

# ● Vol. 12, Issue 1

# Impressions

Oct 2022

Journal of Indian Dental Association  
Attingal Branch



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# Impressions

Vol. 12, Issue 1  
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## ABOUT IDA ATTINGAL

IDA Attingal, symbolizes & represents, updates & educates, promotes & supports the local dental community of erstwhile Attingal, in delivering, quality dental health care to the general public. Maintenance of proper standards & ethical manner in practice, better interpersonal relations, as well as willingness to share knowledge, among members, has provided a high degree of respectability to the organization. Effective follow up of organizational proceedings at the state & national level by the branch executive, ensures that the members are kept abreast of all IDA activities. Regular representation at IDA events & healthy interaction with other branch members, has made IDA Attingal quite popular & a force to reckon. Adding to this would be a plethora of eminent leaders from the branch, who have raised to higher echelons in IDA. Through various Scientific programmes, presentations, journals & newsletters, the branch creates awareness of the latest advancements in dentistry, among members.

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## President's Message

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### Season's greetings

Dear Friends,

It's a proud privilege for me to communicate with you through IDA Attingal branch dental journal as President of IDA Attingal branch. I express my sincere gratitude to all office bearers and members of IDA Attingal branch for entrusting and providing me an opportunity to serve IDA Attingal branch.

Our branch has always been a very active body. In today's fast changing scenario, It has been a sincere effort from our side to bring out the art and science, of what is performed and to reflect on the importance of update in dentistry. We would like to encourage our young dentists to contribute and share their experience.

I am glad and honored to pen down the message that we have begun well with our diverse programs from January 2022 and enjoyed their resounding success because of our constant extra ordinary efforts. We have enthusiastically done two webinars, two CDE's, one staff training program, ten CDH programs, three Dental awareness camps, one inter branch cricket tournament and so on.

We have hosted the prestigious and most celebrated state dental conference CORDIAL 21 on 13th, 14th & 15th of May 2022. Hats off to the organizing team who made it outstanding and memorable even in difficult times.

I am proud that our cricket team have won the south zone cricket championship trophy, our cultural team become the overall state champions for IDA kerala state cultural program "Chilamboli 22"

and our table tennis team also succeeded with singles winner trophy and doubles runner up trophy in state level.

Your contribution is a motivation to the work we do and hence I appeal to all our members to contribute in large numbers for successful conduction of all our programs.

With my overwhelming heart, I would like to extend my warm greetings to all my associates for their constant support and team efforts. I ensure you to uphold this performance up to your

expectations and satisfaction.

"TOUGHER WE CAN"

Jai Hind

Jai IDA

**Dr. Arun B.S.**

## Secretary's Message

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Dear Colleagues

I am really honoured to be the secretary of IDA Attingal Branch.

The past two years has been really tough for us both as professionals and as individuals. Now we have overcome all those chaos and is back on track.

But we are facing many tough situations in our day to day professional life. The happiness we find by standing for each other and finding a family within us is priceless.

Words are not enough to thank all the members of our branch who put their effort and time in bringing all together.

Our achievements , the prizes that we bagged this year are nothing but the result of our teamwork .

This teamwork and togetherness is what I am expecting in the coming years also.

Thanking you

**Dr. Subhash R Kurup**



## **GUIDELINES TO THE AUTHORS**

- ❖ Article will be evaluated for publication on the understanding that the work submitted has not been published elsewhere, that it has not and will not be submitted to another journal until the editor has made a decision on its acceptability for this journal, and that, if accepted, its contents will not be published elsewhere without the editor's permission. Accepted papers become the copyright of the Impressions-Journal of IDA Attingal branch and permission must be sought from the publishers before they can be reprinted elsewhere.
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- ❖ Manuscript must contain a structured abstract of a maximum of 200 words, with the headings, purpose of the study, materials and methods, results, and conclusions.
- ❖ Use standard headings: introduction, materials and methods, results, discussion, conclusions.
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# CONTENTS

Massive Dentigerous Cyst Of Maxilla	-	09
Spectra Of Oral Cancer Diagnostics	-	14
A Rare Case Of Dentigerous Cyst Associated With Large Complex Odontoma In A Young Girl	-	21
Job's Syndrome A Rare Immune Disorder	-	25
Shade Selection By Visual And Instrumental Methods	-	28
Durability Of Veneer Compromised By Fracture: Based On Literature Review	-	33
A Journey Through The Advancements Of Denture Base Resins	-	38
Salivary Substitutes In Prosthodontic Rehabilitation	-	44
Improving The Bond During Intra-oral Repair Of Chipped Cad/cam- Hybrid Crowns With Composite	-	50
Irritational Fibroma	-	56
Branch Reports, Activities & Achievements	-	58

## Editorial

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### A GLIMPSE ON RECENT ADVANCES IN DENTISTRY

Dentistry has evolved since ages. Evidence and non evidence based treatment has been published since time immemorial. Now we are in an era which demands the most advanced treatment available at the moment . This is indeed an opportunity and challenge among the fraternity.

Regular updation of the recent advances is the need of the hour. In this era of digital technology updation of newer techniques and knowledge is not a tough task. Each and every field of dentistry has taken a huge leap forward.

In the field of diagnosing oral lesions biophotonics has played a vital role. A cloud-based machine-learning (ML) algorithm is used identify the lesions. Artificial intelligence (AI) is slowly but surely getting into every treatment aspect of dentistry.

Tele dentistry, virtual reality and augmented reality, 3D printing are some of near recent advances. CBCT, MRI , CT, Ultrasound, Sialography etc has already taken over the radiological aspect in treatment planning and diagnosis.

The above mentioned are a just partial view of a larger spectrum. With technology creeping into every aspect of day to day life, we can expect more to come in the field of dentistry.

**Dr. Ramesh S.**



## MASSIVE DENTIGEROUS CYST OF MAXILLA

Dr Aswathi K\*, Dr K L Girija\*\*, Dr Asish R\*\*,  
Dr Ramesh S\*\*\*, Dr Mini MM\*\*\*

### Abstract

Dentigerous cyst is a type of developmental odontogenic cyst. It is formed by the accumulation of fluid between the reduced enamel epithelium and the enamel surface. About 70% of dentigerous cysts occur in the mandible, and 30% in the maxilla. Most typical dentigerous cysts are commonly seen in association with mandibular third molars and maxillary canines. These cysts are considered to be the most common cause of ectopic eruption of teeth.

Here is a case of dentigerous cyst in a child associated with an impacted tooth. The patient was treated surgically by marsupialization of the cyst.

*Key words: Odontogenic cyst, Developmental cyst, Dentigerous cyst, Marsupialization*

**Acknowledgement:** Special thanks to Department of Oral and Maxillofacial Surgery, Department of Oral Pathology and Department of Pedodontics, Government Dental college Trivandrum.

### Introduction

Dentigerous cysts are the most common developmental cysts of the jaws and the second most common type of odontogenic cysts after radicular cysts. Usually, it is associated with an impacted or unerupted teeth. Mandibular third molars, maxillary canines and mandibular premolars are most frequently involved. Rarely dentigerous cyst is also seems to be associated with odontoma, deciduous teeth and supernumerary teeth. Occurrence is mostly in the first and early part of the second decades of life. Males were affected more frequently, with no racial predilection. –

Ectopic eruption of teeth into regions other than the oral cavity is rare. One of the sites for an ectopic

tooth in a nondental location is the maxillary sinus. The etiology of ectopic eruption is considered as trauma, infection, developmental anomalies and pathologic conditions, such as dentigerous cysts. It is believed that the displacement of teeth buds by the expansion of these dental cysts result in the “ectopic” eruption of such teeth.

The standard treatment for a dentigerous cyst is enucleation and extraction of the cyst-associated impacted or unerupted tooth.

### Case report

A 10-year-old child patient presented to the Department of oral medicine and radiology with a complaint of swelling over left side of face since 1 month. Initially the swelling was small, which gradually increased in size. Patient was not symptomatic at the initial stages of disease. Later due to the extreme size of the swelling, patient started experiencing some difficulties while having food associated with mild pain. Patient not taken any medication for the same. History of a single episode of fluid discharge from the swelling 2 days back.

On extraoral examination, a diffuse swelling noted over left side of the face, crossing the midline and extending over the anterior maxilla. Swelling is displacing the ala of nose upwards with obliteration of mucobuccal fold. Patient was unable to close mouth completely due to incompetent lips. No evidence of epiphora, epistaxis or nasal fluid discharge noted. No alteration in voice also noted. Intraoral examination showed a swelling extending from 53 to 63, which causes protrusion of upper lip by obliteration of the labial vestibule. The swelling is cystic in consistency and is depressible

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on the anterior aspect. Incompet lips noted. The teeth associated to it, that is 11,12,53,21,22,63 appear grade 1 mobile and 11 tilted more mesially.

CECT shown evidence of large expansile cystic lesion measuring 5.8\*4.7 cm noticed in superior alveolus originating from unerupted tooth. The lesion encroaching into maxillary antra with oroantral and oronasal communication. CBCT shown an extensive expansile lytic lesion involving anterior maxilla crossing the midline. On the left side lesion extends till the mesial aspect of 25 and on the right side lesion extends till the distal aspect of developing 13. Anterosuperiorly lesion is pushing floor of nasal cavity upwards with thinning and perforation over left side. Posterosuperiorly lesion extending till the left maxillary sinus with complete destruction of medial wall of maxillary sinus. From the left maxillary sinus through the osteomeatal complex the lesion is extending till left ethmoidal sinus. Inferiorly the lesion is involving whole of the maxillary alveolus from 53 to 65. Anterior extension of the lesion with complete labial cortical plate perforation noted. Expansion and perforation of palatal cortical plate noted in relation to 21,22,63. Roots of teeth associated to the lesion are

displaced. Developing 23 located within the lesion is pushed posterior, superior and buccal to the lesion. An inverted and impacted mesiodens also noted palatal to the root of 21.

FNAC was done and obtained a brown coloured fluid on aspiration. A provisional diagnosis of odontogenic cyst with differential diagnosis of odontogenic tumour and juvenile ossifying fibroma were made based on its appearance, progression clinical features and radiographic examination. Marsupialization of the lesion done and iodoform pack given. FNAC report shown numerous inflammatory cells predominantly lymphocytes and neutrophils with occasional macrophage in a background of RBC's. HPR report shown a densely fibrous connective tissue capsule lined by 2-3 layered odontogenic epithelium. In one area lining is of pseudostratified ciliated columnar epithelium. Connective tissue capsule showed collection of inflammatory cells. Vascularity of stroma is moderate with areas of hemorrhage. Peripheral reactive bone formation can be appreciated. Deeper region shows muscle fibres. HPR was suggestive of a dentigerous cyst.

**FIGURE 1: EXTRAORAL PRE AND POST OPERATIVE IMAGES OF PATIENT**



**Diffuse swelling noted over left side of the face, crossing the midline and extending over the anterior maxilla**

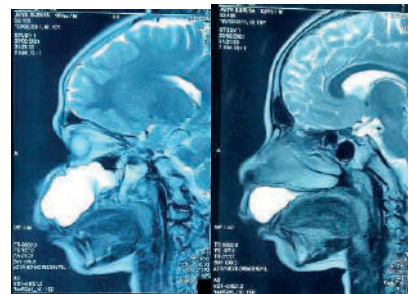
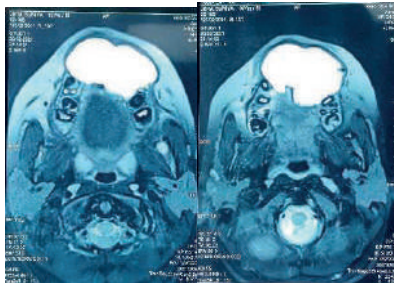
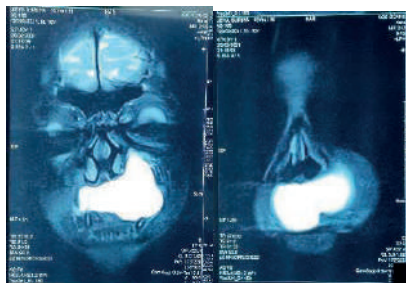


**Patient reviewed after marsupialization, which shows an evident reduction in size of the swelling**



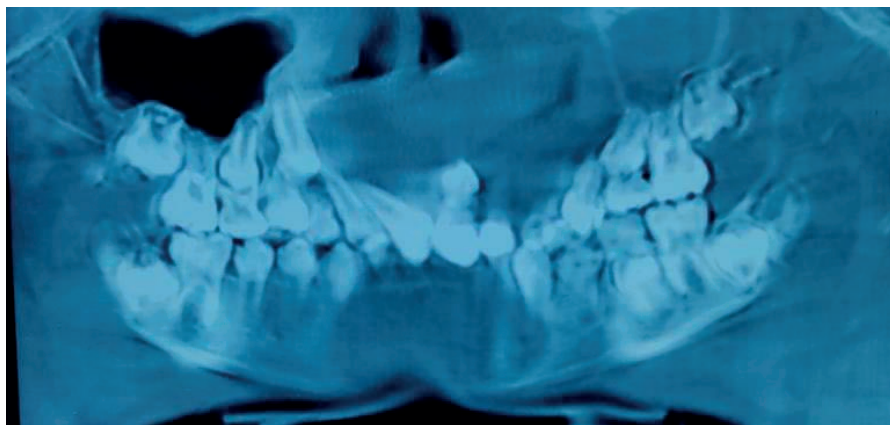
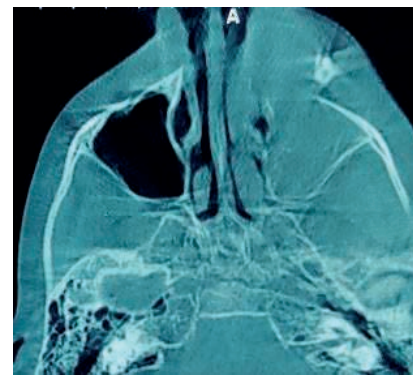
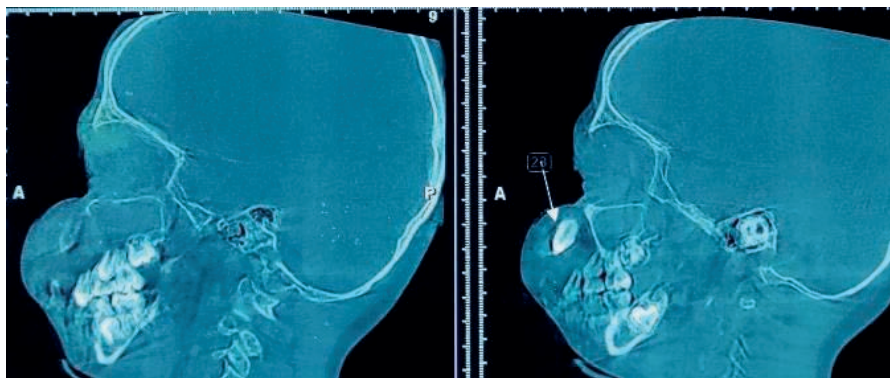
**A swelling extending from 53 to 63, which causes protrusion of upper lip by obliteration of the labial vestibule**

**An acrylic plate is placed over the labial vestibule after marsupialization**



CECT images showing evidence of large expansile cystic lesion measuring 5.8\*4.7 cm noticed in superior alveolus originating from unerupted tooth. The lesion encroaching into maxillary antra with oroantral and oronasal communication.

**FIGURE 4:CBCT IMAGES**



CBCT images with sagittal ,coronal and axial ,panoramic, 3D reconstructed views showing almost complete destruction of anterior maxilla , impacted mesiodens and developing 23.

## Discussion

Typically, dentigerous cysts are painless but may cause facial swelling, asymmetry and delayed tooth eruption. The dentigerous cyst progresses slowly and may exist for several years without being noticed. In most cases it is found accidentally during radiographic examinations. Cyst may extend into other vital structures. When the maxillary sinus is invaded, symptoms usually occur. In such cases, dentigerous cysts in the maxillary sinus may be discovered with routine radiographic examination. In other instances, patients become symptomatic and experience the classic signs of sinus disease. These may include nasolacrimal obstruction, pain, headache.

On radiographic examination, dentigerous cysts appear as unilocular radiolucent cysts of varying sizes, with well-defined sclerotic borders, associated with the crown of an unerupted tooth. Occlusal, Panoramic radiography, Paranasal sinus views and plain skull radiography are simple and inexpensive methods that can be used to visualize a cyst. Panoramic radiographs are preferred over CT, for dental evaluation. Freedland and Henneman—reported that for the evaluation of a lesion of maxillary sinus, more than 1 film is necessary to determine the actual position. CT scans provide more detail, allowing for the visualization of the size and extent of the lesion with determination of orbital or nasal invasion or involvement. For dental examination. Therefore, CT may be more valuable than plain film radiographs, not only for definitive diagnosis, but also for evaluation of the associated pathology, exact localization of the ectopic tooth, and proper treatment planning. Although dentigerous cysts can involve any unerupted tooth, they usually involve third molars and rarely involve unerupted deciduous teeth, supernumerary teeth, or odontomas. The differential diagnosis of a dentigerous cyst includes other odontogenic cysts and tumours.

Histologically, dentigerous cysts are lined by a layer of nonkeratinized stratified squamous epithelium, with a surrounding wall of thin connective tissue

containing odontogenic epithelial rests. Odontogenic tumours, such as ameloblastoma or epidermoid carcinomas, occasionally arise from the lining of the dentigerous cyst.

Removal of the cyst in total with the associated impacted tooth is a main treatment modality to prevent recurrence. Dentigerous cysts involving the maxillary sinus, with impacted tooth in the antra, can be removed via a Caldwell-Luc procedure. Marsupialization is another treatment, which will try to preserve the tooth associated to it and promote its eruption. Large cysts which involve a larger part of bone that thin the bone dangerously are often treated via marsupialization. According to Litvin et al ,marsupialization was successfully used to minimize the amount of maxillary destruction and surgical morbidity that might have resulted from the immediate enucleation of the lesion for dentigerous cysts within the maxillary antrum. The major disadvantage of marsupialization is recurrence or persistence of the lesion.

## Conclusion

Dentigerous cysts are benign odontogenic lesions arising from the completed crown of impacted, embedded or unerupted teeth, and are most common in the first two decades of life.— We have described a patient with an impacted supernumerary tooth associated with dentigerous cyst in the anterior maxilla ,maxillary sinus presented with maxillary pain and swelling. Unerupted and missing teeth should be investigated to prevent dentigerous cyst and likewise lesions and their unwanted effects by radiographically. Also as there are chances tumour transformation if cysts are forgotten untreated.— Dentigerous cysts are commonly encountered in the practice of dentistry. Most common treatment modalities are enucleation and marsupialization, and are based on the premise that the pathological process can be controlled locally with minimal injury to the adjacent host structures. In cases of child, however, loss of permanent tooth buds in the management of a large dentigerous cyst can be devastating.—

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## SPECTRA OF ORAL CANCER DIAGNOSTICS

Dr. Fathima S.C.R.\*, Dr. Girija K.L.\*\*, Dr. Asish R.\*\*,  
Dr. Ramesh S.\*\*\*, Dr. Mini M.M.\*\*\*

### Abstract

Oral cancer is ranked as the sixth most common malignancy in Asia. Detection of the oral cancer in its early stages may contribute to higher survival rates. Several diagnostic modalities are currently under use and yet many are in their developing stage. The development and implementation of newer diagnostic techniques provide a promising future in the field of cancer diagnostics.

*Key Words: Oral Cancer, diagnostic techniques, recent advances*

### Introduction

Oral cancer is ranked as one of the sixth most frequent malignancies in Asia. The prevalence of oral cancer is high in South and Southeast Asia. In India, every 10 in 10,000 persons have oral cancer though in some districts, the incidence is as high as 21.4 out of 100,000 individuals.<sup>1</sup>

Oral Squamous cell carcinoma accounts for about 90% of oral cancers, 20% of which are preceded by a potentially malignant lesion(PMD). Most of the oral potentially malignant illnesses (OPMDs) are usually asymptomatic making the early diagnosis a difficult process.

Based on National Cancer Institute Data, every 10.8 out of 100,000 individuals have oral cancer in United States.<sup>1</sup> The five-year survival rate in developed nations like the United States increased from 53% in the years from 1975 to 1977 to 63% between 1999 and 2005.<sup>2</sup> The increased use of newer diagnostic techniques that identify the disease in its early stages and/or novel chemotherapeutic treatments may contribute to the higher survival rates.<sup>3</sup>

### ORAL CANCER DIAGNOSTICS – OLD AND NEW

The utility of clinical oral examination for the diagnosis of OPMDs is not very successful, despite the possibility that visible mucosal lesions may precede oral malignancies. However, early diagnosis of an oral mucosal lesion will help with therapy and treatment outcomes with lower costs of care as well as decreased morbidity and mortality.

A wide array of diagnostic techniques for oral cancer have been developed and used till date and even many are at a developing stage promising a better future

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**Table 1 – Various methods used for diagnosis of oral cancer**

<p><b>CLINICAL METHODS</b></p> <ol style="list-style-type: none"> <li>1. Physical examination</li> <li>2. Vital staining</li> <li>3. Chemiluminescence based - ViziLite</li> </ol>	<p><b>IMAGING METHODS</b></p> <ol style="list-style-type: none"> <li>1. Plain radiographs</li> <li>2. CT</li> <li>3. CBCT</li> <li>4. MRI</li> <li>5. Nuclear imaging</li> </ol>	<p><b>PHOTODIAGNOSIS</b></p> <ol style="list-style-type: none"> <li>1. Autofluorescence based - VELScope</li> <li>2. Multispectral Fluorescence and Reflectance based - Identafi, OralScan</li> </ol>
<p><b>OPTICAL TECHNIQUES</b></p> <ol style="list-style-type: none"> <li>1. Elastic scattering spectroscopy</li> <li>2. Fluorescence spectroscopy</li> <li>3. Chemiluminescence</li> <li>4. Contact endoscopy</li> <li>5. Raman spectroscopy</li> <li>6. Optical coherence tomography (OCT)</li> </ol>	<p><b>HISTOPATHOLOGIC METHODS</b></p> <ol style="list-style-type: none"> <li>1. Exfoliative Cytology</li> <li>2. Oral CDx System</li> <li>3. Scalpel Biopsy</li> <li>4. Laser Capture Microdissection</li> <li>5. Spectral cytopathology (SCP)</li> </ol>	<p><b>MOLECULAR METHODS</b></p> <ol style="list-style-type: none"> <li>1. Quantification of nuclear DNA Content</li> <li>2. Tumor Markers</li> <li>3. Microsatellite Markers</li> </ol>
<p><b>OTHER DEVELOPING NEWER METHODS</b></p> <ol style="list-style-type: none"> <li>1. Saliva-Based Oral Cancer Diagnosis</li> <li>2. Lab-on-a-Chip</li> <li>3. Artificial Intelligence (AI)-Based System</li> </ol>		

**Physical Examination**

The physical examination, which typically entails two steps—a thorough visual inspection and palpation—is the first and most important way to detect oral cancer. Some of the frequent symptoms include soft tissue thickening, lumps, soreness, difficulty moving the jaw, chewing, and swallowing, ear ache etc. 4 Along with the pathogenic alterations, anomalies in the texture and colour can also be noted.5

**Vital staining**

To detect mucosal abnormalities in the oral cavity, toluidine blue staining, commonly known as toloum chloride, is utilised. Toluidine blue is an example of an acidophilic metachromatic dye that selectively stains acidic tissue components like sulphate, phosphate, and carboxylic moieties (such as DNA and RNA). Toluidine blue combined with Lugol's iodine aids in identifying inflammatory lesions. The degree of differentiation of malignant

lesions can be predicted by this combination, making it a crucial visual staining approach for the pre-therapeutic evaluation of oral cancer.4,6

**ViziLite®**

It is a portable, disposable chemiluminescence-based instrument that illuminates the oral cavity with light at wavelengths of 430 nm, 540 nm, and 580 nm.

When electrons stimulated by a chemical exergonic reaction return to their ground state after being excited, it is referred to as chemiluminescence. Light photons are produced as the electronic potential energy in the molecules changes, which causes the emission of visible light radiation. For many years, this method has been utilised as a diagnostic tool in the inspection of the oral mucosa to find OPMDs or malignant lesions. 7,8

### **Radiolographic techniques**

Plain Radiographs can be used to assess the spread of oral cancer. An orthopantomogram, also called as panoramic view, is often used to detect the involvement of maxillary or mandibular bones in oral cancer.<sup>4</sup>

### **Magnetic resonance imaging**

The soft-tissue discrimination provided by MRI assists in determining the tumor's invasion depth, local and regional spread and lymphadenopathy.<sup>9</sup> Due to its extremely high contrast resolution and multiplanar views, MRI is a reliable method for detecting the spread of tumor to the surrounding soft tissues. MRI helps in identifying the origin, location, and borders of lesions as well. As a result, MRI may be used in conjunction with biopsy for the routine detection of oral cancer cases.<sup>4,10</sup>

### **Computed tomography**

The CT scan employs x-ray radiation and a computer to make images of the body in order to identify the cancerous lesion and assess its spread to other body sections. The CT scan is a commonly available and financially more affordable treatment, making it a standard imaging method for the detection of head and neck malignancies.

However, it has been found that a CT scan cannot detect lesions in the early stages. Minor early-stage tumours in the buccal cavity can be spotted by CT scan only after they have been enhanced with an intravenous contrast medium.<sup>4,11</sup>

### **Positron emission tomography**

The PET scan is used to assess whether tumour cells have migrated to the lymph nodes or other bodily regions. A radioactive dye is ingested or injected, and the gamma rays released by the positron decays are observed. Staging the lymph nodes with this procedure yields precise results.<sup>12</sup> Prior to surgery, lymph node status is assessed using a PET scan with fluorodeoxy-glucose (FDG). PET scanning is therefore essential for the early diagnosis of oral cancer.<sup>4,13</sup>

### **VELScope®**

Visually Enhanced Lesion Scope (VELScope) is an autofluorescence based handheld camera device that emits blue light (400 nm and 460 nm wavelengths) combined with optical filtering in order to visualize oral abnormalities. It is noninvasive and screens for alterations in oral mucosal autofluorescence.<sup>14</sup> Autofluorescence occurs when light of a specific wavelength interacts with cells, causing excitation and re-emission of light of different wavelengths. Human tissues naturally include natural fluorophores such as collagen, tryptophan, elastin, keratin, haemoglobin, and NADH. In OPMDs and malignant lesions, the concentration of these fluorophores changes, which affects the tissues' normal light scattering and absorption characteristics.<sup>8,15</sup>

### **Spectroscopy**

Autofluorescence and chemiluminescence, two non-invasive in-vivo technologies, have been researched for the detection of (pre-)malignant tissue alterations. When activated by light, a number of endogenous fluorophores cause tissues to glow.<sup>16</sup>

The wavelength of absorption is affected by variations in blood volume and oxygenation, which are signs of disease brought on by altered tissue metabolism or neovascularization. Diffuse reflectance spectroscopy (DRS) has been used in studies to identify (pre)malignant tissue alterations in vivo.<sup>3,17</sup>

### **Raman spectroscopy**

Raman spectroscopy (RS) is a type of vibrational spectroscopy. It is one of the non-invasive methods that is most frequently employed for the non-destructive characterisation of molecules and other materials.<sup>18</sup> Using RS, a molecule's vibrational modes that are sensitive to its chemical bonds are investigated. This process creates a distinctive "fingerprint" that makes it possible to identify different substances.<sup>19</sup>



**Identafi®**

It is a multispectral fluorescence and reflectance based probe-like medical device designed for screening of OPMDs and uses three light sources: white light, violet light (405 nm), and green-amber light (545 nm).<sup>20</sup> Identafi® reveals that diseased tissues are more vascular than normal tissues, however this increase is not exclusive to oral cancer. This method also picks up other lesions such oral lichen planus and hyperkeratosis.<sup>8,20</sup>

**OralScan®**

It consists of an intraoral camera with a hand-held multispectral wide-field imaging system for recording diffuse reflectance and tissue autofluorescence. On a personal computer, proprietary software is used to control the monochrome USB camera. A cloud-based machine-learning (ML) algorithm is used to process and evaluate the acquired photos in order to provide real-time user input. The most malignant spot in a lesion can be identified for biopsy with the aid of pseudo-color maps that show differences in oxygenated haemoglobin absorption in tissue.<sup>21</sup>

**Optical Coherence Tomography**

Optical Coherence Tomography(OCT)is a non-invasive tomographic imaging technique used to find cancerous, dysplastic, and inflammatory lesions. In order to create a cross-sectional architectural representation of tissue, OCT captures subsurface reflections. Gold nanoparticles with surface plasmon resonance can be used to improve the contrast in these photographs.<sup>3</sup>

**Exfoliative Cytology**

This include microscopical examination of shed cells from an epithelial surface. The cytological smear is usually reported into five classes – Normal, Atypical, Indeterminate, Suggestive of cancer and Positive for cancer.

**Oral CDx System**

This refers to a highly specialized, computer assisted analysis of oral brush biopsy. It can be performed in the dental office and is available as

oral CDx test kits. The oral CDx computer which scan the specimen, can detect abnormal oral epithelial cells. The result may be grouped as negative, positive or atypical.

**Scalpel Biopsy**

It involves controlled and deliberate removal followed by microscopic examination of tissue from a living organism, and includes incision biopsy, excision biopsy and punch biopsy.

**Spectral cytopathology (SCP)**

It is a recently established method for diagnosing disease in exfoliated cells. Papamarkakis et al. used infrared micro-spectral measurement to gather data on the biochemical makeup of each cell, which was then analysed using many variables. These distinctive spectral patterns could be replicated and were subjected to multivariate statistical analysis in order to identify cells that were molecularly involved in viral infection, dysplasia, or neoplasia.<sup>22</sup>

**Laser Capture Microdissection**

Laser capture microdissection (LCM) has substantially accelerated attempts to define the molecular basis of malignancy and improved the accuracy of cancer biology research. LCM offers a perfect technique for removing cells from specimens while preserving the precise shape of both the captured cells and the surrounding tissue. A more precise microdissection can be achieved by combining fast immunohistochemical staining methods with LCM.<sup>23</sup>

**DNA-Analysis**

DNA image cytometry detects ploidy status of cells to assess it's potential for malignancy. The samples are compared to a reference set of cells after being stained with Feulgen dye. Recently, a computer-aided study was created to find variations in cellular DNA content. Genomic instability aids in the development of cancer, and aberrant DNA content can help identify dysplastic tumours that may progress.<sup>3,24</sup>

### **Tumor Markers**

These are biochemical substances - hormones, enzymes or proteins present in circulation, body fluids or cells - which can be used to monitor or identify the presence of any tumour. They are either produced by cancer cells or by the host as a response to the cancer. They can be grouped into Genomic Markers, Proliferative Markers, and Differentiation Markers

### **Microsatellite Markers**

A recently identified mechanism of mutation in cancer is generalised genomic instability, which can be seen as somatic alterations in allele sizes at microsatellite loci in tumours compared to peripheral lymphocyte DNA. Microsatellite analysis of allelic loss is done with the help of polymerase chain reactions.<sup>25</sup>

### **Saliva-Based Oral Cancer Diagnosis**

Saliva testing, a non-invasive substitute for serum testing, may be a successful tool for diagnosing oral cancer, assessing the prognosis, and tracking post-therapy status. Apart from the fact that it may be obtained non-invasively, saliva offers many advantages over serum as a diagnostic tool. It can be used to assess proteomic or genomic targets such as enzymes, cytokines, growth factors, metalloproteinases, endothelin, telomerase, cytokeratins, mRNAs, and DNA transcripts as well as evaluate certain salivary macromolecules.<sup>3,26</sup> Salivary biomarkers including thioredoxin, IL-8, SAT, ODZ and IL-6 had been used successfully in the diagnosis of oral cancer.

### **Lab-on-a-Chip**

Lab-on-a-chip and micro-total-analysis systems (TAS), as well as microfluidics technology, are general terms for the adaption, miniaturisation, integration, and automation of analytical laboratory techniques onto a single device or "chip." The silicon integrated circuit chip, which has transformed electronics, computers, and communications, is frequently viewed as the chemistry or biotechnology counterpart of microfluidics. Membrane-associated cell proteins

that are exclusively expressed on the cell membranes of oral dysplastic and cancer cells, as well as those cells' particular gene transcription profiles, are used in the chip's detection of these cells.<sup>3,27</sup>

### **Artificial Intelligence (AI) based System**

Recent advancements in artificial intelligence (AI) technology have been used to enhance diagnoses, which is beneficial for the early detection of oral cancer. AI, which uses machines to simulate human thinking and behaviour, has a significant impact on all aspects of our daily life, including medical diagnosis.<sup>28</sup> AI-based technology with clinical decision making or diagnoses systems can be useful modalities in oral cancer screening, lesion discrimination, and prediction model.<sup>29</sup> The rapid development of AI-based systems will have great impact on the screening and diagnosis of OPMDs and oral cancer. However, this technology is still in its infancy and there is a need for in-depth development prior to use as aids for diagnosis and for the prediction of oral cancer risk.<sup>8</sup>

### **Conclusion**

An early detection of oral cancer would help to have a better prognosis and fewer harm from its treatment. The diagnosis of oral cancer may be achieved by a number of diagnostic modalities. Newer non invasive techniques inclusive of various optical and photo diagnostic methods like ViziLite®, VELScope®, Identafi®, OralScan® provide a possibility of an easier chairside diagnosis of oral cancer and OPMDs. In addition, a variety of innovative approaches are also being developed towards this goal. The research and development in the field of oral cancer diagnostics provide a tremendous promise in the clinical application of these techniques.

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## A RARE CASE OF DENTIGEROUS CYST ASSOCIATED WITH LARGE COMPLEX ODONTOMA IN A YOUNG GIRL

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Dr Ramesh S\*\*\*, Dr Mini M M\*\*\*

### Abstract

Odontomas are most commonly occurring tumours of the jaw.(1) However, existence of complex odontoma with dentigerous cyst in paediatric population is rare. Present case report is aimed at describing clinical, radiologic histopathologic features of a large complex odontoma associated with dentigerous cyst in a young girl.

*Key words: Complex odontoma, Dentigerous cyst, Radiographic imaging.*

*Acknowledgement: Special thanks to Department of oral and maxillofacial surgery and Department of Oral Pathology, Govt Dental College, Trivandrum.*

### Introduction

Odontoma is the most common odontogenic tumour of epithelial and mesenchymal origin and usually present without clinical symptoms. It can be divided into compound odontoma and complex odontoma. Compound odontomas are calcified tissue and they bear similarity to the teeth, whereas complex odontomas do not show similarity to the tooth. Diagnosis of the odontomas is usually accidental on radiographic examination.(1)

Dentigerous cysts are one of the most common developmental odontogenic cysts involving the unerupted or impacted tooth.(2) When dentigerous cyst and odontoma occurs concurrently, there is possibility of combined lesion attaining a larger size and potential for significant jaw destruction.(3)

### Case report

A 10-year-old girl reported with complaint of painless, gradually increasing swelling on left side of lower jaw since 1 month without any history of trauma and associated symptoms. Clinically patient

was healthy with an unremarkable medical history.

Upon extra oral examination facial asymmetry due to a diffuse swelling on left side of face in the mandibular body angle region was noticed. on palpation bony hard diffuse nonreducible, noncompressible, nontender swelling on left side of mandible extending from midway of the body to ramus with bilateral level 1b reactive lymphadenopathy was observed.



Figure 1  
Extraoral photograph



Figure 2  
Intraoral photograph

Intraoral examination revealed missing 37 with an expansile, nontender, bony hard swelling extending from mesio-buccal aspect of 36 with bicortical expansion along the alveolar ridge in the region of clinically missing 37 up to coronoid region. Surface over the swelling appears normal and no teeth tenderness on percussion and teeth mobility was elicited.

Blood investigation, panoramic radiograph, CT scans were advised.

Blood report showed normal Hb, TC, DC, ESR, CT, BT, serum Calcium, Phosphorous, Alkaline phosphatase values.

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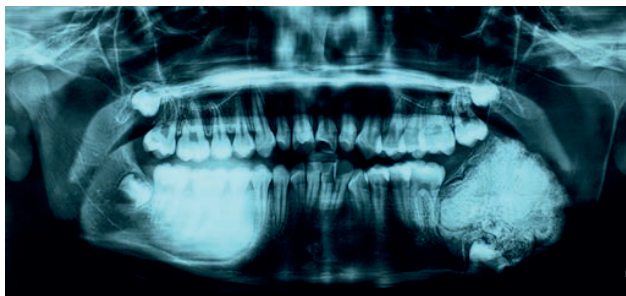


Figure 3 Panoramic view

Panoramic radiograph revealed an expansile mixed radio opaque, radiolucent lesion with well-defined sclerotic margin of size 6\*4cm extending from distal aspect of 36 up to left condylar neck involving entire ramus. The lesion pushing the tooth bud of 37 towards inferior border with loss of continuity of inferior border noted. A non- homogenous oval shaped radio opacity with well-defined radiolucent borders seen within the anterior part.

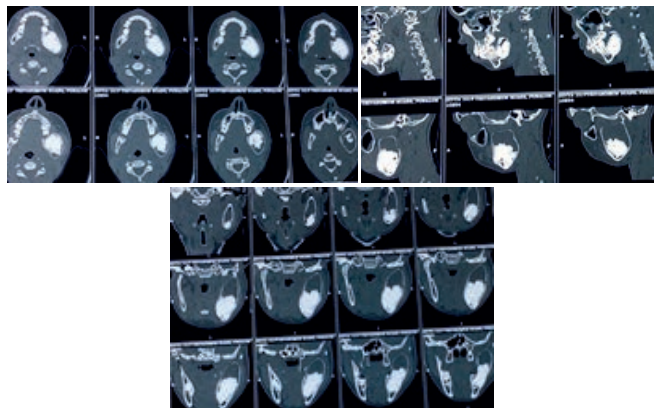


Figure 4 CTscan images

CT report showing large expansile lytic lesion with sclerotic margin seen in the left ramus of mandible, causing surface erosion. Features suggestive of neoplastic growth.

Differential diagnosis of ossifying fibroma, calcifying epithelial odontogenic tumour, and dentigerous cyst with odontoma and ameloblastic fibrodontoma were proposed as possible clinical radiographic diagnosis.

Lesion were excised and send for histopathologic examination

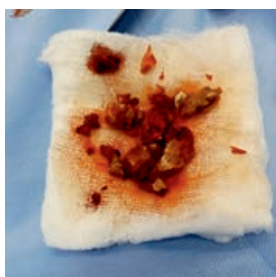


Figure 5  
Excised odontome

Histopathology reports confirmed Dentigerous cyst associated with Complex Odontome.

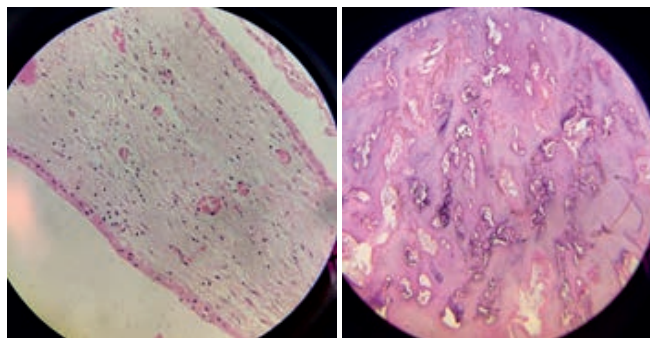


Figure 6 Histopathologic images



Figure 7 Post operative Panoramic radiograph

### Discussion

According to 2005 World Health Organization (WHO) classification of odontogenic tumours, there are two types of odontomas, compound (small tooth like structures) and complex (a conglomeration of dentin, enamel and cementum) odontomas.(4)In 1974,Shafer, Hine and Levy described odontomes as tumour of odontogenic origin but their current views support that an odontoma is as a hamartoma.(5) Clinically, they are classified as intraosseous (central), peripheral (soft tissue or extraosseous), and erupted odontomas. The term odontoma was first coined by Broca in 1866, who defined it as a tumour formed by overgrowth of complete dental tissue. Odontomas are the most frequently occurring odontogenic tumors which constitute 22% of all the odontogenic tumors of the jaws, characterized by their slow growth and nonaggressive behavior. The etiology of odontoma is still unclear, despite several theories have been proposed, and various causes including trauma, infection, family history and genetic mutation have been postulated. (6)The frequency of complex variant constitutes between 5 to 30 % of all

odontogenic tumors. Usually they are located in the posterior mandible and the second most common site is the anterior maxilla. They are usually symptomless and often prevent the eruption of contiguous teeth; they are frequently discovered incidentally during routine radiographic examination. Sometimes it may include retention of permanent teeth, bone expansion, pain, and tooth displacement (7). In this case odontoma was observed on the posterior mandible, with bony expansion and it prevent the eruption of 37 on that region, satisfying the results of odontoma related studies.

Odontomas present different stages of development which can be identified based on radiological features and the degree of calcification of the lesion. The first stage is characterized by radiolucency; the second stage shows partial calcification and the third stage exhibits predominant tissue calcifications with the surrounding radiolucent halo (7). In this case odontoma was in third stage with predominant tissue calcification with surrounding radiolucent halo. Histologically, the odontoma is not a diagnostic dilemma. It is composed of dentin, cementum, pulpal tissue and enamel. However, mature enamel is lost during the decalcification processing and will not be seen on conventional hematoxylin and eosin-stained slides. Complex odontomas consist of an irregular mass of mature hard and soft dental tissues, which has no resemblance to teeth. Odontoma has a limited growth potential, but it should be removed because it contains various tooth formulations that can predispose to cystic change, cause interference with eruption of permanent teeth and considerable destruction of bone. Odontomas can cause cystic degeneration, although this is considered to be a rare phenomenon. The early diagnosis and management of odontomas is important because these are a major category of odontogenic tumors occurring within the jaws. Odontomas are usually managed by conservative surgical excision. Prognosis after treatment is very favorable, with rare risk of recurrence.

Dentigerous cysts are odontogenic cysts that are attached to the cemento-enamel junction of the unerupted tooth. Occasionally they are associated with supernumerary tooth or odontoma. They are

most frequently involved mandibular third molars and maxillary canines. Dentigerous cysts are typically asymptomatic and are an incidental finding on routine radiographs. They are rarely painful and any pain suffered is associated with infection in the lesion. In some instances, these cysts can grow to very large size and affect the surrounding anatomical structure such as the mandibular canal, can trigger the inflammation, expansion and erosion of the cortical bone. They are solitary; however, multiple cysts may be seen with syndromes such as Gardner's syndrome, mucopolysaccharidosis, Maroteaux Lamy syndrome and basal cell nevus syndrome. Radiographically, the dentigerous cyst usually occurs as a well-defined unilocular radiolucency, often with a sclerotic border. Three types of dentigerous cyst have been identified in central variety which the tooth crown is enclosed by the radiolucency, and the crown protrudes into the cystic lumen. The lateral variety in which the cyst occurs laterally along the tooth root, thus, partially surrounding the crown. The circumferential variety exists when the cyst not only surrounds the crown, but also extends down along the root surface, thus, giving the impression of the tooth within the cyst. The standard treatment for these cysts is the enucleation and the extraction of the affected tooth. However, if the patient is a child and the affected tooth is not developed, a more conservative attitude should be considered, such as marsupialization. Dentigerous cysts were diagnosed in conjunction with 27.6% of the odontomas. Radiologically, this association appears as a mixed image containing radiolucent and radiopaque areas, with the differential diagnosis including calcifying cystic odontogenic tumors and ameloblastic fibro odontomas. Usually, they are asymptomatic and this delays the diagnosis. They together are a potential for complications like attaining large size, root resorption, destruction of the jaw bones and sometimes neoplastic changes like ameloblastoma. Prompt diagnosis and treatment is mandatory to prevent complications.(7)

## Conclusion

Expansile pediatric jaw lesions are complicated by the difficulty in diagnosis due to complex anatomy and facial developmental process during infancy

and childhood. These lesions require a systematic approach and a broad consideration of clinical and imaging characteristics to enable reliable diagnosis. Odontomas are common but complex odontoma with dentigerous cyst in pediatric population are rare. Correct diagnosis of the condition facilitates the clinician to adopt a simpler and less complex approach of treatment and ensure better prognosis.

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## JOB'S SYNDROME A RARE IMMUNE DISORDER

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### Abstract

Autosomal dominant hyper IGE (HIES or Job's) syndrome is a rare syndrome characterized by unusual eczema like skin lesions , lung infections and very high concentrations of serum IgE along with facial and dental abnormalities. With around less than 300 published cases it is a very rare disorder affecting fewer than 1 per million people worldwide and thus is rarely encountered by a dentist in his/her clinical practice. However the presence of facial and dental anomalies makes Job's syndrome important in the field of dentistry. This present article reports a case of Job's syndrome presented with atypical eczema , lung infections, history of febrile seizures , history of staphylococcal infections and dental abnormalities.

*Key words: syndrome , autosomal dominant, hyper IgE*

### Introduction

Hyperimmunoglobulin (Ig) E syndrome (HIES) is a rare primary immunodeficiency syndrome with a prevalence lower than 1:1,000,000". The autosomal recessive form of HIES is known as Job's syndrome. It is named after the biblical character Job, whose faithfulness was tested by an affliction with draining skin sores and pustules. In 1966, David et al. first reported Job syndrome in two patients with eczema, recurrent pulmonary infections, and cold lung abscesses. In 1972, Buckley et al. reported the association of this condition with increased serum immunoglobulin E (hyper-IgE) levels and a series of phenotypic features called HIES .The major causal variants of the syndrome are dominant negative variants in the STAT3 .

This condition presents with long-term, severe skin infections. The clinical features can be

classified as immunological manifestations, non-immunological manifestations and oral manifestations. Immunological manifestations include eczema, newborn rashes, boils, recurrent pneumonias, pneumatoceles, candidial infections, peaking of serum IgE levels, eosinophilia and susceptibility to lymphomas. Non immunological manifestations include retention of primary teeth, characteristic face, minimal trauma fractures, scoliosis, hyperextensibility, oral mucosal and gingival abnormalities, hyperintensities on brain magnetic resonance imaging, chiari malformations, craniosynostosis , arterial aneurysms. The commonly seen oral manifestations are failure of primary teeth exfoliation, often preventing the eruption of succedaneous teeth (' OConnelletal, 2000; Domingoetal, 2008). This prolonged retention of primary teeth can lead to permanent tooth impaction or formation of 'double rows', in which succedaneous teeth erupt lingual of the deciduous teeth and predispose to malocclusion. Abnormal persistence of Hertwig's epithelial root sheath in primary teeth was suggested by an early case, but the actual frequency and underlying mechanisms remain to be confirmed ('OConnelletal, 2000).Lesions of the oral mucosa and gingiva, involving the hard palate, dorsal tongue, buccal mucosa, and lip mucosa, have been identified in over 75% of patients ( Domingoetal, 2008). The majority of HIES individuals manifest palatal lesions which consist of a midline fibrotic bridge, either linear or multilobular, and occasionally surrounded by grooves or clefts. Even more prevalent are tongue lesions, consisting of surface grooves of varying depths which may be localized or distributed over the entire tongue surface. The most significant tongue lesion is a deep

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midline cleft anterior to the circumvallate papillae. On the lips and cheeks, mucosal lesions consist of surface fissures and non-rubabble keratotic striations, patches, or plaques, some of which resemble lichenoid formations. All intraoral lesions are asymptomatic and require no intervention. These oral characteristics manifest earlier than the characteristic facial features, highlighting the potential role of oral phenotypes in early diagnosis (Domingoetal, 2008). Oral candidiasis (pseudomembranous, erythematous, median rhomboid glossitis, and angular cheilitis) is also common along with dental caries.(4)

characterized by immunodeficiency and somatic features, such as eczema, Staphylococcus aureus-induced skin abscesses, recurrent pneumonia with pneumatoceles, Candida infections, skeletal/connective tissue defects, and elevated IgE serum levels (>2000 IU/mL).

### Case Report

An 11 year old male patient came to the department of Oral Medicine and Radiology, GDC Trivandrum with chief complaint of bleeding from oral cavity since 4 days and also complained about multiple carious teeth. On history taking patient had an episode of vomiting 4 days back following which patient noticed bleeding from oral cavity. Patient also had long term history of multiple carious teeth. . Patient's medical history revealed history of right lung cyst and bronchiectasis and history of right upper lobectomy. Patient had history of multiple episodes of seizures in the past and is under medication. On examination extra oral findings included multiple skin colored papules present over the face (on the cheeks, chin, nose and ear lobes)and neck. Multiple discrete and confluent well defined healing erosions with surface showing crusting present over left preauricular area and right cheek. Healing erosions with surface crusting in the medial aspect of right leg. Multiple atrophic scars in the trunk and lower limbs. External hordeolum in both eyes. Clubbing of all finger nails with thickening and dark discoloration of finger nails noticed. On intra oral examination, no active bleeding sites are noticed. Hyperpigmented areas were noticed on the

hard palate and whitish areas were noticed on bilateral buccal mucosa. Multiple root stumps of primary teeth were noticed. All permanent first molars had dental caries. Deep dental caries was seen in multiple deciduous teeth and multiple permanent teeth were erupting in abnormal positions.

### Extra Oral Examination



### Intra-oral



Radiographic findings revealed missing upper right first premolar. Blood investigation reports revealed Hb to be 9.7gm/dl and a high ESR of 65mm/hr. peripheral smear revealed hypochromic microcytic anemia and neutrophils with toxic granules and moderate eosinophilia noticed. A very high level of immunoglobulin IgE (23387) was noticed. The higher levels of IgE gave suspicion of HIES and patient was referred to department of pediatrics and a diagnosis of Job's syndrome was made.

### Discussion

Job's syndrome is a multisystem disease characterized by markedly elevated serum IgE, relapsing bacterial infections of skin and respiratory tract, atopic dermatitis-like dermatosis and skeletal abnormalities. Its prognosis depends upon the efficacy of anti-infectious measures since life-threatening infections due to bacterial but also mycological and viral infections are observed. Another negative prognostic factor is the possible development of B-cell neoplasias or leukaemia due to chronic stimulation of immune cells by persistent bacterial antigen presentation. Diagnosis can be problematic as there is no clear criteria and symptoms are quite diverse. However, most clinicians diagnose HIES with its clinical features, The most common locations for cold abscesses are the face and the trunk. Pulmonary complications exist in 77% of cases. Patients can have distinctive coarse facies features that become universal by 16 years of age, including asymmetrical faces, hemitrophy, prominent foreheads, broad nasal bridges, mild prognathism and deep-set eyes(5), In which hemitrophy, and deep set eyes were not seen in our case. The eczema in HIES is difficult to be distinguished from atopic dermatitis. However, a long course from early life with atypical distribution such as in the axilla and groin, recurrent staphylococcus infections with cold abscesses and resistant to conventional treatment are signs of HIES dermatitis rather than atopic dermatitis. Job's syndrome is not a common disease but should be considered in individual cases where a resistant atopic dermatitis is accompanied by skin and airway infections. Medical history, careful clinical examination (the face of Job's syndrome) and determination of serum IgE are essential in diagnosing Job's syndrome(6)

### Conclusion

Jobs syndrome is a rare primary immunodeficiency syndrome with limited documentation in the scientific literature. With many oral manifestations and facial anomalies the syndrome gains importance in the field of dentistry. Apart from the typical triad of atopic dermatitis, recurrent skin staphylococcal infections and recurrent pulmonary infections oral facial abnormalities is an important feature. So it is important to properly diagnose the condition and start the treatments as early as possible. General management include long term antibiotics, if bone and joint abnormalities are present surgical management may be required, dental abnormalities require adequate stomatological treatment.

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## SHADE SELECTION BY VISUAL AND INSTRUMENTAL METHODS

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### Abstract

Shade selection plays a major role in anterior esthetic management in prosthodontics. The common methods in shade selection are the conventional method using visual shade guide and using electronic devices; the colorimeter and spectrophotometer. Visual method depends on the observer and the light source while spectrophotometric shade selection eliminates these errors. This article includes the different methods of teeth shade selection done using the visual method and instrumental methods. It also summarises the advantages and shortcomings of both the methods.

### Introduction

Shade selection is an important procedure to provide patients with an esthetic restoration that blends to the patient's existing dentition. The selection of the color of missing teeth that harmonize with the adjacent teeth and surrounding gingival tissue (emergence profile) is one of the most common cause of failure in prosthetic dentistry.<sup>1</sup> Due to the great variety of natural tooth color, achieving a close shade match of an artificial restoration with the natural dentition is a complex process.<sup>2</sup>

Practitioner requires an understanding of color, light and related characteristic of material as well as the ability to clearly communicate instruction with the lab technicians in order to obtain natural looking restoration. Selection of shade and the correct reproduction of this color in the prosthesis are the two crucial steps in shaded matching. <sup>3</sup> In this article we discuss in detail about various methods of shade selection.

### Dimensions Of Color

Three objective variables describe color perception: hue, value, and chroma. They constitute the three dimensions of color space.

**Hue:** Hue refers to the dominant wavelengths present in the spectral distribution, for example red, green, blue. Light having shorter wavelength (400nm) is violet in color, and light having long wavelength (700nm) is red. The dominant wavelength present in the spectral distribution describe the solid color of an object. White, black, and greys possess no hue.

**Value** is the luminous reflectance of a surface. It is the lightness or darkness of color or the amount of grayness. A black standard is assigned a value of 0, whereas a white standard is assigned 10. It is independent of hue.

**Chroma** represents the strength of the color or degree of saturation of the color (color intensity). The higher the chroma, more intense the color.

### Munsell Color Order System

In Munsell color system, Hue is split into ten gradations: • Yellow • Yellow-red • Red • Red-purple • Purple • Purple-blue • Blue • Blue-green • Green. In natural teeth the value vary from 5.5 to 8.5.

### CIELAB COLOR SYSTEM (L\*.a\*.b)

It relates the tristimulus values to a color area. In this system the color differences which the operator perceive correspond to distances measured colorimetrically. Cielab color order defines color area by 3 coordinates L, a and b. The lightness value, referred to as "L\*" defines black at 0 and white at 100. The a\* axis is relative to the green-red opponent colors, with negative values toward green

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and positive values toward red. The  $b^*$  axis represents the blue-yellow opponents, with negative numbers toward blue and positive toward yellow.

### **Factors Affecting Colour Perception**

The primary prerequisites for color perception include three variable elements: The object, a light source for illumination and an observer.

**Light source:** Color perception depends on the quality of light illuminating the object. Natural light occurring around mid day is the ideal light source for accurate color comparison. Color of sunlight is affected by the time of the day, month and weather conditions. If the light source changes, then the light reflected from an object changes too and a different color is perceived. Hence artificial lighting can be used for color matching in the absence of ideal conditions. Dental unit lights emit light high in the red-yellow spectrum and are low at the blue end. Regular cool white fluorescent lights have high green-yellow spectrum. Color corrected fluorescent lights (5000K) render the color more accurately. Incandescent bulbs are now replaced by full spectrum light emitting diodes (LEDs).

**The object:** Color is a physical property of the light that is modified by the object and the total appearance of the material depends on the object's capacity to modify the incident light. Color appears because the material absorbs the radiating visible light, with the exception of the wavelength reflected to the viewer's eyes. A transparent medium allows visible light to pass through. Translucent medium scatter, transmit and absorb portions of wavelengths of visible light. Opaque materials do not transmit, but they reflect and absorb various wavelengths of visible light.

**The observer:** Visible light enters the eye through the transparent area of the cornea and is focused by the crystalline lens on the retina. These specialized receptor cells in retina (rods and cones) contain photosensitive pigments.<sup>8</sup>

### **Metamerism**

Metamerism is the phenomenon where two objects match in color under one condition but shows apparent differences under another. It occurs when one of the variables of the color triad (object, light source, or observer) is altered while the other two variables remain the same.

There are two types of metamerism: Object metamerism and observer metamerism.

Observer metamerism occurs when the light source remains the same and the observer is changed. It is recommended that a third observer should evaluate the selected color prior to cementation of any final restoration.

Object metamerism occurs when the two items appear the same in one lighting condition, but appear differently when the light source is changed. It is advisable for the viewer (technician, clinician and assistant) to observe the color matching under three different lighting conditions - daylight, color-corrected light and dim light to obtain an appropriate shade matching.<sup>8</sup>

### **Methods Of Shade Selection:**

#### **Visual Method**

Visual color determination by comparison of patient's tooth with a color standard is the most frequently applied method in clinical dentistry.<sup>5</sup> Tooth shade matching is most frequently performed visually using dental shade guide. The first shade guide was introduced in 1956 by Vita Zahnfabrik.<sup>9</sup> Dental shade guide contains a certain number of different shades samples made from different materials depending on the kind of restoration that will be performed and is based on a comparison of a patient's tooth with a color standard.<sup>5</sup> Visual methods are mostly based on clinician's experience and dependant on conditions existing in dental operatory at the moment of tooth shade assessment.

There are various shade guides for different kinds of composite resin materials, porcelain and acrylic resins (e.g.: Vita3D-Master, IPS Impulse, Vita Classical Shade guide, Enamel Plus HFO Shade Guide, Classic Shade Guide, Trublend, Filtek Supreme Plus Universal Restorative, Chromascop

Shade Guide).<sup>6</sup> The most popular shade guides include the vitapan classical shade guide, Vita 3D master shade guide system, and the chromascop shade guide system.

The Vitapan Classical shade guide (Vident, Brea, Calif) was a gold standard in dentistry for decades and, to a large extent, still is. Vitapan Classical shade tabs are divided into four groups, with primary group division based on hue. Within the groups, tab arrangement is based on increasing chroma-the more chromatic tabs are marked with higher numbers. Hue is categorized by letter i.e., A = Orange, B = Yellow, C = Yellow/Grey and D = Orange/Grey. Chroma and Value are categorized by numbers i.e., 1 = least chromatic and highest value, 4 = most chromatic and lowest value. Group A consists of five tabs (A1, A2, A3, A3.5, A4); groups B and C consist of four tabs each (B1, B2, B3, B4 and C1, C2, C3, C4, respectively); and group D consists of three tabs (D2, D3, D4). The manufacturer also provides an alternative tab arrangement, claimed to be established according to degree of brightness (commonly known as value scale) and with no group division.<sup>2</sup>

The Vitapan 3D Master shade guide (Vident) was modified with the introduction of 6 groups in it. No. 0 for the shade matching of bleached teeth. It consists of 26 tabs divided into five groups according to lightness. The first group consist of two tabs; the second, third, and fourth groups have seven tabs each; and the fifth group consists of three tabs. Within this groups, tabs are arranged according to chroma (vertically) and hue (horizontally). Three bleaching shades (OM1, OM2, and OM3) were additionally introduced, indicating high lightness (0), three levels of chroma (1, 2, 3), and medium hue (M).

The Vitapan 3D Master color guide is designed identically to the corresponding shade guide (i.e. 26 shades), except that its tabs include only the dentine shade, with no cervical or incisal shades. Several important characteristics have been improved with Vitapan 3D Master as compared with the Vitapan Classical shade guide: the lightness range is wider; more chromatic tabs are included; the hue range is extended toward reddish spectra part; the shade tabs

are more uniformly spaced; group division is better; and, although certain disharmony still exists, the overall tab arrangement is better. One of the other advantages of VITA 3D-Master is repeatability of shade selection with the system.

Chromascop shade guide tabs (Ivoclar Vivadent, Amherst, NY) similarly to Vitapan 3D Master, a group 0, consisting of four bleaching shades (010, 020, 030, 040), was additionally introduced. It uses only numbering system to identify the shade. Chromascope is arranged in groups based on the hue (100 = white, 200 = yellow, 300 = orange, 400 = grey, 500 = brown) and within the groups according to increasing chroma from 10 to 40.<sup>2</sup>

The Vintage Halo shade guide (Shofu Dental, Menlo Park, Calif) is basically keyed to the Vitapan Classical shade guide. It consists of 38 tabs, divided into three sets according to decreasing lightness: Value Plus (14 tabs: VB1, VB2, VB3, VB4, VA1, VA2, VA3, VA3.5, VA4, VR1, VR2, VR3, VR3.5, VR4, Standard (16 tabs: B1, B2, B3, B4, root B, A1, A2, A3, A3.5, A4, root A, R1, R2, R3, R3.5, R4, and low value (8 tabs: D2, D3, D4, C1, C2, C3, C4, rootC.<sup>2</sup>

A further development is the introduction of new shade guide, i.e., VITA Linear guide 3d-Master which enables the quick determination of precise tooth shades and uses same principles found in VITA 3D-Master guide, only difference is, it is sleeker, linear design.

### **Instrumental Methods**

Microcolor colorimeter (Photoelectric tristimulus colorimeter) is an independent measuring system that requires no outside power source. Dyed polymer optical filters are deposited on top of photodetector cells in a particular pattern. Each photodetector will at that point produce an output signal that is controlled by the overlying optical filter. This measure each primary color component of incident light. The data given by three photodetectors (one specifically enlisting tristimulus value x, y, z each) allows the plotting of incident light's color within color triangle.<sup>6</sup>

Silicon photodiode array: it has an integrated

transimpedance amplifier that gives a low impedance voltage source and augments the dynamic range of output signal. An oscilloscope or 4 - channel chart recorder monitors the output signal. It is an appropriate methods for wiping out the hindrance related with photoelectric kind of colorimeter, which is actually unpredictable and costly. The silicon photodiode requires both an outer force source and standard light source. It is less inclined to overheating and is less expensive.<sup>6</sup>

Electric recording spectrophotometers: These were utilized to quantify the shadings and the information were changed over to Munsell documentations. The idea was to determine the spectral reflectance of the various colors and convert them into numerical values. This was accomplished by first deciding the relative reflectance by comparing it to a known reflectance value. Total reflectance and tristimulus co-ordinates (x, y, z) were determined from every total reflectance curve utilizing (1931) the CIE standard observer functions and standard light source D. They are then converted to corresponding CIELAB color system, and the color was determined through the difference calculated from each value.

Intraoral advanced cameras (Nikon Coolpix 990, Kodak, Nikon D-50, Olympus) used to record tooth shades and give fast and more point by point solution of the chosen shade in a type of computerized information or printed photos. It gives the exchange of nuances in shade transition, craze marks, clarity, translucency, occlusal groove stains, incisal haloes, surface and gingival body color to a dental professional, which is not possible while utilizing conventional cameras or photographs. The utilization of photographs prepared customarily may not be an ideal way of direct color communication, as there is a lack of constancy among cameras and printers that can make the acquired pictures different from actual color of the tooth. The extraoral digital camera is similar to the intraoral camera device, supportive in tooth shade evaluation. Data transfer is less precise and more time consuming. Digital camera imaging systems are more reliable in tooth colour quantification than colorimeters and

spectrophotometers, which are designed for flat, bigger surfaces, rather than curved, small, semi translucent surfaces found on the teeth.

Spectroshade: The windows-based spectroshade framework uses double advanced cameras connected through optic filaments to a completely functional spectrophotometer. As the framework definitely quantifies color characteristics of natural tooth, it demonstrates the deviations of significant value, chroma and hue from a norm, accordingly giving data to alter and accurately match the tooth. The multifocal double lighting component illuminates the tooth in such a way that the readings of its translucency and reflectivity are determined paying little heed to ecological lighting conditions. Dental images can be magnified, highlighted, rotated and measured. The split screen feature allows the comparison of before and after images. It provides full face pictures on an intraoral camera, patient data (including images), spectral information, etc., stored on the 20 GB HDD hard drive, which is available for internet transfer to laboratory or can be transferred to a CD-ROM. <sup>4</sup>

Shadescan: Utilizes digital artificial vision technology with CAD/CAM. Shade is estimated by a hand-held optical gadget from the single picture of the whole tooth at a snap. A shade map of the entire tooth with various established and popular shade systems is obtained. It creates a paint-by-numbers guide of tooth, keying different zones of the dental surface to the selected shade guide by utilizing different resolution; the translucent and opaque areas are identified. Differences in hue, chroma and value between natural tooth and shade guide ceramic are indicated by directing small color modifications. The markings on the tooth are identified and highlighted. This indicates the surface texture. Images are available for electronic transmission to the lab by disk, or e-mail. <sup>4</sup>

Shadeeye - NCC: It comprises of two parts - a principle unit that incorporates an integrated printer and a mobile measuring unit that is the size of a cell phone. The mobile wireless measuring unit analyses the tooth shade digitally and instantly transmits the information to the main unit through an infrared interface. It calculates the appropriate porcelain

mixture. It visually eliminates disruptive factors such as the angle of viewing and position of the patient or dentist. The data, transmitted via disk or e-mail, can be processed on any PC/laptop. The technique involves the placing of a disposable contact tip in the gingival one-third of the tooth and then a color and shade map of the tooth is generated.

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**IKAM:** IKAM combines the latest digital photographic technology and an innovative color analysis software. The color reference system of IKAM is based on actual fired ceramic samples rather than traditional shade guides, eliminating subjective interpretation. Dentist selects the level of detail for each specific case - coarse (predominant shade), medium or fine (detailed analysis). Selected image level produces a shade map of the tooth. The digital camera captures two images of the tooth - glossy and matte. IKAM corrects the distortions by eliminating reflections so that the color underneath can be analysed. The data of the images is encrypted and transmitted to the lab via internet over to the internet to the laboratory. The software also guides the technician in choosing the proper combination of ceramic colors.

**Shade-Rite:** This shade measuring device is handheld and portable. It a specialized imaging software analyses the shades of the tooth to be restored and the surrounding teeth. The cone-shaped sensor is pointed at the tooth to be replaced; the images are acquired, and it is replaced in its cradle. As the unit enters into the docking station, it initiates the system's software. The data is uploaded and software selects the most appropriate shades from the designated ceramic system, creating a prescription for the laboratory. The files are readily accessible and easily transmitted via the internet.

### Conclusion

The color and appearance of teeth is a complex phenomenon, with many factors such as lighting conditions, translucency, opacity, light scattering, gloss and the human eye and brain influencing the overall perception of tooth colour. Each individual perceive color differently here the knowledge and skill of each practitioner always play a significant role. There are several factors that can influence the

clinician color assessment. So only using traditional shade matching technique is not enough to get accurate shade. Technology based system provides an accurate shade selection and natural looking restoration.

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# DURABILITY OF VENEER COMPROMISED BY FRACTURE: BASED ON LITERATURE REVIEW

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## Abstract

Dental porcelain veneers are thin-shells of tooth colored translucent material made to fit over a tooth for the purpose of improvising the color, shape and over all esthetic appearance. Dental veneer provides a dramatic makeover to ones smile and currently has a growing demand among consumers because of its durability and versatilities. It's a conservative method to create life like appearance of natural teeth which boost up one's self esteem remarkably. A successful fixed prosthodontic treatment is influenced by proper treatment plan, proper choice of restorative material, dental preparation of precise technique, contamination free operative field and of course patient compliance. Despite of all the precautions taken, failure of a veneer in due course is inevitable in some cases where fracture constitutes a part.

*KEYWORDS: Dental Veneers, Fracture, Restoration Failure*



## AIM

The purpose of this article is to analyze the incidence causing porcelain veneer failure due to fracture based on reviewing the current available literature.

## CONTENTS

### Introduction

Dental veneers are one among the most conservative method to correct a disfigured tooth within a relatively short time and reasonable cost where patients esthetic concern plays a prime concern. Based on several literature review, the survival life of ceramic veneer bonded to enamel is relatively good up to a period of 15 years or beyond.

### Methodology

An electronic search for articles in relation to porcelain fracture were done using databases: Medline, PubMed, Google scholar, EBSCO; using the following descriptors: “Porcelain veneers”, “ceramic veneer”, “Fracture”, ‘Restoration failure’. The search included only English-language articles published in dental journals where details were collected and duplicated. Inclusion criteria: articles published between the years 1995 to 2020.

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## RESULTS

Author	Study Design	Aim	Methodology	Results
Maria Granell-Ruiz et al, 2014 <sup>7</sup>	Retrospective clinical study	Determine effect of bruxism and the use of occlusal splints affect the survival of porcelain laminate veneers	Restorations were made in 70 patients, including 30 patients with some type of parafunctional habit.	Analysis of the ceramic failures showed 13 fractures, 8 fractures were related to the presence of bruxism
Beier et al, 2012 <sup>5</sup>	Retrospective clinical study (20 yrs)	Evaluate the clinical quality, success rate, and estimated survival rate of anterior veneers made of silicate glass-ceramic	Anterior teeth in the maxillae and mandibles of 84 patients (38 men, 46 women) were restored with 318 porcelain veneer restorations between 1987 and 2009	Survival rate of 94.4% after five years and 93.5% after ten years; they found the main reason for failure is a ceramic fracture
Gonzalez et al., 2012 <sup>14</sup>	Literature Review	Scientific data collected on ceramic veneers faults.	Review was conducted by searching for original articles on the subject in PubMed periodicals from 1990 to 2012	The most important parameters to determine the success and longevity of the laminates are: correct selection of the case, use of the ceramic as a restorative material
Gurel et al., 2013 <sup>10</sup>	Retrospective clinical study up to 12 yrs.	Evaluate failure rates of (PLVs) with influence of enamel preservation	580 laminates were bonded in 66 patients and analyzed for failure when preparation was confined to enamel and dentin	The most frequent type of failure noted was fracture
Castelnuovo et al, 2000 <sup>2</sup>	In vitro study	Evaluated fracture load and mode of failure in veneers	50 maxillary central incisors were prepared with 5 different tooth design and ceramic veneers were bonded. Fracture loads were recorded	Preparation with 1mm incisal and palatal reduction and 4mm incisal reduction and 1mm palatal reduction exhibited fracture
Peumans et al, 2004 <sup>11</sup>	Prospective 10yr Clinical trail	Evaluate clinical performance of veneer	Porcelain laminates placed on 87 maxillary anterior teeth in 25 patients And were recalled for evaluation after 5 n 10 yrs	Fractures of porcelain (11) percentage constituted major failure along with marginal defects

## Discussion

Porcelain veneer used in fixed partial dentistry can offer exceptional satisfaction to both patient and dentist. It can transform an unhealthy, unattractive dentition with poor function into a healthy one along with enhancing the esthetics.

Veneers are usually made of composite resin or with a porcelain offering a greater quality and color stability to the tooth. The restorations of composite can be fabricated within the mouth and whereas porcelain requires a laboratory setting.

As the demand of esthetic dentistry is booming currently in clinical practice it is important to clearly understand where and when the treatment is indicated and how it should be properly executed to be delivered. This entirely depends on the operator's skill and the experience.

In order to limit the instances of failure, a better understanding of different factors that influences the success of ceramic veneer is required.

**Indication of dental veneers are**

- ❖ Discolored tooth due to staining (medicinal, beverage, fluorosis)
- ❖ Abnormal shape and size (morphology, fracture)
- ❖ Mild spacing (diastema, minor mal positions)
- ❖ Repair of fractured crown and bridge facing
- ❖ Altered color due to devitalization
- ❖ Attrition or abrasion

**Contraindication of dental veneers are**

- Improper case selection
- ❖ Patients with parafunctional habits
- ❖ Poor oral hygiene
- ❖ Insufficient tooth structure
- ❖ Evident crowding and severely mal positioned tooth
- ❖ Inflamed periodontium and short labial bracing
- ❖ Excessive restorations

Selection of ideal material is an important criterion during treatment planning with consideration of each veneer materials benefits and limitations in order to avoid failure.

Since history there has been evolution of new materials replacing the early ones to limit their short comings such as bulkiness requirement, difficulty encountered while finishing and polishing, abrasion of opposing tooth and staining in oral environment. Feldspar material with high concentration of potassium oxide provides resistance to porcelains and components like silica, oxygen, alumina added to dental porcelains provide better qualities of melt temperature, viscosity, mechanical strength,

translucency and opacity. They provide greater resistance to reduce points of tension during their cooling, thus blocking the propagation of cracks and avoiding possibility of fractures<sup>1</sup>. Advantages is that as the material is very thin and translucent it appears moreover like natural tooth. Feldspathic porcelain is etched with hydrofluoric acid which gives a great bonding strength to the remaining enamel.

Feldspathic porcelain has some disadvantages. The fabrication of feldspathic porcelain can be done by two methods: the refractory die technique and the platinum foil technique (Horn 1983, Plant & Thomas 1987, Clyde & Gilmour 1988) these methods are technique sensitive and the fabricated veneer needs good care prior to bonding<sup>2</sup>. Masking of badly discolored tooth is difficult because the porcelain is very thin. It was reported that etching the inner surface of the porcelain can cause micro-cracks which can lead to decrease the flexural strength of the porcelain and eventually fracture the veneer<sup>15</sup>. In order to overcome the disadvantage of feldspathic porcelains of being brittle under traction, reinforced ceramics were introduced with addition of alumina, leucite, lithium disilicate and zirconia. They increased the fracture resistance as well as made it possible to use minimal tooth preparation<sup>3</sup>. A meta-analysis study performed by Mariana et al to evaluate the survival outcomes of porcelain and glass-ceramic veneers concluded that fracture/chipping were the most frequent failure mode<sup>15</sup>.



## Tooth preparation

Expertise as well as technical knowledge of operator is of prime importance for clinical success of a veneer restoration. Dentist must plan the preparation within enamel, as this provides opportunity for a reliable and durable bond between restoration and remaining tooth tissue.

In a 12-year study by Gurel et al 584 veneers, survival rate of 99% was seen in veneer preparation confined to enamel and 94% with enamel only at margins<sup>10</sup>. Preparation into dentine should be avoided as the elastic modulus and flexibility between dentine and porcelain are different. This puts the porcelain at risk of fracture when placed under tensile loading. 7.2% or 42 veneers failed. Those veneers bonded to dentin and teeth with preparation margins in dentin were approximately 10 times more likely to fail than those bonded to enamel.<sup>10</sup>

There are four different designs commonly mentioned in literature

- ❖ Window preparation- incisal edge is preserved)
- ❖ Feather preparation-incisal edge of the tooth is prepared bucco-palatable, but incisal length is not reduced
- ❖ Bevel preparation-incisal edge is reduced lightly (0.5-1mm)
- ❖ Incisal overlap preparation (veneer extend to palatal aspect of tooth)<sup>4</sup>

Tooth should be prepared adequately for enough space to accommodate the material thickness. Former studies have also reported fractures of veneers bonded to large composite restorations due to low adhesion between exposed dentin and resin<sup>10</sup>. Define a proper path of insertion that requires minimum tooth and tissue reduction thereby satisfying the aesthetic and biological demands, besides providing adequate space for the masking of dark spots and for the cementing agent to be able to perfectly fit the ceramic veneers to the full extent.

Health of periodontium is another factor which can contribute to failure. It is necessary to adjust the margins through a final finishing line of the preparation to allow the intra-sulcular location when aesthetics is considered. The margin of the ceramic veneers should remain at the gingival border or with a minimal extent in the groove<sup>6</sup>.

Parafunctional habits can also result in failure of ceramic veneers.

American Academy of Orofacial Pain explains bruxism as is a diurnal or nocturnal parafunctional activity which includes clenching, bracing, gnashing and grinding of the teeth<sup>8</sup>. A study conducted by Magne et al showed success rate for the veneer is reduction of success of veneer in 60% of patients with bruxism<sup>9</sup>.

Optimum isolation during cementation can also ensure predictable results<sup>3</sup>.

Several of previous studies had been done to assess the longevity of porcelain veneers. A randomized clinical study done by Layton and Walton (2012) for 21 years showed survival rate of feldspathic veneers of 96% after ten years and 91% after 20 years<sup>12</sup>. Smales and Etemadi in 2003 has reported a survival rate of 95% for porcelain veneers throughout 7 years in their studies<sup>13</sup>. It is essential to consider that these studies and others that reported high survival rate of porcelain veneers had a strict assessment of remaining enamel and bonding systems.

There have been other studies that reported a lower survival rate for veneers. A retrospective study of 2,563 veneers in 1,177 patients done by Burke and Lucarotti (2009) reported a survival rate of 53% over 10 years<sup>16</sup>. The type of the veneer material used was not mentioned. Restorations were done by general dentists, hence it's possible that preparations of teeth did not meet the expertise of specialist. Another retrospective study was done by Shaini et al., (1997) reported a survival rate of 47% in 7 years which were done by undergraduate students and staff member at Birmingham University in the United Kingdom. The study reported that over 90% of veneers were placed on

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## A JOURNEY THROUGH THE ADVANCEMENTS OF DENTURE BASE RESINS

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### Abstract

Various denture base materials have been introduced and used over the years. The most popularly used option, acrylics have their varied drawbacks such as residual monomer allergy, poor mechanical strength, low fatigue strength, brittle on impact, etc. Thus, continuous efforts have been spent in discovering new and improved denture base materials.

*Keywords: Denture base resin, Recent advances, Digital dentures*

### INTRODUCTION:

Denture base materials have undergone revolutionary advancements throughout the years. Starting from simple prosthesis carved from wood, bone, ivory or merely strung together by silk threads, the humble denture has come a long way over time. Poly methylmethacrylate discovered in the early 1930s is still the most predominantly used denture base material because of its excellent qualities of esthetics, ease of processing, repair and being economical. However, its drawbacks such as residual monomer allergy, poor mechanical strength, low fatigue strength, brittleness on impact, poor conductors of heat, low hardness, high coefficient of thermal expansion, thermal shrinkage, poor color stability of self-cured resins, porosity, crazing, war page, poor adhesion to metal and porcelain and requirement of mechanical retention<sup>1</sup> has led various researchers in a quest on finding newer and more improved denture base materials. This led to the idea of incorporating PMMA with reinforced substances and also the introduction of new and different denture base materials. This article reviews the various advancements in the field of acrylic resins.

### Ideal Requirements

- ❖ **Biological** : Non toxic, non irritant
- ❖ **Chemical** : Inert , insoluble & non absorbant
- ❖ **Physical** : Esthetic  
Dimensionally stable  
Low value of specific gravity / density  
High value of thermal conductivity  
Radiopaque
- ❖ **Mechanical**: High value of modulus of elasticity  
High value of elastic limit  
Sufficient flexural strength  
Adequate fatigue life and high fatigue limit  
Good impact strength  
Sufficient abrasion resistance

### High impact resin

These are rubber reinforced resin basically butadiene-styrene polymethyl methacrylate where the rubber particles are grafted to MMA for better bonding with PMMA.

### Clinical application

Features of high impact strength and fatigue properties facilitates its usage in patients with neuromuscular disorders as they have a tendency to drop their prosthesis regularly

### Supplied as: powder-liquid system

E.g Lucitone 199 , D.P.I Tuff , fricke-high impact.

### Benefits:-

Most widely accepted and successful method of reinforcement of resins. Almost ten-fold increase in impact strength is achieved.

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**Fiber reinforced resins:-**

## a) Metal Inserts:-

Metals are added in the form of wires, plates or fillers.

**Benefits:-**

Stronger and possess hypoallergenic effect  
Facilitates making of thin stable narrow dentures  
Imparts natural feel and is dimensionally stable

## b) Carbon fibres:-

Loose strands or woven mat carbon fibers are added to PMMA

Since the dry fibers are difficult to handle, they can be wetted with monomer to form tows of wet fiber to improve handling features.

**Benefits:**

- Improved flexural and impact strength
- Increased fatigue resistance<sup>3</sup>

## c) Aramid Fibers:-

It is an organic compound named polypara-phenylene terephthalamide marketed as Kevlar. Kevlar has a greater tensile strength and modulus in comparison with nylon. The fine nature of the filaments imparts greater strength thereby reducing flaws and defects in the weaker bulk materials.

**Benefits:-**

- These fibers are resistant to chemicals. Thermally stable.
- Have a high mechanical stability.
- High melting point and glass transitional temperature.<sup>4</sup>

## c) Polyethylene fibers

Highly drawn linear polyethylene (HDLPE) fiber is biocompatible and possesses high stiffness and strength hence prevent crack propagation during bending and impact.

**Benefits:**

- Almost invisible in denture base acrylic resins.
- Good biocompatibility.
- Better reduction in water sorption and dimensional changes.
- Better polishing characteristics<sup>7,8</sup>

## d) Glass Fibers

Glass fiber is an inorganic substance based on alumina-lime-borosilicate and is considered to be the predominant reinforcement for a polymer matrix due to their high mechanical properties, low susceptibility to moisture absorption, resistance to chemicals, thermal stability and high melting point. Translucency of glass fibers provides for aesthetically pleasing dentures. The reinforcing effect of the fibers is based on stress transfer from the polymer matrix to fibers and also the behavior of individual fibers acting as a crack stopper.<sup>5</sup>

The reinforcing glass fibers are available in 4 varieties

- Continuous unidirectional (rovings)
- Continuous bidirectional (weaves)
- Continuous random oriented (mat)
- Short random-oriented fiber variety.

i) Continuous, unidirectional fibers the unidirectional fibers provide the highest strength and stiffness to the resin, but in one direction. Reinforcements with unidirectional fibers have anisotropy character and are of great use, when the direction of the greatest loading is known priorly.

When continuous, unidirectional glass partial fiber reinforcement is used in dentures, the fibers should be oriented at a 90-degree angle to the potential fracture line and placed as near as possible to the denture margin, which is prone to fracture.

Reinforcement of other weak regions of the denture is recommended to prevent the occurrence of new fractures. Correct placement of continuous unidirectional fibers in a new denture is difficult hence they are basically used in denture repair.

ii) Continuous, bidirectional fibers

The continuous, bidirectional fibers are net-shaped in nature which are placed in two mutually vertical directions to reinforce the denture in both directions. It has orthotropic mechanical properties hence useful when the precise direction of the effect of greatest loading is unknown. Although reinforcements with net-

shaped woven fibers reinforce the resin to a far lesser degree with regard to the flexure strength, their use considerably increases resistance to fracture for all polymer which makes it important in the case of over dentures.

iii) mat and chopped mat fibers

Continuous fibres are used in random here, to form mat fibres and chopped mat are made with randomly placed short fibres. These reinforcements provide the same mechanical properties in all directions, i.e. isotropic mechanical properties, but are not of much benefit as the fibers can protrude from the polymer matrix and irritate the surrounding mucus membrane with accumulation of plaque.

**Benefits:**

Fiber reinforcement improves the mechanical properties of acrylic resin, especially fatigue resistance, impact strength, and flexural strength. The translucency of glass fibers provides aesthetically pleasing dentures. They have an excellent adhesion to the PMMA resin matrix thereby enhancing its mechanical properties.

**Hypoallergenic Resins:**

Hypoallergenic denture base materials contain much lesser residual monomer content than PMMA<sup>9</sup>, thus can act as an alternative in allergic patients. Enterephthalate based (Promysan, thermoplastic) show low water solubility than PMMA<sup>10</sup>. Light activated indirect composite containing urethane dimethacrylate (UDMA) is an alternative to PMMA for patients hypersensitive to PMMA<sup>11</sup>.

**RESINS WITH MODIFIED CHEMICAL STRUCTURES**

- Quaternary ammonium compound-2% exhibit antiseptic property
- Al<sub>2</sub>O<sub>3</sub> fillers-increases flexural strength and thermal diffusion
- Ceramic or sapphire- improve thermal diffusivity
- Bismuth or uranium- 11-14% impart radiopacity
- Silver nano particles- Antimicrobial activity
- Hydroxyapatite fillers-increase fracture toughness<sup>12</sup>

**THERMOPLASTIC RESINS:**

These are fully polymerized basic material which are softened by heat without causing any chemical changes.

**Benefits:**

- ❖ Excellent esthetics
- ❖ Unbreakable flexible, light weight
- ❖ Stable high fatigue endurance
- ❖ Retain moisture to keep it comfortable for gums
- ❖ Enables be relining and repairing<sup>13</sup>

**Materials used:**

- 1) Thermoplastic nylon-They use rapid injection system(274-2930c) which are translucent and has tissue coloured clasps. They are unbreakable & lightweight in nature. Although resistant to fracture difficult to polish and adjust.  
Eg: valplast, flexiplast (more impact resistance)
- 2) Thermoplastic acetal: polyoxymethylene  
Clasps engage first third of undercuts providing 3-4 times more retention and also Can be given more gingivally enhancing aesthetics<sup>14</sup>  
18 vita +3 pink shades: for simulating lifelike appearance Flexible+monomer free-hypoallergenic in nature  
Used :clasps, denture framework, occlusal splints etc
- 3) Thermoplastic acrylic -Exhibit good flexural and tensile strength But poor wear and impact resistance  
Benefits :Easy to polish, Repairable and relineable at chair side  
  
Exception: Flexite -highest impact resistance among acrylics (very popular in bruxism and parkinsonism patients)
- 4) Thermoplastic polycarbonate: polymer of bisphenol- They are strong, flexible and fracture resistant in nature.  
Used as provisional bridge and crown only  
Clinical advantage  
Minimal residual monomer-can be used in allergic patients Very little water absorption-



less smell and bacterial growth Good adherence and coherence

### **Enigma Gum Toning**

Custom shade matching of natural gingival tissue using 'enigma' colour tones, providing that extra confidence to patient in appearance of their dentures.

They are available in different shades such as ivory, light pink, natural pink, dark pink & light brown to be mixed together for the desired gum tone.<sup>16</sup>

### **Digital Dentures<sup>6</sup>**

An important break through in the field of dentistry is the emergence of recent technology in making complete dentures exclusively with computer-aided design (CAD) and computer-aided manufacturing (CAM).

The availability of CAD/CAM processing along with a limited supply of skillfull dental technicians, led both clinicians and technicians to explore more of usage

of CAD/CAM technology for the making of complete dentures digitally.

### **AvaDent® Digital Dentures**

AvaDent® (Global Dental Science LLC, Scottsdale, AZ) uses CAE and subtractive manufacturing for the fabrication of complete dentures providing both milled and printed trial dentures.

There are two types of definitive complete dentures: a milled denture base with bonded individual teeth from different manufacturer's or a monolithic AvaDent® The AvaDent system also facilitates making of milled record bases, immediate dentures, single arch complete denture, maxillofacial prostheses, implant overdentures and definitive implant fixed complete dentures along with other options. It takes approximately 3 appointments.

### **The Ivoclar digital denture™**

Ivoclar Vivadent (Ivoclar Vivadent Inc., Schann, Liechtenstein) uses a subtractive manufacturing protocol for the fabrication of definitive complete dentures with both milling and 3D printing available for the trial dentures industrially produced

impact resilient PMMA disc ensures homogenous material quality without porosities or air bubbles in material they also exhibit enhanced fracture resistance and increased longevity of denture.

### **Dentca™ Cad/cam Dentures**

Dentca™ (Dentca Inc., Los Angeles, CA) uses additive manufacturing (3D printing) to fabricate a printed base with recesses into which the requested denture teeth can be bonded. The teeth are bonded to the base before the post-curing treatment of the printed resin using the same resin material.

### **The Ceramill® Full Denture System**

The facebow transfer and centric relation recorded by the clinician are used by the laboratory to mount the definitive casts on an Amann Girrbach Artex articulator. These cast are scanned separately, then the occlusal rims and the interocclusal record are positioned on a transfer stand (Ceramill Transferkit) and placed in a Ceramill Map400 optical 3D scanner to transfer the position of the casts to the design software. The Ceramill D-Flow software is used to design the complete dentures.

### **Vita Vionic®**

Vita has integrated their digital denture system with the Amann Girrbach® Ceramill FDS but denture teeth and base materials are made by Vita. The laboratory technician can provide the clinician with three options.

- a) monolithic white trial dentures- milled from a prepolymerized PMMA. Pink PMMA blocks are used to mill definitive dentures with recesses into which individual manufactured VITA denture teeth bonding is done. Once finished and polished, these are sent back to the clinician.
- b) milled wax bases with recesses into which the chosen Vita denture teeth are placed. The wax bases and the teeth are trial checked, adjusted as required and later processed conventionally
- c) milled denture bases uses pre-polymerized pink PMMA disks. The denture teeth are secured to the base by either wax if a trial

appointment is needed or using Vita Vionic Bond when the clinician is confident that the dentures are ready for placement without trial. The dentures are then adjusted with VMLC flow finishing components and polished conventionally.

### **Baltic Denture System (BDS)**

The Baltic Denture System (BDS) has teamed up with Amann Girrbach®

BDS can provide patients complete dentures within 2 appointments. The functional impressions is made in accordance the BDKEY Set components (Merz Dental GmbH). The initial components of the system include maxillary and mandibular adjustable record bases with teeth. The trays that are available in 3 size are adjusted intraorally, and impressions are made while a proprietary facebow that includes a vertical indicator is attached to the maxillary tray to register the facial midline and transfer the esthetic and functional components from the patient to the designing software. A special device called the BDKEY Lock help in jaw relation recording. The presence of teeth on the trays permits evaluation of the overall esthetics, lip support, tooth alignment, and interocclusal space. Because the BDKEY trays identically replicate the size and shape of the denture teeth in the milling blocks, they function as trial dentures to confirm the patient's approval of the future dentures. The milling blanks are made of cross-linked polymethyl methacrylate (PMMA) and available in 3 different sizes. They have an integrated tooth setup with a lingualized occlusion.

### **Denstply dentures**

Dentsply Sirona (York, Pennsylvania, USA) developed a latest resin (Lucitone Digital Print 3D Denture Resin) designed for 3D printing and therefore their system only uses printed bases with recesses into which their specially designed denture teeth (IPN 3D Digital Denture Teeth) are bonded. The printing process produces a very small space between the bonded tooth and the printed base,

into which a bonding agent is applied. The bonding process involves heating the teeth in a chemical bath containing conditioning agent, followed by

applying a bonding agent and use of light polymerization to fix the teeth in position in the denture base. Later, an external sealer is applied on the denture before subjecting to a postpolymerization process in their light-polymerization unit.

### **CONCLUSION**

The newer evolution in denture base resins have provided excellent results thereby overcoming the past limitations of poly-methyl methacrylate denture base resins. With further advancements taking place in this field, it is certain to have additional new applications in the future providing a better treatment & reliable prosthesis to the patients.

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## SALIVARY SUBSTITUTES IN PROSTHODONTIC REHABILITATION

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### Abstract:

Dryness of mouth is a very common finding in older people. This results in repeated failure and discomfort of their dental prosthesis. Failures and discomfort would range from poor denture retention, poor hygiene to burning sensation. To counter these shortcomings a clinician can consider the use of salivary substitutes. The presence of optimal quality and quantity of saliva is an important factor in prosthodontic treatment. Artificial salivary substitutes along with its properties can be a great adjunct that influences the success of prosthodontic treatment. This article is intended to give an insight on indications, contraindications, the role of artificial saliva its properties and use in prosthetic rehabilitation and the commercially available substitutes in the market.

Methodology: An electronic search for articles in relation to salivary substitutes and xerostomia were done using database: Medline, PubMed, Google scholar, EBSCO; using the following descriptors: "artificial saliva, xerostomia, salivary substitutes, prosthesis". The search includes only English language. Inclusion criteria: articles published between 1990 to 2020.

*Key words: Artificial saliva, Xerostomia, Salivary substitutes, Prosthesis*

### Introduction:

Saliva is the most valuable oral fluid that is often taken for granted. It is critical to the preservation and maintenance of oral health, but receives little attention until the quantity or quality is reduced. Multiple systemic comorbidities and long-term related drugs, which are relatively common in edentulous geriatric patients with conventional removable dentures or implant-supported prosthesis, may be associated with oral health disorders such as xerostomia, oral candidiasis, hyperplasia, denture stomatitis, ulceration. Xerostomia, a subjective symptom consisting of a dry-mouth sensation, is often associated with quantitative and qualitative changes in the salivary flow. It can have an impact on nutrition, dental and psychological health. If xerostomia is left untreated, the pH in the oral cavity will decrease and lead to plaque and dental caries. In such patients, dentures which would usually rehabilitate the partially edentulous patients are often poorly tolerated. Saliva forms a thin film between the denture and the oral cavity, and its absence leads to decreased retention and increased chances of ulceration in the oral mucosa. Present treatment methods for xerostomia management are aimed at relieving the symptoms and associated conditions. These include gustatory, masticatory and pharmacological stimulants, substitute therapies, and xerostomia-related preventive effects on oral health. Nevertheless, salivary replacements are used in extreme cases to preserve and improve salivary flow.

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## Development of Salivary Substitutes

Research within the field of development of artificial saliva that reproduces the properties of natural saliva needs data of the structural-functional relationships of individual salivary molecules. Although 99.5% of secretion is water, these molecules form a complex structure.

### First Generation

Protein conditioning of intra-oral surfaces is involved in the first generation of artificial saliva. It involves artificial saliva containing molecules obtained identical to human molecules by recombinant methods. Although the structure of small particles such as histatin or statherin can be restored, the acquisition of a mucin structure in a proper conformation is extremely difficult. It is achieved by using NMR and X-ray crystallography.

### Second Generation

Salivary molecules of the second generation have broadened the antimicrobial spectrum. To protect the antimicrobial domain from exogenous proteolysis, one portion is a protease inhibitor. Another example is the chimeric protein rich in proline/histatins that has a candidacidal portion, while the protein rich in proline serves as an epithelial transglutaminase substrate for mucosal attachment. A third type of artificial saliva of the second generation could consist of synthetic peptides that mimic the shape of the bioactive carbohydrate domains conformation. Such peptides might be used to modulate the oral flora in individuals prone to a high level of plaque mediated diseases. The second-generation artificial saliva substitutes will have to address several biological considerations. 1

### Contents of Salivary Substitutes

Artificial saliva often usually includes antimicrobial-acting enzymes or mucins as lubricants. Different glycerol-containing solutions have been compounded over the past century to lubricate and moisturize the mucosa over a longer period of time than water alone in an effort to provide the necessary lubrication. Lemon juice or citric acid has also been added to induce residual salivation in certain preparations, but this may no longer be sufficient because salivary replacements

are better reserved for those who do not respond to gustatory stimulation. Rising plaque pH.9 was the reason for including an antacid.

Similar to water, these tended to aid in debridement of the mouth and reportedly alleviate tenderness, but again for extreme cases of xerostomia, they did not have any major lasting effect. For its bacteriostatic effect, a dilute, aqueous solution of chlorhexidine has also been recommended in an attempt to parallel the antimicrobial functions of saliva, although this is a relatively non-specific method. Matzker and Schreiber incorporated sodium carboxymethyl cellulose in a phosphate-buffered saline solution along with calcium and phosphate to limit enamel demineralisation in order to create a viscous preparation.

### Composition of Carboxymethylcellulose Based Saliva

Artificial saliva is categorized into 2 groups based on carboxymethylcellulose (CMC) and based on mucin. For imparting lubrication and viscosity, CMC is used. To imitate the electrolyte content of saliva, salts are added. To provide remineralization potential, calcium, phosphate and fluoride ions are added. Mucin is derived from gastric porcine tissues or submaxillary bovine glands.

Sodium carboxymethylcellulose	10.00 g
Potassium chloride	0.62 g
Sodium chloride	0.87 g
Magnesium chloride	0.06 g
Calcium chloride	0.17 g
Di-potassium hydrogen orthophosphate	0.80 g
Potassium di-hydrogen orthophosphate	0.30 g
Sodium fluoride	0.0044 g
Sorbitol	29.95 g
Compound tartrazine solution	0.1 ml
Methyl p-hydroxybenzoate	1.00 g
Spirit of lemon	5.0 ml
Water to make total of	1 litre

#### Composition of Mucin-Based Saliva

Mucin-based salivary replacements on the denture base and the denture base and oral mucosa are considered to have the lowest contact angle and the strongest wetting properties.<sup>2</sup>

Mucin	35.00 g
Potassium chloride	1.20 g
Sodium chloride	0.85 g
Di-potassium hydrogen orthophosphate	0.35 g
Magnesium chloride	0.05 g
Calcium chloride	0.20 g
Xylitol	20.00 g
Water to make total of	1 litre

## Properties of Salivary Substitutes

### Rheological Properties:

Salivary substitutes should simulate the rheological properties of human saliva.

### Viscosity:

Shear rate of salivary substitute while chewing and speaking should be 60s to 160s and viscosity is low at this value. Saliva has a very important role in cleansing process. Low shear rate of saliva at the crevices between the teeth may be of great importance in cleansing action. Diffusion coefficient which is inversely proportional to viscosity has important role in denture fixation. In a study conducted in salivary substitute using tensinometric and ellipsometric salivary substitute has viscosity in the range 5-25mpas. Surface tension for the salivary substitute gradually decreases with time.<sup>3</sup>

### Wettability:

For the optimum retention of the maxillary complete denture adequate wetting of the denture base resin by the salivary substitute is very critical. Salivary substitute must flow easily over the entire surface of the supporting tissue to provide good adhesion of the denture. Wettability of denture base is determined by surface tension and contact angle of the salivary substitute.

### Lubrication:

Lubrication is also considered as another major factor important for the clinical acceptance of saliva substitutes apart from viscosity. Lubrication has been defined as the ability of a substance to reduce friction between two moving surfaces and is considered as one of the major functions of human saliva. Thus, saliva substitutes should yield at least similar lubrication properties as human saliva. There are two types of lubrication, hydrodynamic lubrication and boundary lubrication. The lubricating film is thick and separates the surfaces completely in case of hydrodynamic lubrication and predominantly dependent on the viscosity of the lubricant. In contrast, for boundary lubrication, a small film separates the surfaces, and direct contact between the surfaces cannot be excluded, which

implies that lubrication is not dependent on the properties of the lubricant alone.

### Antimicrobial Effects:

Salivary substitute has antimicrobial effects in patients with xerostomia, radiation therapy, hematopoietic cell transplantation, end stage renal disease. A study conducted by Shah et al used oral balance gel, a commercially available salivary substitute found the antimicrobial effect against *S. sanguinis*, *S. salivarius*, *N. mucosa*, *S. mucilaginosus*, *S. epidermidis*, and *S. aureus* and *C. albicans* and alleviate symptoms of dry mouth. Antimicrobial effects of normal saliva depend on lysozyme and peroxidase activity. Peroxidase provides antimicrobial activity and protection of oral tissues through consumption of hydrogen peroxide. In artificial saliva hen egg white lysozyme and bovine lactoperoxidase molecule has been incorporated to obtain antimicrobial activity.<sup>4</sup>

### Remineralisation Effect of Salivary Substitute:

Salivary substitute has remineralisation effect on tooth. This effect is found mostly in carboxymethylcellulose than mucin based salivary substitute. It depends on viscosity of saliva. Lower the viscosity higher the remineralisation effect. By increasing calcium in mucin based salivary substitute remineralisation of salivary substitute will increase.<sup>5</sup> Literature shows that Ca, P, F added to salivary substitute can promote remineralization. Remineralization effect of salivary substitute prevents caries in hyposalivation patient better than fluoride gel and mouth rinses.<sup>4</sup>

### Effect on Film Forming Properties:

After radiation therapy, the oral mucosa is frequently very vulnerable for potentially pathogenic microorganisms which leads to biofilm-initiated diseases such as caries. In a study done on 20 patients suffering from radiation induced hyposalivation Anderson et al found that, for treatment with the linseed-based saliva substitute, both plaque index and the gingival bleeding index decreased significantly, whereas no significant improvement was found for the treatment with the carboxymethylcellulose-based saliva substitute.

### Effect on Salivary Enzymatic Activity:

In a study conducted using five kinds of saliva substitutes such as Moi-Stir, Stoppers4, MouthKote, Saliva Orthana, and SNU it was found that various types of salivary substitutes affected the activities of salivary enzymes in different ways. Stoppers4 enhanced the enzymatic activities of HEWL, BLP, and α-amylase. Saliva Orthana and SNU inhibited BLP activity and enhanced α-amylase activity. Each saliva substitute affects the enzymatic activity of salivary enzyme and finally oral health in different ways.<sup>4</sup>

### Indications

Salivary substitutes play an important role in the retention of denture in patients with xerostomia. Polyethylene oxide lozenge reduces dryness in such patients and even after drinking water it remains in the mouth and gets reactivated. The spray form of xylitol has lubricating effect on oral mucosa.<sup>6</sup> Salivary substitutes have a substantial effect on radiation therapy patient and Sjogren syndrome.<sup>7</sup> As they have antimicrobial action can be used in patient undergone hematopoietic cell transplantation and neutropenic patient. They are also indicated in hyposalivation due to medication, HIV, lupus aging, salivary gland disorders, pharyngitis.

### Contraindications

In patient with hypersensitivity, renal failure, HF, hypertension, and pregnancy salivary substitutes like carboxymethylcellulose parabens components are contraindicated. Asthmatic patients are not indicated for pilocarpine.<sup>8</sup>

### Side Effects

The commonly observed side effects are itching, tingling sensation, swelling of mouth and face, altered speech, abnormal taste, digestive problems, difficulty in swallowing.<sup>8</sup>

### Commercially Available Salivary Substitutes

There are many artificial saliva brands and types available. The following provides a brief description of the most popular brands:

- ❖ Aquoral: This is a lipid-based oral spray that should be used three to four times daily. Each canister provides approximately 400 sprays.

- ❖ Biotène Oral balance moisturizing gel: This is a sugar-free, alcohol-free, flavourless gel that provides relief of the symptoms of dry mouth for up to 4 hours.
- ❖ Mouth Kote dry mouth spray: Mouth Kote is an oral spray that contains xylitol and provides up to 5 hours of relief from dry mouth symptoms. It contains no sugar or alcohol and has a citrus flavour.
- ❖ NeutraSal: This is a mouth rinse that can be used 2 to 10 times daily as directed by your doctor. It's a dissolving powder to mix with water. It comes in single-use packets.
- ❖ Oasis mouth moisturizing spray: This oral spray for dry mouth can be used up to 30 times a day as needed and provides up to 2 hours of relief.
- ❖ XyliMelts: XyliMelts are discs that stick to teeth or gums to relieve dry mouth. Once in place, they slowly release xylitol to provide hours of relief from symptoms.
- ❖ Wet mouth: Mode of action is Hydration. When used regularly, they keep oral mucosa moist and lubricated. Surface abrasion is reduced and patients are able to perform everyday activities of eating, sleeping and speaking.
- ❖ Banxero: Cures dryness of mouth & throat by increasing salivary flow. Moistens and relieves the pain and discomfort from chronic mouth dryness. Freshens breath with mild mint flavour.
- ❖ Sar saliva gel: Artificial saliva can relieve the symptoms of dry mouth and helps to avoid health complications. It also helps control bacteria in your mouth, which helps prevent infection and tooth decay.
- ❖ Xerostat artificial saliva spray

### Conclusion

Xerostomia patients form a unique group of patients in whom prosthodontic treatment is challenging. Dentist and dental researchers have been keenly interested in saliva and have made important contributions to the knowledge of the subject. Investigation has progressed on the possible effect of various properties of saliva such as amount, solubility, buffering capacity and viscosity in dental caries, periodontal disease, dental restoration and



dental prosthesis. Despite many therapeutic choices, such as salivary gland stimulation or protection, the only successful alternative appears to be the topical substitution of saliva with a substitute. Artificial saliva can relieve the symptoms of dry mouth and helps to avoid health complications. Artificial saliva isn't exactly the same as the saliva produced naturally by our glands, but its combination of ingredients can help relieve symptoms. Its ingredients vary by brand and type, but most are a combination of water and carboxymethylcellulose, glycerine, minerals, xylitol and other flavouring agents.

**Conflicts of Interest: Nil**

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# IMPROVING THE BOND DURING INTRA-ORAL REPAIR OF CHIPPED CAD/CAM- HYBRID CROWNS WITH COMPOSITE

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## ABSTRACT

Ceramics are one of the most popular materials used among CAD/CAM indirect restorations. However due to its properties of low fracture toughness and brittleness, fractures are the most commonly seen mode of failure in these restorations. Hybrid materials such as flexible hybrid ceramic(FHC), Resin nanoceramic (RNC) and polymer infiltrated ceramic network(PICN) combining the properties of composite and ceramics evolved in a bid to reduce the failures. However these materials still exhibit chipping. It is wiser to repair the chipped off crown with composite rather than replace it entirely which may cause trauma to the surrounding tissues. This article aims to review the various surface treatments that help in the improvement of the bond between the hybrid ceramic crown and restorative resin.

A electronic search was conducted on Pubmed and only articles of in vitro studies involving microshear bond strength or microtensile bond strength of repair composite to hybrid ceramic materials were selected.

The various studies reviewed concluded that surface treatment is mandatory when the surface to be restored is not treated with silane, but the best outcomes were obtained with the combination of surface treatment followed by additional silane application. Treatment with Hydroflouric acid (HF) acid provides more successful bond strength when the ceramic content of the hybrid crown material is dominant while air-borne particle abrasion gives more successful bond strength when the composite content of the hybrid crown material increases.

*Key words :CAD/CAM, Hybrid CAD/CAM materials, Surface treatments, Intra-oral repair, repair composite.*

## 1. Introduction

Computer-aided design/computer-aided manufacturing (CAD/CAM) has become commonplace in today's dentistry. With the help of CAD/CAM systems, restorations can be made in a single visit. The most preferred indirect restoration material in clinical practice is ceramics, however they have low fracture toughness and high brittleness.[1] One of the most common failures in ceramic indirect restorations is fractures, especially chipping of the crowns.[2] To overcome this disadvantage, various hybrid materials were introduced.[1]

In these scenarios , the dentist must decide between total replacement or repair of the failed restoration. In most clinical cases, total replacement of the failed restoration may not be a good option as it may cause unnecessary trauma to the healthy dental tissues. High costs, multiple appointments and trauma risk can be minimized by repair of the restoration intra-orally. Therefore, it might be preferable to repair such failed crowns intra-orally, rather than their entire replacement.[3]

Restoration repair is done by the preparation of the surface of the failed restoration followed by completion of the missing part with composite resin material.[1] However, achieving a durable and reliable bond between the failed restoration and composite resin may be a difficult task .

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The minimally invasive technique concept shows that the most important factor that retains the restorations in the prepared tooth is adhesive bonding.[4,5] Several methods which have been suggested to provide an adequate bond strength between the failed restoration and the repair composite include: coarse diamond bur abrasion, hydrofluoric acid etching, phosphoric acid etching, air-borne particle abrasion with aluminum oxide, tribochemical silica coating and application of silane coupling agent.[1,4] The application of an intermediate adhesive also improves the repair bond strength.[1,4]

This article aims to review the literature available on various surface treatments and the other factors that help to achieve a durable bond when a chipped off CAD/CAM hybrid-ceramic crown is to be intraorally restored using repair composite.

## 2. Methodology:

An electronic search was done on PubMed. The following boolean operators were employed:(((CAD/CAM) AND (ceramic)) AND (surface treatment)) AND (repair)) AND (composite),

Articles pertaining to in vitro studies on the microshear bond strength and microtensile bond strength of repair composite to the CAD/CAM material only were selected. Articles involving tests on FHC,RNC or PICN CAD/CAM materials only were selected. Only articles available in English language were selected. Clinical trials involving humans, animal studies and human case reports were excluded. Out of 27 articles, 11 were selected.

3. Factors affecting the durability of the bond between the crown and the repair composite
  1. The type of CAD/CAM ceramic block material/Substrate material used
  2. The type of surface treatment done
  3. The influence of silane application
  4. The type of restorative resin used to repair the fractured restoration
3. 1 types of cad/cam ceramic block material/substrate material

Ceramics have low fracture toughness and high brittleness. To overcome this disadvantage, various hybrid materials were introduced.[1]

### (1) Flexible hybrid ceramic (FHC)

Hybrid ceramic is an interpenetrating phase composite material, formed by the infiltration of 14% resin into 86% ceramic network. 71% Silica and barium glass nanoparticles are included in its composition.[6]

The material thus obtained has a hybrid surface which can be treated to both indirect composite or ceramic materials.[1]

### (2) Resin nanoceramic (RNC)

Resin nanoceramic material combines the advantages of a highly cross-linked resin composite matrix and ceramic.[1]

Its composition includes 20% resin matrix reinforced with 80% silica nanoparticles with diameters of 20 nm and zirconia nanoparticles of 4-11 nm diameters. The organic resin polymer matrix contains urethane dimethacrylate (UDMA) and bisphenol-A polyethylene glycol diether dimethacrylate (Bis-EMA).[1,6,7]

As it is prepolymerized under high pressure and temperature during manufacture, they possess better physicomechanical properties. These include lesser discolouration and higher abrasion resistance when compared to conventional resin composites.

When compared to dental ceramics, they possess relatively high flexural strength combined with a low flexural modulus, resulting in a more flexible, less brittle material with an increased ability to withstand loads.[4]

### 3) Polymer infiltrated ceramic network (PICN)

The newly developed polymer infiltrated-ceramic-network (PICN), an interpenetrating phase composite material combines the Young's modulus of resin-based composites with the superior aesthetics associated with ceramics.[8]

The fabrication process begins with the formation of a porous pre-sintered ceramic

network conditioned by a coupling agent. This network is then infiltrated with a polymer by capillary action.[8] The ceramic network is leucite-based, zirconia reinforced and it is 86% by weight and 75% by volume of the structure. The specific composition includes SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Na<sub>2</sub>O, K<sub>2</sub>O, B<sub>2</sub>O<sub>3</sub>, Zr<sub>2</sub>O, and CaO. The polymer-based network constitutes 25% by weight and 14% by volume and consists of of UDMA and triethylene glycol dimethacrylate (TEGDMA)[7]

The combination of ceramic and resin results in a material that can be etched by hydrofluoric acid, such as in etchable ceramics, or roughened by air-borne particle abrasion, such as indirect composites. The dominance of ceramic phase in the chemical composition causes surface treatment by HF to result in better bond strength value compared to other treatments.[1]

### 3.2 Types of surface treatment

The CAD/CAM materials are subjected to different surface treatments in an attempt to improve the micromechanical bonding between the substrate and the repair composite. These include:

#### ❖ Hydrofluoric acid etching (HF)

In spite of all the potential harmful effects of intra oral administration, hydrofluoric acid etching remains the most preferred surface treatment for acid-sensitive ceramics. 9% hydrofluoric acid is applied to the CAD/CAM material surface for 60 seconds, rinsed in distilled water, and then air dried.[1,19] (5% HF acid according to certain authors).[10,11]

The hydrofluoric acid selectively interacts with the glassy parts of the glass-ceramic materials and creates a porous, irregular surface, thereby increasing the surface roughness. It provides microretention and creates hydroxyl groups that provide chemical bonding with composite resin.[1]

Etching PICN with HF significantly enhanced the repair bond strength compared to other surface treatments.[11]

#### ❖ (34.5-40%)phosphoric acid [6]

Treatment of the CAD/CAM material surface with phosphoric acid has not been found to be as successful when compared to HF acid etching but yet has shown positive results when used as a surface treatment agent.[6]

#### ❖ Air-borne particle abrasion with aluminum oxide (AlO)[1]

Air-borne particle abrasion is the throwing of particles accelerated by air pressure against the substrate surface. A new layer on the substrate surface is formed by the intensity of this impact which has an irregular, porous surface topography. This increased surface roughness provides improved interlocking between substrate and composite resin.[1]

Air-borne particle abrasion treatment can be performed using a sandblaster with 50 µm aluminum-oxide particles ( 10 mm away from specimen surface at 2.5 bar pressure for 10 seconds).[11]

This method of surface treatment was found to be very effective for flexible hybrid ceramic and resin nanoceramic materials.[1] There however were reports of significantly reduced bond strength for PICN.[11]

#### ❖ Tribochemical silica coating (TSC).

Tribochemical silica coating is performed in a manner similar to air-borne particle abrasion treatment using a sandblaster that spews out alumina particles of size 30 µm, 10 mm above from the substrate surface at 2.5 bar pressure. These particles are coated by silica(silicon dioxide).[1,12]

The impact generated by the air abrasion of silica coated particles causes silicization of the substrate surface through a tribochemical reaction. This increases the surface energy of the substrate, hereby enabling optimal wetting of silane.[1]

Tribochemical silica coating was found to have no effect on bond strength for PICN.[11]

#### ❖ Bur roughening

Studies have reported that bur treatment results in roughening on a macro scale. However

micromechanical bonding is important for bond strength, therefore the geometric character of the roughening is more important.[13]

Very good bond strength in polymer infiltrated ceramic network and resin nano ceramic materials were obtained by bur grinding.[9]

❖ Er,Cr:YSGG laser irradiation

Irradiation with ErCr:YSGG lasers cause rough and irregular surfaces occur . Surface roughening used with 3 W and 20 Hz parameters can be employed as an alternative method to coarse bur grinding for repair of PICN and RNC.[7]

### 3.3 Application of silane

Silane coupling agent can be applied onto the substrate surface following the completion of surface treatments.[1] The additionally applied silane coupling agent caused covalent bonds to form between the alumina and silica particles, and the resin material thereby increasing the bond strength between the resins and substrate.[1]

Silane, a bifunctional monomer consists of methacrylate group that copolymerizes with the organic matrix of the composite and silanol group that reacts with the ceramic surfaces.[6]

Literature reports suggest that the bonding effect of silane cannot be optimal without pretreatment of ceramic surfaces.[14]

### 3.4 Type of restorative resin

The substrate surface is now prepared to accept the restoration . First, a silane-containing universal adhesive is applied followed by the repair of the specimen with composite.[1]The silane coupling effect of freshly prepared silane containing universal adhesive was found to be more effective.[15]

One of the main ingredients of universal adhesives is a functional monomer, 10-methacryloyloxydecyl dihydrogen phosphate (10-MDP). 10-MDP chemically interacts with metals, hydroxyapatite or filler particles particularly ZrO<sub>2</sub>. Universal adhesive also contains Bis-GMA monomer . This Bis-GMA monomer can inhibit the reaction between the

silane and the hydroxyl group of the silica-containing restorative materials.[1]

Higher bond strength was obtained by additional silane application which suggests that the amount of silane contained in the universal adhesive does not provide sufficient compatibility.[1] Additional silane application compared to the silane-containing universal adhesive alone was thus more effective.[10]

### Inferences

- ❖ All surface treatments significantly increased repair bond strength when compared to restorations that had no surface treatment irrespective of whether additional silane was applied or not.[1]
- ❖ Application of additional silane yielded higher bond strength than silane-containing universal adhesive application alone.[1]
- ❖ CAD/CAM material type and different surface treatments influence the repair bond strength.[1] The efficiency of surface treatment was highly dependent on the chemical composition of the substrate material rather than the surface treatment itself.[1,4]
- ❖ The type of resin cements and type of surface treatments interaction effects was relevant in the improvement of the bond.[4]
- ❖ The repair capacity of CAD/CAM blocks increased as the resin content of the materials increased.[9]
- ❖ The Bur grinding procedure was found to be a suitable technique for resin-ceramic CAD/CAM materials.[9] the EY laser could be used as an alternative to this method.[9]
- ❖ Conflicting findings from certain studies included that: the surface treatments did not improve the bond strength in resin nano ceramics and instead reduced the bond strength for resin nano ceramic and should be avoided.[16] Another study found no significant difference between Al<sub>2</sub>O<sub>3</sub> sandblasting, tribochemical silica coating and HF acid treatment for PICN materials in influencing the repair bond strength.[1]
- ❖ FHC was found to have more successful bond strength when treated to air-borne particle

abrasion with Al<sub>2</sub>O<sub>3</sub>. This was due to the increased composite content of the substrate material.[1] Treatment with TSC was also quite influential in the improvement of bond strength in FHC materials.[1]

- ❖ For RNC materials, air-borne particle abrasion with Al<sub>2</sub>O<sub>3</sub> exhibited successful bond strength due to the increased composite content of the substrate material.[1] Treatment with TSC was quite influential in the improvement of bond strength in these materials.[1] The highest bond strength values were obtained for RNC materials treated by tribochemical treatment with additional silane.[17]
- ❖ Treatment of PICN material with HF acid was found to have successful bond strength due to the increased ceramic content of the substrate material and this was improved by the application of additional silane.[1,17,18] However there were conflicting studies that found tribochemical treatment with additional silane to give the highest repair bond strength values.[17] Another conflicting study found no significant difference in repair bond strength values among different surface treatments.[1]

### Advantages

- ❖ The surface treatments lead to a definite and significant improvement in the bond strength.
- ❖ Entire removal and replacement of the crown can be avoided which is convenient to the patient and also reduces the risk of damage to the tissue.

### Disadvantages

- ❖ The harmful effects of intraoral use of HF have not been presented with an alternative
- ❖ The method for the clinician to identify the exact type of crown material (unless specifically mentioned in the patient's previous treatment records) have not been specified.
- ❖ The various studies conducted do not have a standard protocol (for eg: The distance between the sandblaster and the substrate material, the

duration of the sandblasting, the concentration of the HF acid and its etching time, etc has not been standardised. This can lead to deviations in the values measured). The studies thus have been found to present conflicting findings.[4]

- ❖ Contamination of the ceramic surface by sand particles, risk of causing health problems, and additional cost of the application device. Furthermore, sandblasting can cause large volume losses on ceramic surfaces.[6]

### Conclusion

- ? Surface treatment is mandatory when additional silane is not preferred, however the best treatment outcomes were obtained with the combination of surface treatment and silane application.
- ❖ Treatment with HF acid provides more successful bond strength when the ceramic content increases in the composition of the substrate material as in the case of polymer infiltrated network (PICN) material whereas air-borne particle abrasion gives more successful bond strength values when the composite content of the substrate material increases as was observed in the case of flexible hybrid ceramic (FHC) and resin nanoceramic (RNC).

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## IRRITATIONAL FIBROMA

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### Abstract

Traumatic or irritant fibroma is the healed lesion result of the inflammatory hyperplastic lesion, which can develop at any age. It is having female predilection & commonly affecting sites are the tongue, gingiva, and buccal mucosa. Generally characterized by a localized slow growth with smooth surface with colour as that of normal mucosa. Treatment commonly done is surgical excision. less chance of recurrence occurs. This case report presents a case of traumatic fibroma

### Introduction

An organ or tissue that has grown in size as a result of a localised tissue injury or an increase in the number of constituent cells is known as an inflammatory hyperplastic lesion. Localised tissue injuries include calculi, foreign objects, overhanging margins, restorations, caries margins, chronic biting, sharp bone spicules, and overextended appliance borders. Fibroma is a benign neoplasm of fibroblastic origin and it occurs as a result of the response to local irritation or trauma that causes reactive hyperplasia of fibrous connective tissue.

Traumatic or irritant fibroma is the healed lesion result of the inflammatory hyperplastic lesion, which can develop at any age. The most common soft-tissue sites affected by this condition are the tongue, gingiva, and buccal mucosa. They are usually characterized by a localized growth with smooth surface, hard in consistency, sessile or pedunculated measuring usually less than 1.5 cm with colour as that of normal mucosa<sup>1</sup>.

In the present case report, the benign lesion is present in the right buccal mucosa

### Case Report

A 34 - year- old male patient reported to the department of Oral Medicine & Radiology, PMS Dental College of Science & Research with a chief complaint of growth that was noted on right buccal mucosa since 2 years. Lesion noticed 2 years back and size gradually increases & attained the present size. History revealed a healthy male with no family history of irritational fibroma. History of trauma sharp tooth noticed on 16,17 & 48.

On intraoral examination, a painless single, round, well circumscribed soft tissue swelling of size 1 x 1.5 cm, pale pink in colour on the right buccal mucosa. on palpation, all inspectory findings regarding site, size, shape was confirmed & growth was soft in consistency & pedunculated. under local anaesthesia excisional biopsy was performed & specimen was sent for histopathological examination.



Figure 1 :  
Extra oral presentation



Figure 2 :  
Intra oral presentation  
of lesion

### Differential Diagnosis

Mucocele, pyogenic granuloma, peripheral giant cell granuloma, peripheral ossifying fibroma, papilloma, lipoma were considered in differential diagnosis

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## Histopathology

Histopathological examination showed circumscribed fibrous connective tissue covered by Para keratinized stratified squamous epithelium. The connective tissue shows thick dense bundles of collagen fibres arranged in haphazard pattern, interlacing pattern with interspersed spindle shaped fibrocytes. Few endothelium lined capillaries are noted. Inflammatory cell infiltrate is minimal.



Fig:3

Gross picture of specimen

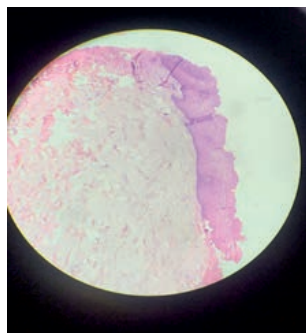


Fig 4:

Histopathology picture

## Discussion

Fibroma is the most common soft tissue lesion seen in the oral cavity & commonly seen in areas which are prone to trauma & irritation. It is also known as irritational fibroma, traumatic fibroma, fibrous hyperplasia, focal fibrous hyperplasia, localized hyperplasia, fibrous polyp, and fibroepithelial polyp. Tissue enlargements present in oral cavity is due to various pathological processes happening in the tissues leading to challenges in diagnosing these lesions. Among these, few enlargements are seen to occur because of chronic tissue injury that stimulates an excessive tissue response, Kfir et al. has classified reactive gingival lesion as fibrous hyperplasia, peripheral fibroma, with calcification, pyogenic granuloma, or peripheral giant cell granuloma. According to Barker and Lucas, irritational fibroma exhibit a pattern of collagen arrangement depending on the site of the lesion. There are two types of pattern (radiating pattern and circular pattern). In radiating type, the fibres radiate towards the epithelium from the base of the lesion. While the circular type shows a combination of disoriented fibres centrally and is surrounded by a peripheral layer of collagen fibres running beneath

and parallel to the overlying epithelium. Differential diagnosis requires identification of any reactive hyperplastic gingival lesion to enable accurate patient evaluation and management. Mucocele, pyogenic granuloma, peripheral giant cell granuloma, peripheral ossifying fibroma, papilloma, lipoma were considered in differential diagnosis. In this case, Clinical findings suggest trauma from sharp tooth will be the cause of traumatic fibroma .

## Conclusion

Fibromas are benign tumour of fibrous connective tissue. The histopathological features of the present case showed the features of a fibroma. But thorough clinical, histopathologic features & surgical findings are required to identify these lesions. To accomplish this; we need more studies to evaluate the true nature of such fibromatous lesions

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# IDA Attingal Branch REPORTS, ACTIVITIES & ACHIEVEMENTS

IDA Attingal Branch  
President : Dr. Arun B.S.  
Hon. Secretary : Dr. Subhash R. Kurup

**AGM & Installation Ceremony**  
The AGM was conducted at Anamthara Resorts, Attingal on 02-01-2022 at 4 pm.

It was followed by the installation ceremony of Dr. Arun B.S. as the new President of India

Attingal Branch and his Team of Office Bearers for the year 2022



## CDE



## CDH





## WDC



## Webinar - Psychological Well-being for Working Women

A webinar was conducted on 19th June 2022 on Zoom Platform between 2.30 to 4.30 pm

Mrs. Umaissia Noufal was the faculty for the webinar. A total of 30 WDC members participated in the webinar.



**IDA ATTINGAL BRANCH**   
**Women's Dental Council**

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**Psychological Well-being for Working Women**



**Mrs Umaissia Noufal**  
 Counselling psychologist at Aspire wellness and centre for learning disability  
 Co-founder and trainer at Mindcraft international Training group.

19/06/2022  
 2pm @ zoom platform

**Register now**  
 8606664320 \ 9047461705

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**President: Dr Arun BS**  
**Secretary: Dr Subhash R Kurup**

WDC representatives : Dr Archana Nair  
 Dr Charishma

## ONAM CELEBRATIONS



## INTRA BRANCH CRICKET TOURNAMENT



## CORDIAL 21

### 52nd Kerala State Dental Conference

IDA Attingal Branch had the privilege to host the 52nd Kerala State Dental Conference on the month of May 13, 14 & 15, 2022 at Travancore International Convention Centre, Kazhakootam.

### Inaugural Ceremony

The 52nd Kerala State Dental Conference was officially inaugurated by Adv. Antony Raju, Minister of Transport, Govt. of Kerala and the Guest of Honor was Dr. Navajot Khose IAS Thiruvananthapuram District Collector.



### Pre-Conference & Scientific Sessions



## Inauguration of Registration Counter



## Trade Fair



## IDA KSB Awards



## Team Cordial



Organising Chairman  
**Dr. Sudeep Sarathchandran**  
Organising Secretary  
**Dr. Ashok Gopan**



## Overall Champions Chilampoli 2022-IDA Attingal Branch



## South Zone Cricket Champion - IDA Attingal Branch







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