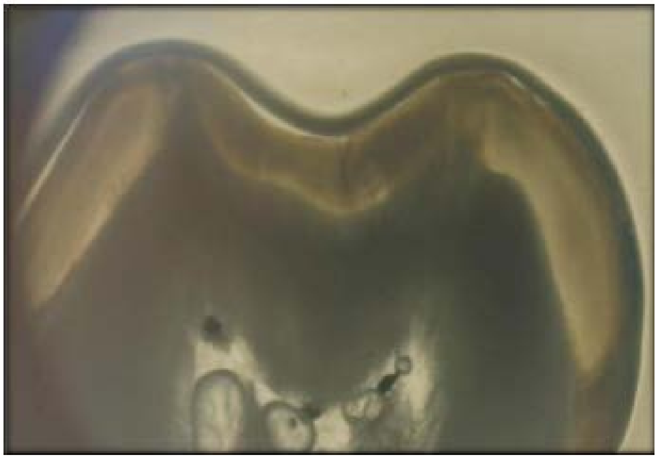

Figure 7: Linear depression

Discussion

Occlusal caries represents a major portion of the total caries experienced in children and adolescents. (13) It is a common belief that the higher caries susceptibility of occlusal surfaces, compared with smooth surface, is a direct result of the structural irregularities associated with occlusal pits and fissures (Newburn 1983, Nikiforuk 1985). (14)

Histological studies have demonstrated a relationship between the shapes of occlusal fissures and the localization, spread of dental caries (Nagano 1961, Konigs 1963, Mortier 1964, Mateeva1970). (9,13,15) Further observations by, konigs 1963, 1966 on serially sectioned teeth indicated that the initiation and localization of dental caries was related to the anatomical configuration of the occlusal surface. (12) However, certain discrepancies seem to exist regarding the differentiation between pits and fissures in fossae and grooves. According to Bodeker, controversy ensues mainly because of the misinterpretation of the terminology fissurea. (16)

Gilling's and Buonocore in 1961 stated that the presence of pits and fissures is a normal occurrence and can be found in molars and premolars and are considered as areas with high susceptibility to caries lesion (Bossert 1933, Koing 1966, Juhl1983). (12,15,17,18,19) Hyatt in 1923 in his article stated that all fissures needs to be restored even before the onset of caries lesion aiming to prevent caries before its development.(20)Mortimer found an equal susceptibility to caries in wide and narrow fissure(9) Konig on the other hand described a higher susceptibility in deep and narrow fissure, whereas Zurhr and Vierus found that wide and V shaped fissures were more susceptible.(12,15) Mondelli et al in 2002 agrees that grooves and the fossae are the natural anatomical details resulting from the coalescence of various developmental lobules, whereas fissures and pits are the deficient union among the lobules in the groove and in the fossae area(21.22) There is also disagreement concerning the position of carious lesion in relation to fissure morphology.

Mortimer and Gustafson found that the walls of the fissures are the first to become carious whereas Nagona and Konig have reported that the base was the first site of early carious lesion in wide fissures, and the walls were the first site in the narrow ones. Recent studies have revealed that fissure morphology is highly variable both within the individual tooth and between different teeth. (9,12,15) Many authors have classified the pits and fissure according to the anatomical from in classes 1) V – type, ample in the top and gradually narrowing to the base 2) U- type almost the same width from top to base 3) I- type, a very narrow groove 4) IK- type, a very narrow groove associated to a large space in the base 5) other types being the V – type more prevalent (Nagona 1961).(10) Valera in 2005 related the type of pits and fissure to depth in which the V – type have a superficial or shallow depth, the U- type have a average depth and most of the other types shows marked depth.(15) According to Lussi -1991 and EK strand et al in 1987 shallow fissure are those which have an inclination between cuspal slopes near the fissure entrance more than 90 degree, wide fissure which has inclination between cuspal slopes 90 degree or less, and narrow fissures are ones which had an inclination between the cuspal slopes less than 30 degrees.(13,23) Wamnenmachers in 1962 classified fissures as funnel shaped, club shaped, deep cervical type, whereas James in the year 2007 classified the fissures as U , V , Y1 and Y2 and all these classification were mostly for the permanent molar teeth.(24) Galil and Gwinnett in 1975 and Marianne juhl in 1983 stated that the pit and fissure morphology are very complex especially in the molars teeth in the permanent dentition and classified the pits and fissures as either pointed, clubbed and rose – head. The Rose – head pattern was termed as 'dental bur configuration'. (22,25)

Most of these findings are based on the studies and observations done on the occlusal surface of permanent teeth and there exists very little literature for primary dentition.(26) Hence the present study was undertaken keeping the above facts in mind to assess the morphology of the occlusal surface of deciduous molar teeth by examining the bucco- lingual serial sections of 100 primary first and second maxillary and mandibular teeth of the thickness 40µm to 100 µm under the stereomicroscope using 10 X magnification. The fissure morphology examined in the present study showed predominantly U- shaped fissures (58%) and V – shaped fissures (42%) with the limited percentage of other type of fissure pattern (7%). Similar observation was noticed in the studies done by Mortimer in 1970, where U and V – type fissures were more prevalent in the primary teeth.(9) In the present study the V shaped fissures were more prevalent in maxillary molars whereas U type fissure pattern was more prevalent in mandibular molars. Previous literature often focused on the inaccessible occlusal fissures as vulnerable areas. Ekstrand, konig, carvalho study stated that caries initiation and development were independent of the anatomical configuration. In the fossa area the occlusal caries development is related to macro morphology of the fissure. (12,27,28) In deciduous teeth where U and V shaped fissure with only few deep invaginations were observed, the occlusal caries is quite common. This can be attributed to the other factors of caries etiology and difference between primary and permanent teeth morphology and histological properties like lower mineral content of the enamel, variation of enamel thickness throughout the fissure surface, cuspal inclination, the width, depth and shape of the fissure, width of the prism ranging from 4µm to 7µm compared to 6 µm to 10 µm in permanent teeth and of the fissure access to the environmental changes.(9,26) A deep, narrow fissure may resist carious destruction, because a deep fissure too narrow to allow the impaction or even diffusion of considerable amounts of substrate, as seen in the I type seems to be less liable to carious attack than one providing a space for plaque and debris to accumulate.(29) Studies showed that steepness of walls and ample space for the retention above the entrance to the fissure appear to be the most important features than the depth of the fissure proper, which is of secondary significance.(13) Klaus G Konig suggested that the shallow fissure portion of grooves formed by walls joining under a wide angle of approximately 90 degree to 70 degree showed low susceptibility to decay, than in grooves formed by angles smaller than 70 degree, where initial decalcification of enamel was rather common and usually started at or near the deepest point of the sulcus.

Similar finding were noticed by Gustafson and Nagano (.10,11,12.). The present study confirmed the fact that the U and V shaped fissure pattern are predominant in the primary molars. However, the preventive measures should be aimed on the accurate assessment of risk associated factors with respect to the tooth surface, such as fissure depth, width, and enamel thickness overlying the fissures, cuspal inclination and the orientation of prism structure in the primary teeth. Hence further studies are recommended to confirm the above parameters and its associated risk with development of dental caries.

Conclusion

1. U and V type of fissure pattern was more prevalent type in the primary molar teeth with few of them exhibiting linear depression pattern.
2. U – type of fissure was more predominant in mandibular molars.
3. U and V- type of fissure were seen with similar frequency in maxillary molars.
4. There was no significant difference in type of fissure pattern between first and second primary molars. (p>0.05) ***
5. There was no significant difference between maxillary and mandibular molars. Further study are recommended with bigger sample size to check the correlation between other risk associated factors of fissure morphology

with caries initiation and progression.4

References

1. Kraus BS, Jordan RE, Abrams L. Dental anatomy and occlusion: a study of the masticatory system. Williams and Wilkins; 1969.
2. Brekhus PJ. A Report on Dental Caries in Ten Thousand Four Hundred Forty-Five University Students (1928–1930) ** Read before the International Association of Dental Research, Memphis, Tenn., March 22, 1931. The Journal of the American Dental Association (1922). 1931 Jul 1;18(7):1350-6.
3. McCall JO. Lessons to Be Learned in a Children's Dental Clinic. Journal of the American Dental Association. 1934 Oct 1;21(10):1869- 83.
4. Prime JM. Inconsistencies in Operative Dentistry** Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936. The Journal of the American Dental Association and The Dental Cosmos. 1937 Jan 1;24(1):82-91.
5. Brucker M. Studies on the incidence and cause of dental defects in children.
6. Fits and fissures. Journal of Dental Research. 1944;23: 89-99. Paynter KJ, Grainger RM. Relationship of morphology and size of teeth to caries. Int Dent J. 1962 Jun;12(147-160):76-8.
7. Feigal RJ. The use of pit and fissure sealants. Pediatric dentistry. 2002;24(5):415-22.
8. Babu G, Mallikarjun S, Wilson B, Prem Kumar C. Pit and fissure sealants in pediatric dentistry. SRM Journal of Research in Dental Sciences. 2014 Oct 1;5(4):253.
9. Mortimer KV. The relationship of deciduous enamel structure to dental disease. Caries research. 1970 Jul 1;4(3):206-23.
10. Nagano T. Relation between the form of pit and fissure and the primary lesion of caries. In Dent Abstr 1961 Jul (Vol. 6, p. 426).
11. Gustafson G. The histopathology of caries of human dental enamel with special reference to the

division of the carious lesion into zones. Acta Odontologica Scandinavica. 1957 Jan 1;15(1):13-55.

12. König KG. Dental Morphology in Relation to Caries Resistance with Special Reference to.

13. Lussi A. Validity of diagnostic and treatment decisions of fissure caries. Caries research. 1991 Jul 1;25(4):296-303

14. New brun Ernest: cariology :3rd edition Quintessence publication: 315- 330.

15. Valera FB, Fernandes TM, de Souza RE, Valera RC, Mondelli J. Morphometric analysis of the occlusal surface: the influence on the prevalence of carious lesions. SALUSVITA SALUSVITA. 2005:301.

16. Bodecker CF. Microscopic study of enamel fissures with reference to their operative treatment. D. Cosmos. 1924 Oct; 66:1054-67.

17. JUHL M. Three-dimensional replicas of pit and fissure morphology in human teeth. European Journal of Oral Sciences. 1983 Apr 1;91(2): 90-5.

18. Ferreira Zandoná AG, Analoui M, Beiswanger BB, Isaacs RL, Kafrawy AH, Eckert GJ, Stookey GK. An in vitro comparison between laser fluorescence and visual examination for detection of demineralization in occlusal pits and fissures. Caries Research. 1998 Apr 1;32(3):210- 8.

19. El-Housseiny A, Jamjoum H. Evaluation of visual, explorer, and a laser device for detection of early occlusal caries. Journal of Clinical Pediatric Dentistry. 2002 Sep 1;26(1):41-8.

20. Hyatt TP, Dwyer HS. A new aspect of prophylactic odontotomy. Journal of the American Dental Association. 1931 Jul 1;18(7):1356-60.

21. Mondelli J, Franco EB, Valera RC, Ishikiriama A, Pereira JC, Francis Chone CE. Dentística: procedimentospré-clínicos. Editorial Premier; 1997.

22. Juhl M. Localization of carious lesions in occlusal pits and fissures of human premolars. European Journal of Oral Sciences. 1983 Aug 1;91(4):251-5.

23. Ek strand Kr, Garlsen O, Thylstrup A. Morphometric analysis of occlusal groove-fossa-system in mandibular third molar. European Journal of Oral Sciences. 1991 Jun 1;99(3):196-204.

24. Höhling J, Wannenmacher E, Wannenmacher M. Über den Zahnstein. Dtsch. Zahnärztebl.1962; 16:143-51.

25. Galil KA, Gwinnett AJ. Three-dimensional replicas of pits and fissures in human teeth: scanning electron microscopy study. Archives of oral biology. 1975 Aug 31;20(8):493-IN8.

26. Gwinnett A. The ultrastructure of the “prismless” enamel of permanent human teeth. Archives of Oral Biology. 1967 Mar 1;12(3):381IN25-7IN30.

27. Ekstrand K, Qvist V, Thylstrup A. Light microscope study of the effect of probing in occlusal surfaces. Caries research. 1987 Jul 1;21(4):368-74.

28. Carvalho JC, Ek strand KR, Thylstrup A. Dental plaque and caries on occlusal surfaces of first permanent molars in relation to stage of eruption. Journal of Dental Research. 1989 May 1;68(5):773-9.

29. 34. Ripa LW, Gwinnett AJ, Buonocore MG. The “prism less” outer layer of deciduous and permanent enamel. Archives of oral biology. 1966 Jan 1;11(1):41IN3-8IN5.m