ORIGINAL RESEARCH PAPER

Oral Pathology

GROUND SECTIONING METHODS OF TOOTH– A REVIEW

KEY WORDS: Ground Sectioning, Recent Advances, Hard Tissue

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ABSTRACT

In histopathology the study of hard tissue is important for diagnosis of various diseases and conditions among that ground section plays a major role. Last few years, dental identification methods were highly increased because of some natural phenomenon like cyclone, flood, earthquake, airplane accidents, industrial accident, terror attacks, volcanic explosions, etc. Teeth has become an important part in many field related to forensics and many medico legal cases were the tooth structure is studied in identification of victims. This article was aimed to highlights varies methods of ground section of teeth, also their significance in various fields and recent advances. There are various other modalities in histopathology like decalcification studies, special satins procedure, Immunohistochemistry. Each and every study has unique importance and application.

INTRODUCTION

Ground sectioning of tooth is important There are many methods available in study of anatomy of the teeth, in which ground section study is utmost simple and effective technique because of teeth section are prepared without using any chemical and it's maintaining anatomy of the teeth. Recent advances in this field include the use of new technologies and techniques to improve the quality of the sections and the information that can be obtained from them. (1)

Apparatus Required

Extracted teeth socked in 20%formaldehyde for 24 hour, Electrical lathe machine, Carborundum stone, Xylene, cover slip and DPX mountant

METHODS

Manually grounding method can be done in two steps;

- 1st step: Rough carborundum stone is used to grind till the section attains 2-3mm.
- 2nd step: Static carborundum stone is used till the section attains 1mm thickness.

Grinding to be done till the thickness of 35 mm using fine carborundum stone. Water is added continuously during the procedure to avoid friction heat. Use Xylene for one minute in grounded section for cleaned purpose. After cleaned section dried and mounded on microscopic slide using DPX and viewed under microscope.

Other Methods Used In Ground Section

- Cutting and grinding
- Etching
- Freezing and fracturing
- Ion milling

1. Cutting And Grinding Method:

It is a commonly used method for preparing ground sections of teeth for microscopic analysis. The process involves cutting a small block of tooth material from the sample using a diamond saw, and then grinding and polishing the block to produce a thin, flat section suitable for microscopic examination.

Sample Preparation:

The tooth is first cleaned and disinfected, and any soft tissue or debris is removed. A small block of tooth material is then cut from the desired location using a diamond saw.

Mounting of Sample:

The tooth block is then mounted on a holder using an epoxy resin or other adhesive. The holder allows the sample to be held securely during the grinding and polishing process.

Grinding:

The mounted tooth block is then ground down using abrasive papers of gradually finer grit. The grinding process is typically done using a rotating disc or wheel that is coated with the abrasive paper. The pressure and speed of grinding should be carefully controlled to avoid excessive heat generation that could damage the tooth structure. (2,3)

Polishing:

Once the grinding process is complete, the sample is polished using a polishing cloth or pad that is coated with a polishing compound, such as diamond suspension. The polishing process is typically done using a rotating platen or wheel.

Final Cleaning:

The ground section is then cleaned to remove any residual polishing compound or debris. The sample can be rinsed in water or a solvent, such as acetone, and then dried.

2. Freezing And Polishing:

Freezing and fracturing is a method for preparing ground sections of materials for microscopic analysis that involves freezing the sample and then fracturing it to create a cross-sectional view of the internal structure. This method is useful for studying the internal microstructure of materials that are difficult to prepare using traditional grinding and polishing methods.

Sample Preparation:

The material sample is first prepared by cutting it to the desired size and shape using a diamond saw or other cutting tool. The sample is then cleaned and dried.

Freezing:

The sample is placed in a cryogenic fluid, such as liquid nitrogen, and allowed to freeze. When rapidly cooled and

freeze it results in the formation of ice crystals within the sample.

Fracturing:
The frozen sample is then fractured using a sharp blow or impact. The resulting fracture surface exposes the internal microstructure of the sample.

3. Etching:
To reveal the microstructure of the sample, it may be necessary to etch the fracture surface using a chemical or electrochemical process. The etching process selectively removes material from the surface, exposing the microstructure of the sample.

Microscopic Examination:
The resulting ground section can be examined using a variety of microscopic techniques, such as scanning electron microscopy or optical microscopy. The section can be used to study the microstructure of the material, including the distribution of phases, the morphology of inclusions, and the presence of defects.

4. Ion Milling:
Ion milling is a method for preparing ground sections of materials for microscopic analysis that uses an ion beam to selectively remove material from the sample surface. This method is commonly used for preparing samples for transmission electron microscopy (TEM) and scanning electron microscopy (SEM).

Sample Preparation:
The material sample is first prepared by cutting it to the desired size and shape using a diamond saw or other cutting tool. The sample is then mounted on a holder using an epoxy resin or other adhesive.

Ion Milling:
The sample is placed in an ion milling system, which uses an ion beam to selectively remove material from the surface. The ion beam can be generated using a variety of ion sources, such as argon or xenon. The ion beam is typically directed at the sample surface at a low angle, which results in a gradual removal of material.

Milling Parameters:
The milling parameters, such as the ion beam energy, current, and angle of incidence, can be adjusted to control the rate and direction of material removal. The milling time can also be controlled to achieve the desired thickness of the resulting section.

Microscopic Examination:
The resulting ground section can be examined using a variety of microscopic techniques, such as TEM or SEM. The section can be used to study the microstructure of the material, including the distribution of phases, the morphology of inclusions, and the presence of defects (4,5,6)

Recent Advances

- One of the most significant advances in ground section of tooth has been the use of 3D imaging techniques to create high-resolution images of teeth. These techniques use X-ray micro-tomography or optical coherence tomography to generate 3D images of the tooth structure. This allows for a more detailed analysis of the tooth structure and can provide insights into the composition and properties of different layers of the tooth.
- Another recent advance is the use of laser micro-dissection to isolate specific regions of the tooth for analysis. This technique uses a laser to cut out precise sections of the tooth, allowing for more targeted analysis of specific structures or layers. This technique has shown promise in the study of enamel development and dental caries.
- Digital microscopy is another recent advance in ground section of tooth technology. This technology allows for high-resolution imaging and analysis of tooth sections without the need for physical slides. This approach is more efficient and streamlined, allowing for the analysis of large datasets. (4,7,8)

Applications

1. Diagnosis of Dental Diseases:
Ground section of tooth is commonly used to diagnose various dental diseases, such as dental caries (cavities), enamel defects, and periodontal disease. By examining the tooth structure under a microscope, dental professionals can identify specific changes in the tooth structure that are associated with these conditions.

2. Evaluation of Dental Materials:
Ground section of tooth is also used to evaluate the effectiveness of dental materials, such as dental fillings and restorations. By examining the interface between the tooth and the material, researchers can determine how well the material is bonding to the tooth and whether it is providing adequate protection.

3. Assessment of Tooth Wear:
Ground section of tooth can be used to assess the extent of tooth wear, which is a common problem in individuals with bruxism (teeth grinding) or other conditions that cause excessive tooth wear. By examining the tooth structure, dental professionals can determine the extent of the wear and recommend appropriate treatment options.

4. Research On Tooth Structure And Development:
Ground section of tooth is also used in dental research to investigate the structure and development of teeth. Researchers can examine the composition and properties of different layers of the tooth, and use this information to gain a better understanding of how teeth form and development (7, 8, 9)

CONCLUSION

Ground sectioning of tooth provides valuable information about its structure, composition and functions. Through careful examination, scientists and researchers can gain insights into the development and evolution of teeth, as well as the causes and mechanisms of tooth decay, wear, and fracture. Ground sections can reveal important details such as the thickness and distribution of enamel, dentin, and cementum, the presence of micro cracks and defects, and the arrangement and orientation of dental tissues. Hence, ground sectioning of tooth is an essential tool for studying and understanding dental structure and functions. It provides a window into the microscopic world of dental tissues and can aid in the diagnosis and treatment of dental diseases. Through continued research and innovation, ground sections will undoubtedly continue to play a vital role in the field of dentistry.

REFERENCES

1. Vikhe DM, Thete SG, Mastud CS, Mantri T, Mhaske PN, Mastud SP, Madanshetty P. Staining the Ground Section of the Tooth Using an Innovative Plant Stain Found in the Pravara Region, India. The Journal of Contemporary Dental Practice. 2020 Oct 1;21(10):1114.
2. Larson K, Ho HH, Anumolu PL, Chen TM. Hematoxylin and eosin tissue stain in Mohs micrographic surgery: a review. Dermatologic surgery. 2011 Aug;37(8):1089-99.
3. Chang KH, Finn DT, Lee D, Bhawan J, Dallal GE, Rogers GS. Novel 16-minute technique for evaluating melanoma resection margins during Mohs surgery. Journal of the American Academy of Dermatology. 2011 Jan 1;64(1):107-12.
4. Vangala MR, Rudraraju A, Subramanyam RV. Mounting ground sections of teeth: Cyanoacrylate adhesive versus Canada balsam. Journal of Oral and Maxillofacial Pathology: JOMFP. 2016 Jan;20(1):20.
5. Rath R, Raghunath V. Peels as an alternative to ground sections–An in vitro microscopic study. Journal of Oral and Maxillofacial Pathology: JOMFP. 2021 Jan;25(1):31.
6. Vikhe DM, Thete SG, Mastud CS, Mantri T, Mhaske PN, Mastud SP, Madanshetty P. Staining the Ground Section of the Tooth Using an Innovative Plant Stain Found in the Pravara Region, India. The Journal of Contemporary Dental

Practice. 2020 Oct 1;21(10):1114.
7. Charles DK, Condon K, Cheverud JM, Buikstra JE. Cementum annulation and age determination in Homo sapiens. I. Tooth variability and observer error. American Journal of Physical Anthropology. 1986 Nov;71(3):311-20.
8. Bancroft JD, Layton C, Suvarna SK. Bancroft's theory and practice of histological techniques. Churchill Livingstone Elsevier; 2013.
9. Cheng ZL, Cai M, Chen XY, Li P, Chen XH, Lin ZM, Xu M. A novel cutting machine supports dental students to study the histology of the tooth hard tissue. Journal of Dental Sciences. 2019 Jun 1;14(2):113-8.