

Impressions

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Journal of Indian Dental Association
Attingal Branch



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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



Season's greetings

Greetings Dear Members,

I have been looking forward to this journal release for quite sometime. The last journal released by our editor, Dr. Ramesh was an excellent one. It was well compiled with some variety articles and content and was well appreciated at the state level and received a special mention too.

As 2023 rolls along, we, as a professional organization, have some work to do. Over the years, we have been trying to come out with a standardized treatment charge list. Though many versions have been made in the past, the concept never really caught on. We, as dentist, have to factor in a lot of things while deciding basic minimum treatment charges. The cost of living is rising on a daily basis and materials, lab and equipment cost are always on the rise. Maintaining a standard of practise is not cheap and we should treat our patients ethically and charge accordingly.

Undercutting leads to the usage of less quality materials, which eventually leads to poor quality of treatment and dissatisfied patients and us, eventually unhappy with the profession. Nothing comes cheap. Good treatment has a price and we have a right to ask for it. I request my fellow members to come to a consensus on the treatment charges and follow it for the progress of our profession and our personal lives.

In this daily rush for wealth, please don't forget about your health. Do regular check ups and exercise for at least half an hour a day. Playing some sport occasionally will do wonders for your health. Not only physical but mental rest and relaxation is necessary to keep us going. A vacation every now and then keeps the daily stress we encounter at bay and helps in family bonding too.

So I end this message in this first journal of ours with my best wishes and prayers for a sound mind and body of all our members.

Regards

Dr. Vasudevan Vinay

Secretary's Message



Dear Members,

It is with great pleasure that I write this message for the first edition of our Journal of the year 2023.

I take this opportunity to thank and congratulate the strong determination and commitment of our Editor Journal, Dr. Ramesh S for all the hard work he put in.

I also thank all our seniors, members of the editorial board, and authors for their contribution in the timely release of the first edition.

A journal's success is always the consistency and quality of the articles published. I request all our dear members to actively involve and contribute for the upcoming issues.

I wish all the very best to Dr. Ramesh S and his editorial board..

Take care

Stay safe

Warm regards,

Dr Subhash R Kurup



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- ❖ 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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Editorial



ORAL CANCER AND PRE CANCEROUS LESIONS/CONDITIONS- ROLE OF DENTAL SURGEONS IN EARLY DIAGNOSIS

Oral cancer incidence in community has been on rise in India as well as in Kerala. Tobacco and alcohol have been identified as the major risk factors for oral cancer along with other factors.

Although the tertiary centres are doing a great job in treatment aspect, the incidence of new cases with final stages of cancer has been increasing. This could be due to lack of awareness in detecting cancerous and precancerous conditions on early stage.

We, as dentist has a major role to play in diagnosing part. In private practice we come across so many pre cancerous lesions and conditions. Identifying and referring to next level is the need of the hour. These include anti tobacco health education, oral self-examination, and oral examination by trained volunteers. IDA has been instrumental in this process through conducting various community level awareness programs and oral screening camp. Those detected with suspicious lesions has to be referred to tertiary centres for confirmation and treatment. Timely follow up is mandatory. This will help in reducing the mortality as the prognosis is stage dependent.

Other lesions which are not malignant, example vesiculobullous, those related with systemic conditions etc also needs proper diagnosis and management.

Dr. Ramesh S.

Reactive Soft Tissue Lesions Of The Oral Cavity-A 10 Year Institutional Study

* Surya S.L, **Anna P. Joseph

ABSTRACT

Reactive lesions of the oral cavity are associated with hyperplasia of the soft tissue resulting from dental plaque, drug-induced stimulus, and local iatrogenic factors. Oral soft tissue growth have high prevalence rates, different involvement patterns with an alarming presentations.

Aim: To study and assess the prevalence and characteristics of various types of focal reactive soft tissue lesions of the oral cavity.

Objective: This study analyses demographic data, clinical presentations, histopathological features and compares the clinico-pathologic profiles of the reactive oral soft tissue lesions.

Materials and Methods: Retrospective study of the reactive soft tissue lesions reported to the Department of Oral and Maxillofacial Pathology, during ten year period. In this study, cases identified were grouped into seven as: pyogenic granuloma, irritation fibroma, peripheral ossifying fibroma, inflammatory fibrous hyperplasia, peripheral giant cell granuloma, fibroepithelial hyperplasia and giant cell fibroma based on the histopathological diagnosis. Clinical data referring to age, gender, location of the lesion, and duration were obtained and analyzed. H & E stained sections of the lesions were retrieved and re-evaluated for histological parameters like epithelial and connective tissue morphology, inflammatory cell infiltrate, mineralization etc.

Results: In this present study of reactive soft tissue lesion, irritation fibroma had the highest incidence followed by pyogenic granuloma. Giant cell fibroma had the lowest incidence. Majority of the reactive hyperplastic lesions occur in gingiva and buccal mucosa. The peripheral ossifying fibroma showed no sex predilection while fibroepithelial hyperplasia, pyogenic granuloma and irritation fibroma were more common in females.

INTRODUCTION

The tissues of the oral region are constantly exposed to a plethora of inflammatory stimuli that can be of bacterial, physical, chemical or immunologic in

the origin. Chronic/long-standing, low-grade inflammatory stimuli can induce an escalated reparative response in the oral tissues resulting in the occurrence of non-neoplastic, hyperplastic lesions that are collectively referred to as reactive lesions. These proliferations are painless pedunculated or sessile masses in different colors, from light pink to red. The surface appearance is variable from non-ulcerated smooth to ulcerated mass. Lesion size varies from a few millimeters to several centimeters. Oral soft tissue growth have high prevalence rates, different involvement patterns with an alarming presentations. Even though the lesion is benign, it has a tendency of recurrence with incomplete excision and inability to remove local irritants.^{1,2}

Review of the literature reveals that there are controversies among the findings of previous studies, and that all reactive hyperplastic lesions have rarely been evaluated in one study. The distribution data of oral reactive lesions have shown some differences in type, age, gender, and location of prevalent lesions in different studies. In this present study the reactive lesions were classified on the basis of histopathological diagnosis into pyogenic granuloma (PG), irritation fibroma (IF), peripheral ossifying fibroma (POF), inflammatory fibrous hyperplasia (IFH), peripheral giant cell granuloma (PGCG), fibroepithelial hyperplasia (FEH) and giant cell fibroma (GCF). We investigate the prevalence and characteristics of various types of focal reactive soft tissue lesions of the oral cavity reported to our institution over last year ten year period.

MATERIALS AND METHODS

This retrospective study was performed from the departmental archives of PMS College of Dental Sciences and Research, Vattapara, Trivandrum, Kerala from the year January 2012 to January 2022. Patient records were assessed to select those with the diagnosis of reactive hyperplastic lesions. Reactive lesions were classified on the basis of histopathological diagnosis into pyogenic granuloma (PG), irritation fibroma (IF), peripheral ossifying fibroma (POF), inflammatory

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fibrous hyperplasia(IFH), peripheral giant cell granuloma(PGCG), fibroepithelial hyperplasia (FEH) and giant cell fibroma(GCF) (Figure 1). Data included the type of lesion, age, gender, site, location and duration were obtained from the patient's report for each case. The site involvement was categorized into gingiva, labial mucosa, buccal mucosa, lip, tongue and palate which was further divided into anterior and posterior quadrants of maxilla and mandible. Cases with missing reports and pathologic slides were disqualified from the study. The histopathologically diagnosed cases were reconfirmed and then stained slides were analysed, and was grouped in one of the seven previously mentioned lesions. For detailed histopathological diagnosis for some microscopical parameters were analysed according to the criteria given by Peralles et al:6

- ❖Pattern of the lining epithelium – subdivided in normal, atrophic, hyperplastic or absent
- ❖Type of connective tissue loose or dense
- ❖Presence of vascular proliferation – presence of abundant capillary or cavernous vascular
- ❖Proliferations in the connective tissue
- ❖Distribution of inflammatory infiltrate- Mild/Moderate/Intense
- ❖Type of inflammatory infiltrate predominantly acute, chronic or both
- ❖Presence of mineralized material – foci of bone and/or cementum
- ❖Presence of foreign body multinucleated giant cells.

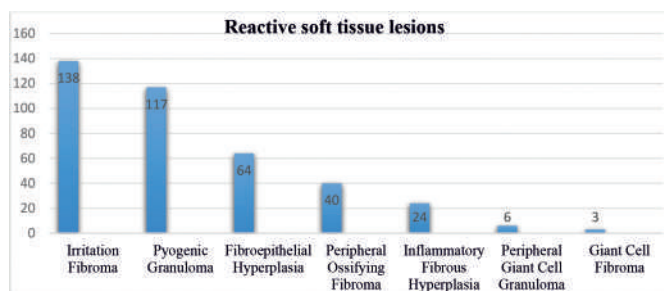
Data including the age, gender, area involved and the type of lesion were collected, analysed using Statistical Package for Social Sciences (SPSS) Version 22, IBM Statistics and presented in descriptive and tabular forms.

RESULTS

Of the total cases of 3947 reviewed in this ten year retrospective study, 392 cases were confirmed cases of reactive lesions of oral mucosa with a prevalence of 10.07%. The most common lesion was found to be irritation fibroma (n= 138, 35.20%) followed by pyogenic granuloma (n= 117, 29.84%), and the least common was of giant cell fibroma (n= 3, 0.76%).Table 1 shows the prevalence of reactive soft tissue lesions. The most common cause was the

presence of local deposits in approximately 70% of cases and rest included minor trauma, abrasion, hormonal imbalance, overhanging restorations, and ill-fitting dentures. The mean ages for the occurrence were 3th–5th decade except Pyogenic Granuloma which presented mostly in 2nd decade. Majority of the reactive hyperplastic lesions occur in gingiva and buccal mucosa. The peripheral ossifying fibroma showed no sex predilection while fibroepithelial hyperplasia, pyogenic granuloma and irritation fibroma were more common in females. The sizes of majority of the lesions were approximately 0.5–1.5 cm. The common sites were anterior maxilla followed by posterior mandible and least in lip. The duration of all the lesions was seen to be 2 months to 1 year. Majority of them presented with poor oral hygiene status (n= 307, 78.31%). Recurrences were present in a few surgically excised lesions

Table 1: Prevalence of reactive soft tissue lesions



Age: The age ranged from 6 to 75 years with the mean age of 40.31 years. IF, FEH and IFH were more frequent in the fourth decade, POF in the third decade and PG and PGCG were more common in the third decade. Table 2 shows the distribution of reactive soft tissue lesions in different ages.

Table-2: Distribution of focal reactive lesions in different ages.

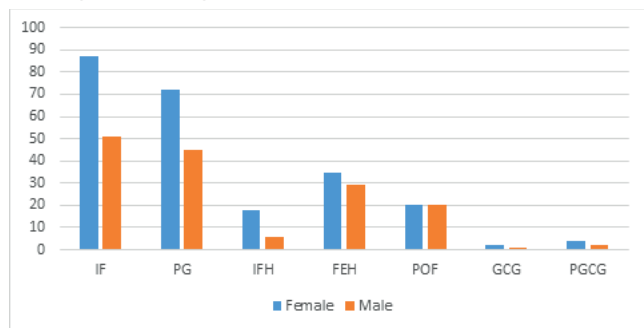
Focal Reactive Lesions	Age (years)	
	Mean	Range
IF	42.2	12-75
FEH	43.9	6-69
IFH	47.1	24-62
PG	33.3	8-75
PGCG	30.1	13-39
POF	38.8	23-65
GCF	21.3	7-32

pyogenic granuloma (PG), irritation fibroma(IF), peripheral ossifying fibroma(POF), inflammatory fibrous hyperplasia(IFH), peripheral giant cell granuloma(PGCG), fibroepithelial hyperplasia (FEH) and giant cell fibroma(GCF).

Gender: FEH, PG, IFH and IF were more common in females, PGCG and GCF were more common in males whereas POF shows no sex predilection. 239 (60%) cases occurred in females whereas 159 (40%) cases occurred in males. Male to female ratio was 1:1.5. All the reactive soft tissue lesions were more common in

females. Table 3 shows the distribution of reactive soft tissue lesions among different genders.

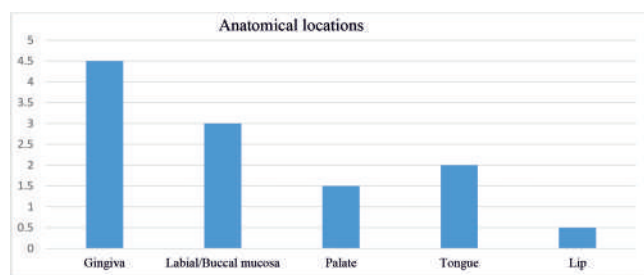
Table-3: Distribution of reactive soft tissue lesions among different genders.



pyogenic granuloma (PG), irritation fibroma(IF), peripheral ossifying fibroma(POF), inflammatory fibrous hyperplasia(IFH), peripheral giant cell granuloma(PGCG), fibroepithelial hyperplasia (FEH) and giant cell fibroma(GCF).

Anatomical location: The analysis of site of the lesions showed that the maxillary and mandibular jaw was affected in 54% and 46 % of the cases respectively. The reactive lesions were mostly occur in the gingiva 4.5% .Table 4 shows the distribution of reactive soft tissue lesions in different anatomic locations

Table-4: Distribution of reactive soft tissue lesions in different anatomic locations



Histopathological analysis: Histopathological parameters such as epithelium, connective tissue, type and intensity of inflammatory cell infiltrate, vascular proliferation, presence of mineralization and multinucleated giant cells were evaluated. Table 4shows the histopathological analysis of reactive lesions in the oral cavity.

Table-4: Histopathological analysis of reactive soft tissue lesions in the oral cavity

Lesion	Epithelium	Connective tissue	Inflammatory Cell Infiltrate	Mineralization	Multinucleated giant cell
PG	Atrophic/ Ulcerated	Loose	Moderate	Absent	Absent
FEH	Hyperplastic	Dense	Mild to Moderate	Absent	Absent
POF	Ulcerated	Loose/ Dense	Mild	Present	Absent
IFH	Hyperplastic	Dense	Intense	Absent	Absent
IF	Hyper-Keratinized	Dense	Moderate	Absent	Absent
GCF	Atrophic	Loose	Mild to Moderate	Absent	Present
PGCG	Atrophic/ Ulcerated	Dense	Intense	Absent	Present

Epithelial morphology of ulceration and hyperplasia were found predominantly in Pyogenic granuloma. Hyperkeratinised epithelium is seen majority in Irritation fibroma and hyperplastic epithelium in Inflammatory fibrous hyperplasia and Fibroepithelial hyperplasia. Most of the reactive lesions showed atrophic or hyperplastic epithelium followed by hyperkeratinized epithelium.

Connective tissue was predominantly dense in Inflammatory fibrous hyperplasia, Fibroepithelial hyperplasia and Irritation fibroma whereas loose connective tissue was seen in Pyogenic granuloma with vascular proliferation. Fibroblastic proliferation also noted in Peripheral giant cell granuloma and Peripheral ossifying fibroma. (Figure 2)

Chronic inflammatory cell infiltrate was found in all the reviewed cases. Inflammatory cell infiltrate was considered intense in Inflammatory fibrous hyperplasia and Peripheral giant cell granuloma. Moderate inflammatory cells seen in Irritation fibroma and Pyogenic granuloma whereas mild to moderate in all other reactive lesions.

Vascular proliferation and numerous endothelium lined vascular spaces filled with RBCs are found to be associated with Pyogenic granuloma. Mineralization showed marked affinity in all cases of peripheral ossifying fibroma. The type of mineralized component varies from bone or cementum like material. The bone is woven and trabecular type characterized by large to small irregular basophilic masses. Multinucleated giant cells surrounded by plump mesenchymal cells were found solely in Peripheral giant cell granuloma and Giant cell fibroma. (Figure 3)

DISCUSSION

Reactive hyperplasia comprises of a group of fibrous connective tissue lesions that commonly occur in the oral mucosa as a result of injury or chronic irritation.8 Chronic trauma can induce inflammation which produce granulation tissue with endothelial cells, chronic inflammatory cells and later fibroblasts proliferate and manifest as an overgrowth. Reactive lesions show a response to a low-grade irritation or injury such as calculus, cheek biting, food impaction, iatrogenic injuries such as broken teeth, overhanging dental restorations and extended flanges of denture. Apart from local chronic irritations, these lesions emerge to be etiologically associated to systemic factors such as hormonal changes.7These tumor like lesions are not neoplastic, but they indicate a chronic process in which an exaggerated repair occurs granulation tissue and formation of scar following repair in the oral cavity.9Their clinical features are sometimes very similar to those of tumors and hence a correct histopathological diagnosis is needed to rule out non aggressive entities.

In our study, the most frequent histopathologically

described soft tissue enlargement was irritation fibroma (IF) (35.2%). The average age of occurrence was 42.1 with the range being 12-75 years. Females were frequently affected than males. The most common site affected was lower anterior region followed by lower anterior region. Our findings are consistent with the study reported by Jiang et al. Irritation fibroma is an exophytic soft tissue mass in the oral mucosa. Indeed, it is not a real neoplasm but a focal hyperplasia of fibrous connective tissue induced by local trauma or chronic irritation. Clinically, irritation fibroma's usually manifest an exophytic, firm and asymptomatic nodule with pink or flesh-colored and smooth surface. The nodule often has a well-defined boundary. It is slow-growing and rarely exceeds 1.5 cm in diameter. The histopathological feature of Irritation fibroma appears as a nodular mass composed of collagenized fibrous connective tissue. The epidermis usually presents hyperplasia and hyperkeratosis due to chronic irritation. Dense collagen fibers and focal hyperplasia of mature fibroblasts can be found in connective tissue, with slight or no inflammatory cell infiltration.¹⁰

Pyogenic granuloma (PG), sometimes known as granuloma gravidarum, refers to a common, acquired, benign vascular tumor that arises in tissues such as the skin and mucous membranes. It is more accurately called a lobular capillary hemangioma. The lesion grossly appears as a solitary, red, pedunculated papule that is very friable. Less commonly, it may present as a sessile plaque. It shows rapid exophytic growth, with a surface that often undergoes ulceration.¹¹ Histologically, the lesion is composed of a vast number of endothelium lined vascular spaces and an infiltrate of lymphocytes, plasma cells and frequently polymorphonuclear neutrophils, and is covered by a thin, often ulcerated layer of stratified squamous epithelium.¹² These findings were similar to the study conducted by Sarwal et al. The prevalence of pyogenic granuloma reported in the present study was 29.84% of all the reactive gingival lesions with an average age of occurrence being 33.3 and in the range of 8–75 years. Females were commonly affected than males and most common site exaggerated was upper and lower anterior gingiva.

Fibroepithelial hyperplasia (FEH) accounts for the great majority of localized reactive lesions as was substantiated by various reports in the literature¹³. In this present study it comprised of 16.32 % of all the reactive lesions. Although the fibroepithelial hyperplasia can occur anywhere in the mouth, the most common location is the gingiva followed by buccal mucosa. These lesions are most common in the 4th decades of life and the mean age of occurrence of the lesion in our study is 43.92 years. These lesions are seen

slightly more in the females. Fibroepithelial hyperplasia occurs more frequently in older age groups than do pyogenic granuloma and peripheral fibroma with calcification. Kashyap et al observed the greatest number of cases of fibrous hyperplasia in the fourth decade which is similar to our study.¹⁵ Histopathologically it shows hyperplastic tissue with a varying degree of vascularity. The nonulcerated lesion is covered by a layer of keratinized squamous cell epithelium. The tissue mass consists of bundles of collagen fibers often arranged in radiating, circular or haphazard fashion. The vast majority is exceedingly dense fibrous connective tissue with poor vascularity and few chronic inflammatory cells present.¹⁴

Peripheral ossifying fibroma (POF), the nomenclature for this lesion, however, has been confusing and is often reported as a peripheral fibroma with calcification. Current literature refers to this lesion as the Peripheral ossifying fibroma (WHO type) and it is recognized separately from the Peripheral odontogenic fibroma. The Peripheral ossifying fibroma is thought to originate from the superficial periodontal ligament and is found most often in the anterior maxilla. This raised lesion may appear smooth and pink or ulcerated and erythematous.¹⁵ The clinical appearance may be identical to the peripheral fibroma and both are associated with local irritating factors. Peripheral ossifying fibroma constituted 10.2 % of all the reactive gingival lesions with peak incidence for the Peripheral ossifying fibroma was in the third decade followed by a definite decline, which is concurrent with the present study. A female predilection was reported by Kfir et al but our results showed no sex predilection between both sex and lower anterior gingiva being most commonly involved site. Histopathologically, Peripheral ossifying fibroma showed atrophic epithelium and dense connective tissue stroma with fibroblastic proliferation and minimal vascular proliferation. Intense chronic inflammatory cell infiltrate was seen. Foci of cementum and bone calcifications were seen in all the cases of Peripheral ossifying fibroma with no multinucleated giant cells.

The prevalence of inflammatory fibrous hyperplasia (IFH) is 6.1% with mean age of 47 years ranged from 24-62 years. It is a benign soft tissue response to a local irritant. The color ranges from whitish pink or reddish depending upon whether or not the surface is ulcerated, keratotic or both or neither. It can be soft or firm in palpation.¹⁶ Histologically, inflammatory fibrous hyperplasia is made up of hyperplastic surface epithelium and dense connective tissue with dilated blood vessels, usually with chronic inflammatory cells such as lymphocytes and plasma cells, but it can also be made up of solid connective tissue with minimum to no

inflammatory cells, the latter called fibrous hyperplasia. This study supports previous findings by Zain et al that inflammatory fibrous hyperplasia may occur on any oral mucosal site preferably on the gingiva and palate

Peripheral giant cell granuloma (PGCG) constitutes only 1.5% of all reactive gingival lesions. Peripheral giant cell granuloma is seen in the third decade, males and prevalent in both upper and lower anterior region. Peripheral giant cell granuloma showed atrophic to ulcerated epithelium and dense connective tissue stroma with fibroblastic and extensive vascular proliferation. All the cases of peripheral giant cell granuloma showed much foreign body type of multinucleated giant cells in the connective tissue stroma. These findings in this present study were also similarly reported by salum et al.

The giant cell fibroma (GCF) was the least common lesion in this study comprising of 0.76% of all the reactive lesions .In this study the age of patient ranged from 7-32 years with mean age of 21.3 years and with the highest incidence in the second decade of life similar to other studies. Giant cell fibroma affects in males and seen in palate. It was histopathologically consistent with the study conducted by Hunasgi et al.6 and showed atrophic epithelium and loose connective tissue stroma with mild to moderate inflammatory cell infiltrate. Multinucleated giant cells were noted in the deeper connective tissue stroma.

Our study suggests that Irritation fibroma, Pyogenic granuloma, Fibroepithelial hyperplasia, Peripheral giant cell granuloma, and Peripheral ossifying fibroma are mucosal responses to chronic, low grade irritation caused by plaque and calculus, or any other irritant. However, the histological appearance of each entity may be influenced by the intensity of the irritation, duration of the lesion and the metabolic effects hormones in the body. Some differences have been found between the findings of this study and the previous reports. We attribute these dissimilarities to ethnic and racial differences and hygienic status of the selected cases. The present study is a proper method for expanding our knowledge about the existing differences.

CONCLUSION

The reactive lesions present commonly in oral cavity secondary to injury and local factors which can mimic benign to rarely malignant lesions. The clinical and histopathological examination helps to categorize the type of lesions. The complete removal of local irritants with follow-up and maintenance of oral hygiene helps to prevent the recurrences of such lesions.

Financial support and Sponsorship

Nil

Conflicts of Interest

There are no conflicts of Interest

FIGURE1:

Clinical appearance of (A)Pyogenic granuloma (B) Irritation fibroma (C) Peripheral ossifying Fibroma (D) Fibroepithelial hyperplasia (E) Peripheral giant cell granuloma

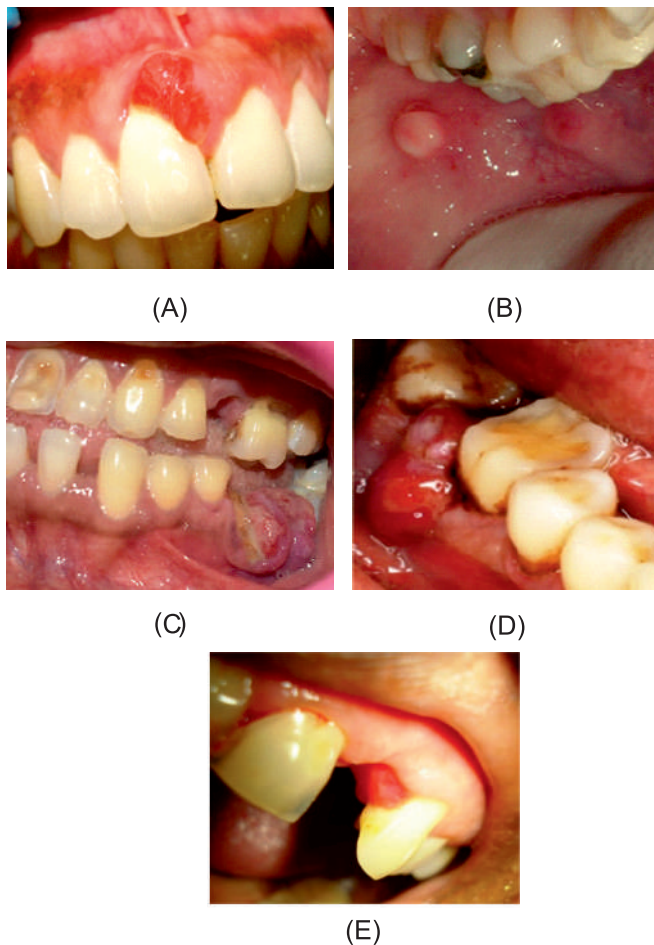


FIGURE 2 showing the epithelial and connective tissue morphology of (A) Pyogenic granuloma (H&E, ×10) (B) Peripheral Ossifying fibroma (H&E, ×10) (C) Inflammatory fibrous hyperplasia(H&E, ×10) (D) Fibroepithelial hyperplasia(H&E, ×10)

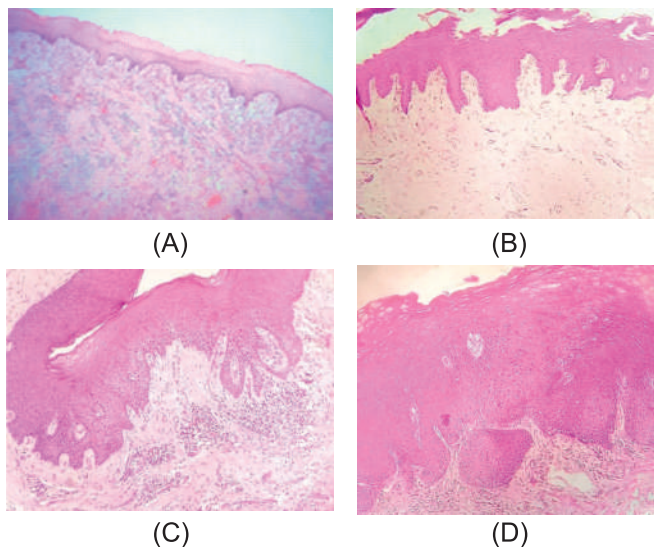
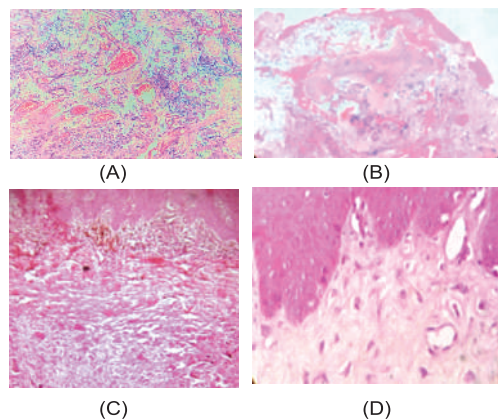


FIGURE 3 showing (A) vascular proliferation seen in pyogenic granuloma (H&E, ×10). (B) Mineralization of bone/bone-like areas seen in peripheral ossifying fibroma (H&E, ×10). (C) & (D) Foreign body type of multinucleated giant cells seen exclusively in peripheral giant cell granuloma and giant cell fibroma (H&E, ×40)



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Oral Submucous Fibrosis-Recent advances in Surgical and non Surgical management with review of literature

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ABSTRACT

Oral submucous fibrosis (OSF) is a debilitating, potentially cancerous oral condition, caused primarily by chewing areca nut and its mixtures, as demonstrated by numerous epidemiological studies and other corroborative evidence. The condition may sometimes extend beyond the mouth to the oesophagus. OSF is well established as a condition with high malignant potential and is considered irreversible. This paper's purpose is to discuss current literature on OSF and help the reader to be better acquainted with the possible etiology, pathogenesis, clinical manifestations, histological features, and management of OSF.

Keywords : Oral Submucous Fibrosis,Arecanut,Medical and Surgical Management

INTRODUCTION:

Oral Submucous Fibrosis (OSMF) is a chronic debilitating disease and a premalignant condition of the oral cavity seen predominantly in the Indian subcontinent. It is characterized by inflammation and progressive generalized submucosal fibrosis, leading to limitation of mouth opening. It exhibits characteristic histological features consisting of juxtra- epithelial hyalinization and excessive collagen deposition in the connective tissue, secondary to which the epithelium becomes atrophic.¹

The buccal mucosa is the most commonly involved site, but may also involve the other parts of the oral cavity including pharynx.

HISTORICAL ASPECTS:

Oral Submucous Fibrosis has been well established in Indian medical literature since the time of Sushruta. A condition resembling OSMF was described as early as "600" BC by Sushruta. It was named as "VIDARI". Vidari had features of progressive narrowing of the mouth, depigmentation of the oral mucosa and pain on taking food.²

Schwartz first described OSMF in 1952 among five East African women of Indian origin, with

a condition of the oral mucosa including the palate and the pillars of the fauces, which he called "atrophica idiopathica mucosa oris". Later on it was termed Oral Submucous Fibrosis by Joshi from India (Mumbai) in 1953 implying predominantly its histological nature. Lal D in 1953, from India described it as a "diffuse oral sub mucous fibrosis". The first report among non- Indians was from Taiwan by Su J.P., in 1954 who described it as "idiopathic scleroderma of the mouth".³

Rao in 1962 described it as "idiopathic palatal fibrosis". Behl in 1962 called it as "sclerosing stomatitis". However, the most accepted term is "Submucous fibrosis" but "juxta-epithelial fibrosis" appeared more appropriate to Pindborg et al (1966).⁴

In 1966, Pindborg defined OSMF as "an insidious chronic disease affecting the mucosa or any part of the oral cavity and occasionally extending into the pharynx and oesophagus. Although, occasionally preceded by and/or associated with vesicle formation, it is always associated with a juxtaepithelial inflammatory reaction followed by a fibroelastic change in the lamina propria, with epithelial atrophy leading to stiffness of the oral mucosa and causing trismus and inability to eat."⁵

In 1978, The World Health Organization published a report defining leukoplakia and related lesions. In that report, Oral Sub Mucous Fibrosis was defined as a "A slowly progressive disease in which fibrous bands form in the oral mucosa, ultimately leading to severe restriction of movement of the mouth including the tongue."⁶

The possible pre-cancerous nature of OSMF was first described by Paymaster in 1956 and later confirmed by Pindborg.⁷ The malignant transformation rates are as high as 7.6% and a relative risk of 397.3 for oral cancer development, compared to individuals with tobacco habits but without any precancerous lesion or condition.³

This disease affects approximately 0.5% of the population in the Indian subcontinent and is now a public health issue in many parts of the world, including the United Kingdom, South Africa, and many south eastern Asian countries. OSMF affects an estimated 10% to 25% The role of nutrition among deficient subjects and the development of OSMF have been reported since 1952. Several investigators have reported anaemia, vitamin, iron and serum protein deficiencies among

of individuals who are habitual arecanut-chewers, common in Taiwan.⁸

The disease affects between 0.2% and 1.2% of an urban population attending dental clinics in India and epidemiological studies suggest an overall prevalence of up to 0.4% in such places as Kerala.⁹

The disease is most common in persons aged 20-40 years with a peak incidence of 29.09 years and male to female ratio of 34:1.⁽¹⁰⁾

ETIOLOGY

The cause of OSMF is believed to be multifactorial. A number of factors may trigger the disease process which include chilli consumption, areca nut chewing, smoking and chewing tobacco, infections and individual factors i.e., immunologic disturbances (autoimmune disorder), genetic susceptibility, collagen disorders, chronic irritation, nutritional deficiency states such as anaemia (iron deficiency) and vitamin deficiencies (B-complex and folic acid).

The characteristic occurrence of OSMF among Indians and other Asiatics has prompted many investigators to search for etiologic factors that may be a part of their diet or environment.

1.Chilli:

The suspicion that chilli could be an etiologic agent arose from ecologic observations and was further strengthened by clinical and histologic characteristics of this condition. OSMF is found mostly among Indians and other population groups that use chillies (*Capsicum annum* and *Capsicum frutescense*) to spice their food. Capsaicin, which is a vanillylamide of 8-methyl-6-nonenic acid, is the active ingredient of chillies, and plays an etiological role in OSMF.

2.Nutritional factors:

The role of nutrition among deficient subjects and the development of OSMF have been reported since 1952. Several investigators have reported anaemia, vitamin, iron and serum protein deficiencies among OSMF patients.

In OSMF oral mucosa is altered following a prolonged period of chronic deficiency of iron and/or vitamin B complex especially folic acid and this results in a hypersensitive response to oral irritants such as chillies and betel quid more easily.¹² These mucosal changes

seem analogous to sideropenic dysphagia.^{7,9,10}

3.Genetics:

Genetic basis for OSMF has also been investigated in order to establish some association between the etiologies of this disorder affecting oral mucosa. The speculation arose as the hypothesis of hypersensitivity to chillies in the development of OSMF, was inconceivable as the disease does not occur with expected frequency in Mexico and S. America, where the diet including chillies equals or even exceeds that in the Far East.⁷

4. Immunity and Autoimmunity:

Occurrence of OSMF in cases without any history of using irritants, in teenagers, idiopathic nature of the disease and various immunological changes have led many researchers to consider OSMF as an autoimmune disorder.¹⁰ Suspicion of an autoimmune explanation for OSMF stems from certain similarities of clinical and histological features with other collagen disorders, namely scleroderma and rheumatoid arthritis which have an autoimmune pathogenesis.^{3,7}

5.Infections:

A.Viral infection:

Pillai Radhakrishna et al proposed an association of viral infection with decreased immunity in OSMF patients. Viral antigens can elicit changes in mononuclear cell phenotypes with the induction of an inappropriate specific suppressor T-cell response and abnormality of the CD4 / CD8 ratio. The resultant immuno-suppression allows spread of the viral antigens and this probably causes the transformation of the epithelium. Although anti - HSV 1 antibody is found to be more in the serum of OSMF patients when compared to controls and other carcinomas (other than SCC), virus specific proteins have not been derived from the lesion.⁷ HPV, may play a role in the initiation and progression of OSMF.¹⁸

B. Candidal infection:

Clinically and experimentally, candidiasis has been associated with epithelial hyperplasia. The development of precancers into invasive malignant neoplasms also has been reported to be higher. Pillai Radhakrishna et al proposed the role of *Candida* in pathogenesis and even in malignant transformation, although it has a definite role in nitrosamine production. An association between *Candida*, virus and nutritional status has also been postulated.⁷

6.Tobacco:

Tobacco, though not commonly implied as an etiological agent for OSMF, is a frequent addition to betel quids and increases the risk for the disease.

7.Areca nut:

“Currently areca nut is considered to be the most important etiologic agent for OSMF”.

Epidemiologic studies that included case-series reports, large cross-sectional surveys, case-control studies, cohort and intervention studies have identified areca nut as the major etiologic agent. Tissue – culture studies involving human fibroblasts, areca nut extracts and areca nut alkaloids supported this etiologic hypothesis by showing fibroblastic proliferation and increased collagen formation.^{3, 11, 14, 16} Clear dose-dependent relationship was observed for both frequency and duration of chewing areca nut.

8. Psychiatric morbidity:

Patients with OSMF may have an association with psychiatric morbidity that seems to be more in functionally worse patients. The younger age group are more commonly affected. This may be due to dependence to areca nut products.¹⁶

PATHOGENESIS

A very common out view of OSMF is an oral fibrotic disease which affects the connective tissue, which brings out secondary alterations in the epithelium. Thus, the simplistic model of OSMF is that of a remodelling connective tissue on account of persistent irritation/stimulus leading to chronic inflammation and thus, increased deposition and decreased degradation or “fibrosis”. Although it appears simple, it involves an end number of complex interactions between various inflammatory mediators, growth factors and probably hormones. “The knowledge about the pathogenesis of OSMF is just like a drop in the sea; and requires various additional investigations/experiments”.

CLINICAL PRESENTATION

Oral submucous fibrosis is a chronic condition and its onset is insidious and is often of 2-5 years duration. Though most of the patients lie in the age group of 20-40 years, no age has been spared. It occurs in a wide age range, 2-89 years. No caste or religious community is specially affected and affects people of all socio economic status of society. OSMF affects both sexes, though the sex distribution shows some variations. Predominance in females has been found in some studies by Rao in 1962, Pindborg et al in 1968, and Gupta et al in 1980.²

The first classification system was put forth by JV Desai in 1957, who divided OSMF into three stages as follows:

- ❖ Stage I: Stomatitis and vesiculation
- ❖ Stage II: Fibrosis
- ❖ Stage III: As its sequelae

Pindborg JJ (1989) divided OSMF based on the physical findings into 3 stages as follows: 15

❖ Stage I: Stomatitis includes erythematous mucosa, vesicles, mucosal ulcers, melanotic mucosal pigmentation, and mucosal petechiae.

❖ Stage II: Fibrosis occurs in healing vesicles and ulcers, which is the hallmark of this stage.

-Early lesions demonstrate blanching of the oral mucosa.

-Older lesions include vertical and circular palpable fibrous bands in the buccal mucosa and around the mouth opening or lips. This results in a mottled, marble like appearance of the mucosa because of the vertical, thick, fibrous bands running in association with a blanched mucosa. Specific findings include reduction of the mouth opening, stiff and small tongue, blanched and leathery floor of the mouth, fibrotic and depigmented gingiva, rubbery soft palate with decreased mobility, blanched and atrophic tonsils, shrunken bud-like uvula (“hockystick uvula”)¹⁶ and sunken cheeks, not commensurate with age or nutritional status.

❖ Stage 3: Sequelae of OSMF are as follows,- Leukoplakia is found in more than 25% of individuals with OSMF. Speech and hearing deficits may occur because of involvement of the tongue and the eustachian tubes.

HISTOLOGICAL FEATURES

The histopathological features of OSMF can be readily diagnosed at an advanced stage as it consists often of atrophic epithelium with juxta-epithelial hyalinization which in turn is due to collagen deposition of varying density. But identifying initial stages is challenging where clinical history has a significant role to play.

The histological features can be studied under epithelial changes and connective tissue changes.^{13, 25}

Classification systems based on histopathological features:

Pindborg JJ et al (1966) were the first to divide OSMF depending only on histopathological features: 15

❖ Very early stage: Finely fibrillar collagen dispersed with marked oedema. Plump young fibroblasts with abundant cytoplasm. Blood vessels are dilated and congested. Inflammatory cells, mainly polymorphonuclear leukocytes with occasional eosinophils, are found.

❖ Early stage: Juxtaepithelial area shows early hyalinization. The collagen is still in separate thick bundles. Moderate number of plump young fibroblasts is present. The blood vessels are dilated and congested. The inflammatory cells are primarily lymphocytes, eosinophils and occasional plasma cells.

❖ Moderately advanced stage: The collagen is

moderately hyalinized. The fibroblastic response is less marked, the cells present being mostly adult fibrocytes. Thickened collagen bundles are separated by slight residual oedema. Blood vessels are either normal or compressed. The inflammatory exudate consists of lymphocytes, plasma cells.

❖ **Advanced stage:** Collagen is completely hyalinized and is seen as smooth sheets with no distinct bundles. The hyalinised areas are devoid of fibroblasts. Blood vessels are completely obliterated or narrowed. The inflammatory exudate consists of lymphocytes and plasma cells. Interestingly the melanin-containing cells in the lamina propria are surrounded by dense collagen, which explains the clinically observed loss of pigmentation.

PRECANCEROUS NATURE AND MALIGNANT TRANSFORMATION

Pindborg in 1972 put forward five criterias to prove that the disease is precancerous. They included, high recurrence of OSMF in oral cancer patients, higher incidence of SCC in patients with OSMF, histological diagnosis of cancer without any clinical suspicion in OSMF, high frequency of epithelial dysplasia and higher prevalence of leukoplakia among OSMF cases.²⁴

The hypothesis that dense fibrosis and less vascularity of the corium, in the presence of an altered cytokine activity creates a unique environment for carcinogens from both tobacco and areca nut to act on the epithelium is widely accepted. It could be assumed that carcinogens from areca nut accumulate over a long period of time either on or immediately below the epithelium allowing the carcinogens to act for a longer duration before it diffuses into deeper tissues.²

MANAGEMENT

The treatment of patients with OSMF depends on the degree of clinical involvement. If the disease is detected at a very early stage, cessation of the habit is sufficient. Most patients with OSMF present with moderate to severe staging, which is irreversible. Medical treatment is symptomatic and aimed at improving mouth movements.^{2, 12}

To improve current treatment regimens for OSMF, the following strategies have been proposed:¹²

a) Vitamins and minerals : Supplementary diets administered to OSMF patients are mainly for high protein and calories and for vitamin B complex and vitamin A, C. Some minerals also play essential roles in the activities of enzymes and the synthesis of important substances. Zinc and magnesium were used as an important adjunctive treatment for OSMF.²³

These are commonly employed in combination with other more specific therapeutic agents like ingestion of iodinated salt and/or local applications.

b) Antioxidants : In a study conducted by Vijay Kumar, administration of three antioxidant capsules per day for three months to patients with clinically and histologically proved OSMF have shown a significant improvement in mouth opening, tongue protrusion and blowing capacity and decreased burning sensation.²² Each capsule consisted of Beta-carotene 50mg (in 20% dispersion), Vitamin E (Acetate) I.P. 10% I.U., Vitamin C I.P. 50% mg, Vitamin A I.P. 2500 I.U., Zinc sulphate 27.45 mg, Selenium dioxide monohydrate 70mg.

Lycopene is a natural pigment synthesized by plants and seen in ripe tomatoes, watermelons, grapefruits, guavas, rosehips and red chillies giving them characteristic red color. It is an open-chain unsaturated carotenoid. The antioxidant and anti proliferative activity of lycopene is at least twice as great as that of Beta-carotene. It was found that lycopene either singly or in combination with intralesional steroid injections was more efficacious, safe, and reliable adjuvant drug in the management of OSMF. The curative effects are due to an inhibition of abnormal fibroblasts, up-regulation of lymphocyte resistance to stress and a suppression of the inflammatory response.

c) Anti-inflammatory / Immunomodulatory drugs: Local and systemic application of colchicines, glucocorticoids and placental extract are commonly used. Colchicine is an anti-inflammatory drug that suppresses collagen synthesis and/or stimulates collagenase. Glucocorticoids such as dexamethasone act as immunosuppressive agents and also prevent or suppress inflammatory reactions, thereby preventing fibrosis by decreasing fibroblastic proliferation and deposition of collagen.

d) Local drug delivery: A combination of hydrocortisone acetate (1.5 ml 25 mg/ml) and hyaluronidase (1500 IU) at weekly interval for 22 wk and combination of triamcinolone acetonide, 10 mg/ml and hyaluronidase (1500 IU) at 15 days interval for 22 wk, i.e. 11 injections in 22 wk. Injection in all patients were given submucosally in retromolar trigone and adjacent soft palate and cheek. By breaking down hyaluronic acid, hyaluronidase lowers the viscosity of the intercellular cement substances and also decreases collagen formation. According to Karkar in 1985, the combination of steroids and topical hyaluronidase showed better long-term results than either used alone. Chymotrypsin, an endopeptidase, hydrolyses the ester and peptide bonds thus acting as a proteolytic and anti-inflammatory agent.²³

e) Interferon gamma (IFN- γ): M.F.Haque et al studied the effect of IFN- γ , an anti-fibrotic cytokine on collagen synthesis by OSMF fibroblasts invitro and the effect of

intra-lesional injections of rhIFN- γ on fibrosis. It was found that the administration of 15 injections of 50 μ g (0.25 ml) of rhIFN- γ intra-lesionally twice a week had a beneficial effect in reversing the fibrosis.

f)Immune milk: Tai et al treated OSMF patients with milk from cows immunized with human intestinal bacteria, which may suppress the inflammatory reaction and modulate cytokine production of anti-inflammatory components. After 3 months of treatment, 69.2% of patients had significantly increased their maximum mouth-opening by more than 3mm.²³

g)Combined therapy: Significantly better results have been obtained by giving local injection of chymotrypsin, hyaluronidase and dexamethasone together with one drug alone or a combination of dexamethasone with either chymotrypsin or hyaluronidase. Combined therapy with nylidrin hydrochloride (a peripheral vasodilators), vitamins D, E and B complex, iodine, placental extract, local and systemic corticosteroids, and physiotherapy claims a success rate of 62% in OSMF.¹⁹

h) Physiotherapy : This includes measures such as forceful mouth opening and heat therapy. Heat has been commonly used and the results have been described as satisfactory.^{19,21}

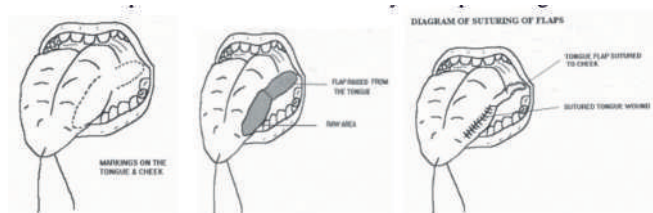
i)Stem cell therapy: Recently scientists have proven that intralesional injection of autologous bone marrow stem cells is a safe and effective treatment modality in OSMF. It has been shown autologous bone marrow stem cell injections induces angiogenesis in the area of lesion which in turn decreases the extent of fibrosis thereby leading to significant increase in mouth opening.

j) Curcumin and turmeric oil: Curcumin produced quicker improvement than the other medications during treatment, turmeric oil was found to have a long-term effect on follow-up evaluation curcumin capsules are instructed to take two capsules twice daily making a daily dose of 1 gm.

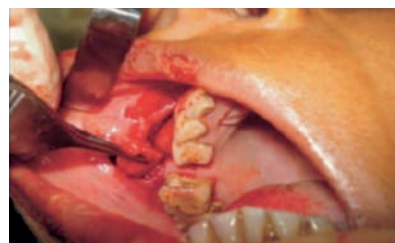
k) Surgical management: It is needed in patients with severe fibrosis. Surgical measures such as forcing the mouth open and cutting the fibrotic bands under anaesthesia have resulted in more fibrosis and disability. Submucosal resection of fibrotic bands and replacement with a partial - thickness skin or mucosal graft following bilateral temporalis myotomy or coronoidectomy have also been attempted. Trismus associated with OSMF may be due to changes in the temporalis tendon secondary to OSMF; skin grafts may relieve symptoms. Nasolabial flaps and lingual pedicle flaps are carried out in patients with OSMF in whom the tongue is not involved.



Inferiorly based nasolabial flap is a reliable, economical option for the management of oral submucous fibrosis. Nasolabial flaps from the tip of nasolabial fold to corner of mouth were marked & bilaterally raised in the plane of the superficial musculoaponeurotic system. The flap was transposed intraorally through a small transbuccal tunnel near the commissure of the mouth, with no tension and the caudal base of the inferiorly based nasolabial flap was deepithelized in a triangular fashion. The area of deepithelialization is determined by the required length of the transbuccal tunnel.²⁵



Depending upon the site to be reconstructed, the tongue flap can either be from the anterior 2/3 or posterior 1/3 of the tongue. The anterior pillar and retromolar fibrotic bands are incised with a knife. On the dorsolateral aspect of tongue, using indelible marking in, a mark is made starting half of an inch from the anterior pillar of the palate, parallel to the midline of the tongue up to 1 cm behind the tip of the tongue. The marking is taken down inferiorly to the sublingual surface up to the last molar, which includes the lateral margin of the tongue.



The buccal pad of fat covered the defect in soft palate region and anteriorly upto cuspid region in most of the cases. The buccal pad of fat was approached via the posterosuperior margin of the created buccal defect with blunt dissection and milking phenomenon. Buccal pad of fat was teased out gently until a sufficient amount was obtained to cover the defect without tension. It was secured in place with horizontal mattress suture.

Presterilized collagen membrane was used to cover the anterior defect.

A new treatment regimen composed of surgical excision of the fibrotic bands with submucosal placement of fresh human placental grafts, followed by local injections of dexamethasone was recommended recently for advanced cases. The rationale for using placental grafts in OSMF is that they have both a hormonal and a mechanical effect; the biogenic stimulant effect is because the placenta is a homograft that is immunologically competent and rich in steroids, proteins, chorionic gonadotropins, estrogens and progesterones. The grafts are easily mouldable and undergo total absorption only after prolonged periods, thus mechanically preventing fibrosis.

DISCUSSION

From the data currently available on OSMF, it appears quite clear that the disease is multifactorial, as is the case with oral cancer and most of its precursor lesions. The available literature indicates that the main etiological factors for OSMF are the constituents of areca nut, mainly arecoline and tannins. These chemicals appear to interfere with the molecular processes of deposition and/or degradation of extracellular matrix molecules such as collagen, causing imbalance in the normal process.

The most likely events that take place with regards to the above imbalance may be reduced phagocytosis of collagen by fibroblasts, up or down regulation of key enzymes such as lysyloxidase, matrix metalloproteinases and tissue inhibitors of matrix metalloproteinases. The process may be influenced by increased secretion of inflammatory cytokines, growth factors and decreased production of anti-fibrotic cytokines. Although the above mechanisms may explain the induction, maintenance and progression of fibrosis in OSMF, further research is required in order to identify the mechanisms leading to carcinogenesis in this fibrotic oral mucosa.

Nutritional deficiencies may not play a primary role but it could synergies the symptomatology by contributing to epithelial atrophy. Although the involvement of HLA and genetic predisposition has been reported, specific haplotypes have not been determined.

Since the pathogenesis is still obscure, and the disease, once established, is not reversible, alleviation of the symptoms and enhancement of the living conditions of the patient form the basis for its management. This includes conservative and surgical modalities depending on the stage of the disease; however the core for the therapy remains cessation of areca nut use.

As they always say that prevention is better than cure, application of stringent laws and better

legislative rules for prevention of tobacco and areca nut use could go a long way in addressing this public health issue. Till then, the pursuit for the precise pathogenesis and hence effective cure of this inscrutable disease continues.

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Management Of Periodontitis By Using A Local Drug Delivery- A Review

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ABSTRACT

Periodontitis is an inflammatory disease of the supporting tissues of the teeth caused by groups of specific microorganisms. Various methods of treatments were used in the management of periodontal infection such as mechanical debridement of plaque, topical and systemic administration of antibacterial agents. The local drug delivery of antimicrobials was introduced for overcoming the limitations of systemic antimicrobial therapy. Various antimicrobial agents have been used effectively in the management of periodontal infection.

Keywords: *Periodontitis, Local drug delivery and Scaling & Root Planing*

INTRODUCTION

The inflammation in the periodontal tissue is initiated by microbial plaque and bacterial infection. In the periodontal pocket the bacteria form a highly structured and complex biofilm. As this continues, the biofilm reaches far subgingivally and it becomes difficult for the patient to reach it during oral hygiene practices¹. Traditional treatment options for such conditions includes mechanical debridement aimed at removing the subgingival flora and providing a clean, smooth and compatible root surface. But, in several instances, the complex anatomy of the root and the location of the lesion may hamper the treatment and prevent sufficient reduction of the bacterial load². To overcome this, addition of antimicrobials both systemic and locally would enhance a treatment protocol and serve as adjuncts to mechanical therapy.

Systemic antimicrobial agents may reduce or eliminate bacteria that cannot be removed by scaling and root planning. However, adverse effects such as drug toxicity, drug interaction and patient's

compliance, limit the use of systemic antimicrobials. Therefore, to override these short comings, local deliveries of antibacterial agents into periodontal pockets have been extensively studied.

It was Dr. Max Goodson in 1979, who developed local delivery of therapeutic agents into a viable concept. This modern of drug delivery avoids most of the problems associated with systemic therapy, limiting the drug to its target site and hence achieving a much higher concentration¹⁴.

According to Greenstein and Tonetti, local application of pharmacological agents must fulfill the following criteria¹³:

- a) It must reach the intended site of action
- b) It must remain at an adequate concentration
- c) It should last for a sufficient duration of time

IDEAL REQUIREMENTS OF LOCALLY DELIVERED DRUG

1. The drug delivery system should deliver the drug to the base of the pocket.
2. It should be effective against periodontal pathogens only and not on commensal microflora.
3. Drug must show in-vitro activity against the organisms.
4. The target dose should be sufficient enough to kill the targeted organisms also should not have any adverse effects.
5. Substainity.
6. Prolonged shelf life.
7. It should be both biodegradable and biocompatible.
8. Ease of placement.

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- 9. Ready to use chairside.
- 10. Should be economical³

ADVANTAGES

- 1. Attains a 100-fold higher concentration of antimicrobial agents in sub-gingival sites.
- 2. The concentration of the drug in periodontal pocket is not affected by the fluctuation in plasma levels.
- 3. The technique is suitable for agents which cannot be given systemically, such as chlorhexidine.
- 4. Small doses can be administered.
- 5. Superinfection and drug resistance are rare.
- 6. Reduction in frequency of drug administration
- 7. Improved patient compliance³

DISADVANTAGES

- 1. Time consuming
- 2. Does not have any effect on adjacent or nearby structures such as tonsils, buccal mucosa etc. so may cause chances of reinfection.
- 3. Difficulty in placing into the deeper parts of the pocket area or furcation³.

INDICATIONS

- 1. Patients with grade A/B periodontitis where the initial treatment has been done, but certain sites are non-responsive to the treatment or the sites where surgery cannot be done.
- 2. Patients on maintenance, who are otherwise stable, but exhibit localized, persistent or recurrent deep pockets.
- 3. Ailing/failing dental implants where surgical intervention is not indicated or will yield a compromised result.
- 4. Grade II furcation involvements when surgical intervention is not planned.

CONTRAINDICATIONS

- 1. Periodontal patients with known hypersensitivity reaction to any components of the LDD systems to be used.
- 2. As a replacement to scaling and root planning during initial periodontal therapy and maintenance.
- 3. As a replacement for surgical periodontal therapy in cases indicated for periodontal surgery.
- 4. As a replacement for systemic antibiotic therapy, where their systemic administration is indicated.
- 5. In pregnant or lactating patients³.

CLASSIFICATION^{2,3,4}

1. LANGER AND PEPPAS (1981)-Based on their mechanism of action:

- ✓ Diffusion controlled systems
- ✓ Chemically controlled systems
- ✓ Solvent activated systems
- ✓ Release induced by external forces

2. KORNMAN (1993)

- ✓ Reservoirs without a rate controlling system
- ✓ Reservoirs with a rate controlling system

3. RAMS AND SLOTS (1996)-Based on application of therapy

- I. Personally applied:
 - ✓ Non-sustained subgingival drug delivery
 - ✓ Sustained subgingival drug delivery

II. Professionally applied:

- ✓ Non-sustained subgingival drug delivery
- ✓ Sustained subgingival drug delivery

4. SOSKOLNE WA (1997) - Based on dosage form

- I. Fibers:
 - e.g., Tetracycline

ii. Films / slabs:

- e.g., Chlorhexidine chip
- ✓ Non-degradable films
- ✓ Degradable films

iii.3) Injectable systems:

- e.g., Minocycline

5. GREENSTEIN & TONETTI (2000)- Based on duration of action:

- i. Sustained release devices:
 - Designed to provide drug delivery for less than 24 hours.
- ii. Controlled release devices:
 - Designed to provide drug release that at least exceeds 1 day or for at least 3 days following application (Kornman 1993).

6. SOSKOLONE WA FRIEDMAN M. - Depending on degradability

- i. Non-degradable devices (First generation):
 - These devices are to be removed by the dentist thereby controlling the time of exposure to the device depending on the status of pocket healing. Major disadvantage is an extra visit to the dental office.
- ii. Degradable devices (Second generation):
 - These devices get degraded on its own in the Sulcus, but

the time of exposure and contact cannot be controlled.

Various Drugs/Agents Used In The Local Drug Delivery System:

1)TETRACYCLINE

•FIBERS (ACTISITE)

The current FDA approved Tetracycline fibers being used is ACSTITE which is a non-resorbable cylindrical drug delivery device made of a biologically inert Ethylene Vinyl Acetate (EVC) Copolymer that is 23cm long, 0.5 mm in diameter and contains 12.7mg tetracycline loaded with 25% tetracycline HCl powder. When packed into the periodontal pocket, it is well tolerated by oral tissues, and for 10 days it sustains tetracycline concentrations. This delivery system is able to maintain concentrations of tetracycline in gingival fluid in excess of 1,300µg/ml for a 7-day period with mean concentrations of 43 µm/ml in the superficial portions of the pocket wall^{3,5}. The fibers are placed in layers to completely fill the periodontal pocket and are secured with dressing. These fibers are left in the pocket for 10 days, after which they must be removed from the pocket. Recently bio-resorbable tetracycline fibers has been developed with base of collagen films, which is commercially available as PERIODONTAL PLUS AB. Its main advantage is that it does not require an additional appointment for removal as it biodegrades within 7 days⁵. This product has a shelf life of 2 years and comprises 25 mg of pure fibrillar collagen with about 2 mg of uniformly impregnated tetracycline HCL, that is sterilized by gamma radiation⁵. The fibril itself releases anti collagenase enzyme as it degrades. It has an added advantage of having a hemostatic ability.



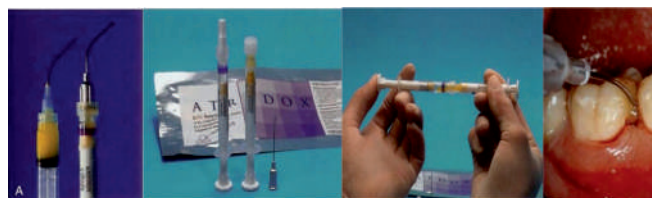
•GELS

Tetracycline serratiopeptidase containing periodontal gel, the purpose was to reduce the polymer concentration and to obtain reasonable viscosity at a lower concentration of pluronic acid³.



2)DOXYCYCLINE

Doxycycline is a bacteriostatic agent. A biodegradable formulation containing :10% by weight doxycycline, 33% by weight poly (DL-Lactide), 57% by weight N-methyl 2-pyrrolidone. Approximately 95% of the polymer is bio-absorbed or expelled from the periodontal pocket naturally within 28 days. The efficiency of 10% doxycycline hyclate as a local delivery antimicrobial agent for achieving probing depth reduction and gaining clinical attachment. It is a liquid biodegradable system that hardens when placed in the periodontal pocket. The delivery system consists of two syringes. One syringe contains the liquid delivery system and the other syringe contains drug powder. The procedure of drug delivery involves uncoupling the two syringes after mixing, attaching a blunt cannula to one syringe and placing the gel in the periodontal pocket by inserting the tip of the cannula slowly into the periodontal pocket. The drug release from the carrier take place within seven days. It is recommended that; the area should be covered with a protective dressing^{5,6,7}.



3)MINOCYCLINE

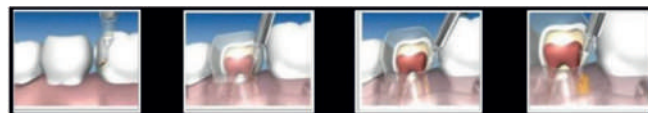
Minocycline HCL, a semi synthetic tetracycline is one of the most active antibiotics for microorganisms associated with periodontitis. It has a significant antimicrobial activity against a wide range of organisms as well as an anti-collagenase effect. There are three modes of local application are available: Film, Microspheres, Ointment. Arestin is microsphere based and Dentomycin is ointment based commercially available LDD systems for minocycline^{2,3}.

•FILM

Ethyl cellulose films containing 30% of minocycline were tested as a sustained release device. The result of this study indicated that it completely eradicates pathogenic flora from the periodontal pocket after 14 days⁸.

•ARESTIN

The microsphere is 20-30um in diameter. 1mg of minocycline is microencapsulated into a bio-absorbable polymer and delivered subgingivally as a powder via a syringe. Once these microspheres come in contact with GCF, they release the drug at a slower rate, but sufficiently above the minimum inhibitory concentration (MIC), over a period of 14 days. The released drug effectively reduces the number of microorganisms in periodontal pocket.



·DENTOMYCIN

They consist of: Magnesium chloride hexahydrate, Ammonio methacrylate copolymer, Triacetin, Glycerol. The gel contains 2% minocycline.

They tip of the applicator should be inserted till the point of resistance in each pocket to be treated before the medication is administered. The amount of gel administered should be sufficient to fill each pocket to the point of overflow.



4)METRONIDAZOLE

Effective against gram –ve microorganisms. Used for the treatment of anaerobic periodontal infections. Commonly used LLD preparation containing metronidazole includes: Elyzol and Metrogene.

·ELYZOL

It consists of bioabsorbable gel that contains 25% metronidazole benzoate in a sesame oil matrix. The gel is placed in the periodontal pocket with a syringe and a blunt cannula. The gel in periodontal pocket liquidizes due to body heat and then again solidifies due to contact with water to form crystals. The activity and resorption of the material occur within 12-24 hours.



·METROGENE

The system consists of 5% metronidazole in natural bovine collagen. The material is supplied in the form of sponge square pieces. The sponge is placed in the periodontal pocket and when it comes in contact with

GCF, it rapidly forms a resorbable gel which releases the drug in a slow manner.

5)CHLORHEXIDINE

Chlorhexidine belongs to the family of biguanide, it is used as an antifungal and antibacterial agent. It is mainly active against gram positive group of organisms. It is bacteriostatic at low and bactericidal at high concentrations. It is available in the forms of: Mouth rinses, Gels, Varnishes and Chips3.

·PERIOCHIP

A small chip composed of biodegradable hydrolyzed gelatin matrix, comprised of 34% chlorhexidine cross-linked with glutaraldehyde and also containing glycerine and water. The chip is 5mm long, 4mm wide with 2.5mg of chlorhexidine gluconate5. The strip is orange – brown in color with one of its ends rounded.

While placement, the rounded end of the strip is inserted into the periodontal placement of the chip, the area should be dried so that it does not become soft due to contact with saliva which will make it difficult to place. The chip is self – retentive and degrades within 7-10 days.



·PERIOCOL-CG

This system consists of type I collagen membrane (derived from fish sources) containing 2.5mg CHX derived from a 20% CHX solution. Size of the chip: 4 x 5 mm, Thickness of the chip: 0.25-0.32mm, Weight of the chips: 10mg. Collagen membrane which has been used in this system has many advantages - It is naturally occurring protein having excellent hemostatic properties. 40-45% of CHX is released within the first 24 hours of placement and the remaining drug is released in a linear fashion within 7-8 days. The chip completely resorbs within 30 days3.



·CHLO-SITE

It is a gel-based system that contains 1.5% CHX. The carrier system is made up of xanthan gel which is a saccharidic polymer that when combined with water forms a three – dimensional pseudo-plastic reticulum. The gel has good adhesive properties in the periodontal pocket and does not require periodontal dressing. The gel gets dissolved within 10-30 days after placement. The effective antimicrobial concentration of CHX is maintained for up to 15 days.



NEWER DRUGS

1)CLARITHROMYCIN GEL

Clarithromycin (CLM) is a classic macrolide that possesses a broad antimicrobial spectrum, better bioavailability, favorable tissue distribution, and a low incidence of adverse drug reactions.

2)AZITHROMYCIN GEL

Azithromycin (AZM) is a semi-synthetic, acid-stable antibiotic. It has a long half-life and good tissue penetration. AZM has a wide antimicrobial spectrum of action toward anaerobic bacteria as well as Gram-negative bacilli. It is effective against periodontal pathogens like Aggregatibacter actinomycetemcomitans and Porphyromonas gingivalis, and this antimicrobial activity supports its use in the treatment of periodontal infections⁹.

3)STATINS

Statins like SMV, lovastatin, and pravastatin are specific competitive inhibitors of 3-hydroxy-2-methylglutaryl coenzyme A (HMG-CoA) reductase. These agents are widely used to lower cholesterol, and they provide an important and effective approach for the treatment of hyperlipidemia and arteriosclerosis. Statins also seem to modulate bone formation by increasing the expression of bone morphogenetic protein-2, inflammation, and angiogenesis, thus providing a new direction in the field of periodontal therapy¹⁰.

4)ALENDRONATE GEL

Alendronate (ALN), an aminobisphosphonate, acts as a potent inhibitor of bone resorption¹¹.

5)METFORMIN GEL

Metformin is used to stimulate osteoblasts and reduce alveolar bone loss.

6)FIBROBLAST GROWTH FACTOR

Fibroblast growth factor is effectively introduction in local drug delivery. To regenerate periodontal tissues, a sandwich membrane composed of a collagen sponge scaffold and gelatin microspheres containing basic fibroblast growth factor (bFGF) in a controlled-release system was developed¹².

7)HERBAL PRODUCTS

Various herbal formulations like: Aloe Vera, Bloodroot, Chamomile, Eucalyptus neem, Tulsi, Propolis, cocoa husk, Pomegranate, cranberry etc. are being used widely these days. These products have shown to improve gingival and periodontal parameters without side effects.



CONCLUSION

Application of local drug delivery is effective against the periodontal disease in adjunct to scaling and root planing. It can be concluded that local drug delivery though is not a substitute for conventional therapy, but can be of added benefit if used as an adjunct with the conventional scaling and root planning².

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Silver Diamine Fluoride In Pediatric Dentistry: A Boon For Prevention.

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ABSTRACT:

Early childhood caries (ECC) has become a global oral health problem affecting children leading to a poor quality of life. Various remineralizing agents are using nowadays to reduce caries attack. Fluorides are the traditional choice for remineralizing the caries lesion. Silver diamine fluoride (SDF) has the highest concentration of fluoride among the available fluoride agents. SDF has antimicrobial action and can arrest caries. SDF is a powerful tool in the fight against ECC, though the parental acceptance was poor because of the formation of silver compounds results in staining on anterior teeth.

Keywords: *Fluoride, Ecc, Remineralising Agents, Tooth Staining*

INTRODUCTION

Dental caries is one of the most prevalent diseases in children worldwide¹. High prevalence in primary teeth negatively affect the quality of life of children and parents². With various remineralizing agents available, studies have demonstrated the efficacy of SDF for arresting cavitated lesions in both primary and permanent teeth with high success rate³. Therefore, SDF will be a promising option for caries management at the lesion level, particularly in children with caries susceptibility.

SDF is a basic solution (pH of 10-12) with a 38% w/v Ag (NH₃)₂F. The silver functions as an antimicrobial agent while fluorides promote remineralization and the ammonia (NH₃) present stabilize the solution.⁴

INDICATIONS

Arrest active carious lesions, because of its antimicrobial action against various cariogenic monospecies strains⁵ and multispecies cariogenic biofilms formed on dentine surfaces. Both silver and fluoride ions contained in SDF have the ability to inhibit the formation of cariogenic biofilms. High concentration fluorides can inhibit biofilm formation because fluorides, due to its antimicrobial property, can bind to bacterial cellular components and influence enzymes that are related to carbohydrate metabolism as well as to sugar uptake⁶. Silver ions on the other hand, destroy the cell wall structure of bacteria, inhibit enzyme activities and influence metabolic processes and can inhibit the replication of bacterial DNA.

SDF at a concentration of 38% contains 44,800 ppm fluoride which is the highest among the available fluoride agents. Fluoride promotes the remineralisation of hydroxyapatite in enamel and dentine. This is because of the formation of silver phosphate and calcium fluoride when SDF interacts with the hydroxyapatite of the teeth. The subsequent dissolution of fluoride and calcium facilitates the formation of insoluble fluorapatite. The calcium fluoride formed after application of SDF is considered to be a pH regulated slow-release reservoir of fluoride on the tooth surface. Direct application to healthy surfaces in children helps prevent caries. This is because of its property to reduce *S. mutans* count which can prevent initiation of caries and also remineralize carious lesions.

Due to its ability to occlude dentinal tubule, SDF can be used in patients with dentinal hypersensitivity.⁸ Tan HP et al in 2010, have shown that due to the high ability of SDF to arrest dental caries, annual application of SDF is effective in arresting caries on the root surface without any risk of toxicity⁹.

CONTRAINDICATIONS

Silver allergy is an absolute contraindication. Relative contraindications include any significant desquamative gingivitis or mucositis that disrupts the protective barrier formed by stratified squamous epithelium. Increased absorption and pain would be expected with contact. Saturated solution of potassium iodide (SSKI) is contraindicated in pregnant women and during the first six months of breastfeeding due to concern of overloading the developing thyroid with iodide; thyroid specialists suggest a pregnancy test prior to use in women of childbearing age uncertain of their status¹⁰.

METHOD OF APPLICATION OF SDF

A micro brush should be fully immersed in SDF solution and applied directly to the tooth surface. SDF should ideally be left for one to three minutes¹¹; however, it must be appreciated that this may not always be possible, especially with uncooperative patients.

Patients will often describe a 'metallic taste' when SDF is applied. Excess should then be appropriately removed with cotton wool or a gauze. If potassium iodide (KI) is to be applied, then a micro brush, fully immersed in the KI, should be applied to the SDF. Initially, a white precipitate will form. KI should be repeatedly applied until the precipitate

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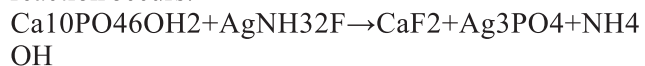
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turns colourless. Leaving precipitate on the tooth may result in a reduction in bond strength¹² therefore, precipitate should be rinsed away and the tooth has to be air-dried before undertaking further restorative intervention. If contact with the mucosa occurs, it is essential that the area be thoroughly rinsed. The burn/staining usually appears as a mixed white/black lesion, which usually resolves within one week.¹³



MECHANISM OF ACTION

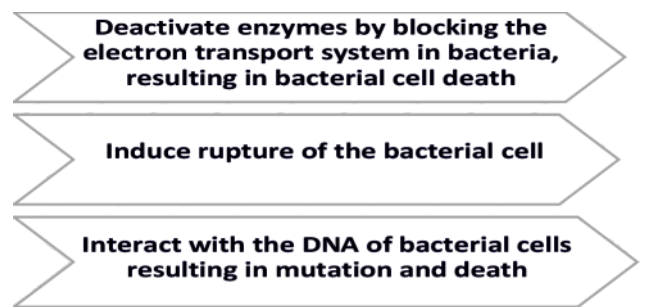
When SDF is applied to the tooth, the following reaction occurs:



Hydroxyapatite + SDF → Calcium fluoride + Silver phosphate + Ammonium hydroxide

Antibacterial mechanisms of SDF can also be attributed to the formation of organometallic complexes inside the bacterial cell.

Organometallic complexes can ¹⁴



The formation of silver compounds results in striking tooth structure color change.

ADVANTAGES

SDF is an effective, safe, and equitable product ¹⁵. It offers the clinician the possibility of avoiding invasive treatments and the use of dental local anesthesia and dental drills, which triggers for dental fear and anxiety. In young patients with behavioral problems that are not manageable in a normal clinical setting, the option for an SDF treatment may avoid sedation and general anesthesia and the risks associated with them.

ACCEPTANCE OF SDF TREATMENT

The black staining from SDF affects the esthetic appearance of a child, which can be a reason for parents to reject the treatment or dentists to be reluctant to recommend it. This issue is consistent with findings

from several studies in which the most frequently reported barrier to SDF treatment was parental acceptance. Although many factors may affect parental acceptance¹⁶ (e.g., parental education, family income, ethnicity, dental workplace). But the key factors affecting parental acceptance were the location of the teeth and the child's cooperation. Staining on posterior teeth was more acceptable than staining on anterior teeth under all circumstances. Although staining on anterior teeth was undesirable, most parents preferred this option to advanced behavioral techniques such as sedation or general anesthesia¹⁶.

DRAWBACK OF SILVER DIAMINE FLUORIDE

The inherent drawback of using SDF to arrest caries is that the lesions will be stained black; therefore, some children and their parents may not be pleased with the esthetics of this treatment outcome. It has been suggested that when carious dentin was treated with SDF, silver phosphate was formed, and this was insoluble¹⁷.

Silver phosphate is yellow when it is first formed, but readily turns black under sunlight or the influence of reducing agents. To overcome this limitation Knight et al¹⁷, proposed to use Potassium iodide after application of SDF to the tooth structure remaining free silver ions in solution will react with potassium Iodide to precipitate creamy white silver iodide crystals. Hence, free silver ions are no longer available to react with sulfur and other reagents in the mouth to form black precipitates into the teeth. Further research in this direction is still required.

Moreover, SDF can stain the skin of the body and clothes. The stain caused by SDF on the skin, does not cause any pain, cannot be washed away, and it takes a long time for it to be removed. If the skin or clothes have been stained the following procedure is suggested for removing the stain: (a) Wash out with running water, soap, or ammonia water, immediately after staining. (b) If the discoloration is not removed and persists, apply the solution of sodium hypochlorite or a bleaching powder (with caution in dyed cloth).

SDF solution also has a metallic taste which is unpleasant. Furthermore, gingival and mucosal irritation can occur. In most cases, the damage is transient and the tissue affected turns white, but it will heal within 1–2 days. When the solution is to be applied to the lesions very close to the gingiva, use a rubber dam, or protect the gingiva with Vaseline or cocoa butter.

CONCLUSION

Silver diamine fluoride is a non-invasive, painless, and effective treatment for the management of carious

lesions in children. It is simple and quick to use without the risk of any harm to the child patient. In the age where early childhood caries (ECC) has become a global oral health problem affecting children causing pain, poor aesthetics, dietary deficiency, malocclusion and financial loss leading to a poor quality of life, SDF is a powerful tool in the fight against ECC. Considering the simplicity and safety of its use, it can be associated with other non-invasive, micro-invasive or minimally invasive strategies.

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Preventive Resin Restoration - Prevention From Extension

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ABSTRACT

Dental caries has been recognized as a major public health problem globally which has an equivalent effect on all age groups. Caries predominantly affects the occlusal surfaces of erupting molars and premolars and thus accounts for nearly 80-90% of pit and fissure caries in permanent teeth. With the proven results of etched resin techniques, there has been renewed interest in cavity design with a view to preservation of healthy tooth structure. Among the newer techniques long term success are preventive resin restorations. Three types of preventive resin restoration with high rates of retention have been described. Minimal exploratory openings in enamel are filled with pits and fissure sealant, whereas carious lesions are removed without any extension into surrounding healthy tooth. The cavity is obturated with filled resin and the unaffected pits and fissures are protected with pit and fissure sealant. The success rate of these Conservative restorations can be enhanced by paying strict attention to the technique, thereby ensuring a non-contaminated surface. A number of suggestions are offered on how this success rate can be increased. [1]

Keywords: Preventive Resin Restoration, Caries, Pit & Fissures, Sealants

INTRODUCTION

Dental caries has been rated as an important global oral health problem in the world today. Despite of the great improvements in the oral health of population, dental caries still continues to affect oral health of all age groups. Great efforts have been made for achieving caries prevention by methods of diet counselling, fluoride application, motivation for oral hygiene maintenance. These methods have helped in controlling smooth surface caries but caries prevalence of pit and fissure caries still seems to be high.

Pits & Fissures are naturally occurring depressions and clefts respectively which harbours carious bacteria and substrates, by virtue of their anatomic shape and are extremely susceptible to caries. Caries occurring in the pits and fissures account for 80% to 90% and 44% of the total caries in permanent teeth and primary teeth respectively. [2]

HISTORY

The earlier treatment strategies for preventing pit and

fissure caries can be traced back to the 18th century when Hunter thought that physically blocking the pits and fissures can lead to caries prevention.

Wilson, 1895 advocated the use of zinc phosphate as fissure filling material.

In the year 1905 Willoughby D. Miller applied an antibacterial agent silver nitrate onto the tooth surfaces to chemically treat the biofilm present.

Fissure eradication by Bodecker in 1929 based on the concept of "extension for prevention" were introduced. Then with the advent of acid etch technique and adhesion concept by M.G Bunocore in 1955 revolutionary changes were seen.

In the mid 1960's investigations using methyl cyanoacrylate as sealant material by Cueto were performed but the material was not marketed. Then Bowen invented BISGMA (bisphenol-a-glycidyl dimethacrylate) a viscous resin which was proved to have good bonding properties to etched enamel by Bunocore in 1970. This bonding property thus lead to successful creation of dental sealants which then started emerging as an effective means for managing pit and fissure caries.

Preventive resin restoration (PRR) is a conservative reply to 'extension for prevention' philosophy. PRR is a secondary prevention technique which allows to halt the progress of the carious lesion at its incipient stage and thus prevents further decay. The strategy integrates the preventive aspect of occlusal sealant therapy for caries susceptible pits and fissures with the therapeutic restoration of incipient caries that occur in the same occlusal surface with composite resin. These restorations are now termed as "Conservative Adhesive Restoration"(CAR) to reflect the fact that other adhesive material may be utilized in these restorations. This updated term was first described by Simonsen and Stallard in 1977 and refined in 1985. [3,4]

INDICATIONS

Several indications of PRR comprised of questionable caries, or an explorer catch in a pit or fissure; very minimal, superficial pit and fissure caries; deep pits and fissures that could impede absolute penetration of sealant material or it might be carious at their bases; deep pits and fissures with considerable supplemental fissuring and

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minimal areas of decay; a smeared, chalky appearance along pits and fissures that could stipulate incipient caries

In 1991, Simonsen reported on a random sample of participants in a sealant study recalled after 15 years. He reported that, in the group with sealant, 69% of the surfaces were sound 15 years after a single sealant application, whereas 31% were carious or restored. In the group without sealant, matched by age, gender, and residence, 17% of the surfaces were sound, whereas 83% were carious or restored. He also estimated that a pit and fissure surface on a permanent first molar is 7.5 times more likely to be carious or restored after 15 years if it is not sealed with a single application of pit and fissure sealant.

Mertz-Fairhurst et al. conducted a landmark study regarding the effects of sealing caries. Many of her publications along the way peaked in 10-year data. Mertz-Fairhurst's 10-year study investigated bonded and sealed composite restorations placed directly over frank cavitated lesions extending into dentine versus sealed conservative amalgam restorations. The results imply that both types of sealed restorations show higher clinical performance and longevity compared with unsealed amalgam restorations. Furthermore, the bonded and sealed composite restorations placed over the frank cavitated lesions stopped the progress of these carious lesions for the duration of the study, 10 years. [5,4,6,7]

DIAGNOSIS

The clinical diagnosis for PRRs has three primary elements:

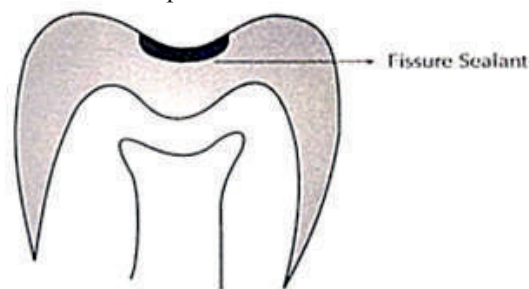
1. Assessment of the patient's caries risk
2. Investigate and note the patient's medical history and do testing as necessary to determine caries risk
3. Diagnosis of lesion depth not only cavitated lesions diagnose enamel lesions too. This is the major step as the progression of the enamel lesion can be stopped
4. Diagnosis of lesion activity both the activity of the lesion and the risk of caries are very important for diagnosis and treatment planning.

TYPES OF PREVENTIVE RESIN RESTORATION

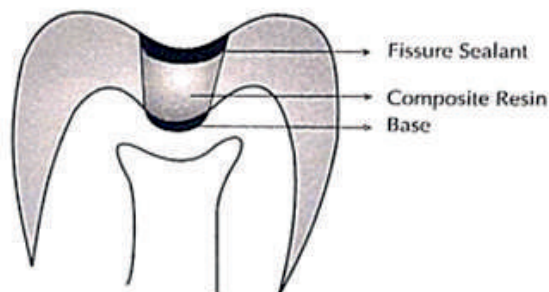
There are three types of preventive resin restorations based on the extent and depth of the carious lesion as determined by exploratory preparation.

Simonsen classified these types as types A, B, and C[4]

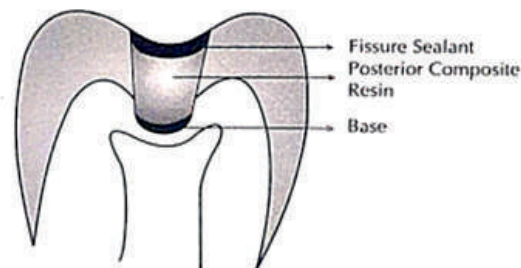
Type A comprises suspicious pits and fissures where caries removal is limited to enamel. A slow-speed round bur is used to remove any decalcified enamel, and local anesthesia is not required.



Type B is defined as the incipient lesion in dentin that is minimal and confined to pit and fissures; can be removed using round bur and lost tooth structure is replaced by flowable resin. This conservative method of caries prevention is now frequently termed as "Microdentistry". [8]



Type C is characterized by the need for greater exploratory preparation of depth. This restoration requires the administration of local anesthetic; removal required larger size bur and liner placement over the exposed dentin.



Initially, Simonsen advocated an unfilled sealant for type A, a diluted composite resin for type B, and a filled composite resin for type C. The concept of a diluted composite resin, which is a mixture of filled composite resin and an unfilled bonding agent, has a superior retention due to the greater wear resistance of the filled resin particles, whereas the dilution with the unfilled resin provided the necessary viscosity for flow.

The long-term effectiveness of the bonded restoration with sealant overlay has been proven. The restorations have success equivalent to or better than that of amalgam

restorations. Once again, however, success is dependent upon whether the sealant remains intact.

The use of flowable composite systems is also gaining in popularity, because they are easy to apply and because evidence shows that less microleakage occurs with these systems than when teeth are restored with condensable composite resins, such as sealant materials that have slightly more filler than filled sealants. Therefore, the practical results of sealing with a flowable or a filled sealant should not differ. [4,8]

Advantages[6,9,10,11]

- Minimum tooth preparation is only required comparing conventional preparation which eliminates better sound tooth structure.

- The sealed restoration can eliminates marginal leakage and recurrent caries.

- Decreased caries progression rate in children.

- The patient undergoes very less discomfort and usually does not require anaesthesia as less mechanical preparation is required.

- The restoration may be added to, restored, or mended without further tooth preparation.

Disadvantages

- Technique sensitive i.e. requires strict adherence to principles of acid etching and also absolute moisture control is needed.

- Long term wear and retention needs to be determined still.

Placement Technique [12]

1.Administering local anaesthesia

Although optional, infiltration or block anaesthesia should be considered for the patient's comfort.

Rationale- Although minimal instrumentation is associated with the procedure but sometimes excavation with high-speed burs may be painful and also application of the rubber dam retainers might be perceived painful by some patients and thus use of local anaesthesia plays an important role

2.Isolation

Only the tooth or teeth being treated needs be isolated. Rationale - A procedure involving conditioning with acid, application of composite resin and sealant, and possible use of glass-ionomer lining cement is technique sensitive and time consuming. Each of these steps is sensitive to moisture contamination and thus

use of rubber dam becomes a mandatory step to prevent salivary contamination of the concerned tooth.

3.Caries Removal

A small pear-shaped, or round-ended bur is used. The cavosurface margin is not bevelled.

Rationale- Small burs are used to conserve tooth structure and help ensure a narrow cavity preparation. Beveling of the cavosurface margin is not required as it has no significant effect on the clinical performance of posterior composite resins.

4.Providing pulpal protection if necessary

Calcium hydroxide is placed only on the floor of the preparation. Glass-ionomer lining cement (GIC) should cover all of the dentin and not extend onto the enamel.

Rationale- If the excavation extends close to the pulpal tissue, i.e. in cases where remaining dentinal thickness in between the floor of the cavity preparation and the pulp is ≤ 0.5 mm, calcium hydroxide liner is recommended.

5.Cleaning the occlusal surface

Prophylaxis using aqueous slurry of fine pumice in a rotating rubber cup or fluoridated/non fluoridated paste is done to clean the occlusal surface, including the cavosurface margin. The tooth is then washed and dried.

Rationale- Maximal bond strengths are obtained when a prophylaxis is given prior to acid conditioning.

6.Conditioning the entire occlusal surface

The surface, including the cavosurface margin and enamel cavity walls, is usually etched with 37% phosphoric acid gel or liquid then thoroughly washed and dried.

Rationale- Etching of the tooth surface is a key moment in the preparation of the tooth for application of adhesive restorations. Conditioning creates pores in the enamel and enables the microscopic infiltration of resin into the dentinal tubules, where it polymerizes and bonds and leads to formation of "resin-tags".

7.Placement of bonding agent

The cavity walls and surface of the glass-ionomer cement liner are covered with a bonding agent.

Rationale- Use of a bonding agent improves the bond strength between a GIC and composite resin.

8.Placement of posterior composite resin into the preparation

Two different techniques of posterior composite restoration can be used i.e. Layering technique or the Bulk Fill technique.

Rationale- The composite resin micromechanically

bonds to the conditioned enamel and provides an effective marginal seal. Bonding occurs between the composite resin and prepared glass-ionomer cement and dentinal walls. In layering technique light cured composite are placed in increments of about 2mm and cured.

The bulk fill technique involves placement of low shrinkage bulk fill composites upto 4-5 mm depending on manufacture's instruction. Two consistencies are available for the bulk-fill composites: flowable consistency (used as a base or liner) and regular consistency (used to fill and restore in one shot).

9. Sealant application

The acid-conditioned occlusal surface and the restoration surface are then covered with sealant, which is either hardened by chemical cure or light cure. After the curing process is over retention and coverage of the sealant are checked. If sealant can be dislodged from the pits or fissures with an explorer, the tooth and restoration are again re-etched for 10 seconds, washed, and dried, and new sealant is applied. Also sealants are checked for any voids or bubbles and for any deficient or excess material placement.

Rationale- Sealant application helps to prevent caries of the pits and fissures that were not included in the cavity preparation.

10. Occlusal Equilibration

The occlusion is equilibrated after rubber dam removal, particularly when semi filled sealants are used.

Rationale-Unfilled sealants wear off quickly whereas semi filled sealants are more abrasion resistant and thus require removal of high points.

Recent Advances

Brand new materials may help to decrease the risk of early failure in difficult-to-seal teeth. With the use of an intermediate bonding layer between enamel and sealant, it shows effectiveness in major saliva contamination as well as a clinical study

Advances in PRR:

ACP releasing sealant, amorphous calcium proteins, release fluoride, tooth colour, enamel LOC, self etching, light cure, release fluoride, natural white, enamel wetbond, no BISPHENO, no BISGMA, fluoride releasing, light cured are innovations in PRR. Newer materials may help reduce the risk of early failure in difficult-to-seal teeth. Use of an intermediate bonding layer between enamel and sealant has been shown effective in the face of major saliva contamination in our previous lab studies as well as a clinical study.

A new adhesive fissure sealant, which consisted of a

solution of 3% 2-hydroxy-3- β naphthoxypropyl methacrylate in methyl methacrylate (MMA), poly-MMA powder and an oxidizedtri-n-butyl borane, a polymerisation initiator, was developed.

Resin based sealants:

- First generation: UVcuring. They are no longer marketed.
- Second generation: chemical-curing (autopolymerized).
- Third generation: visiblelight-cured.
- Fourth generation: contain fluoride.

There was a controversy related to the safety of Bisphenol A (BPA), concerns have been raised over the use of resin based sealants. BPA is a xenoestrogen, which mimics the relative bioactivity of estrogen, a female sex hormone. Pure BPA is rarely present in dental sealants, however they may contain BPA derivatives. There is very little research about the potential estrogen-like effects of BPA derivatives. A transient presence of BPA in saliva has been reported immediately following placement of some resin based sealants. The longest duration of salivary BPA was 3 hours after placement, so there is little risk of chronic low-dose BPA exposure. The currently available evidence suggests that there is no risk of estrogen-like side effects with resin based sealants. [13,14,15,16,17,18,19,20]

Conclusion

Use of sealants has proved to have good result. For prevention of dental caries in pit and fissure, sealants were introduced. There is evidence suggesting effectiveness of sealants when compared with no sealants. Sealants prevent bacteria growth which causes caries. Biomaterials to seal pit and fissure should present with the simple application method, biocompatibility, low viscosity and good surface retention and low solubility. And to improve this biomaterial, more laboratory should be developed.

Although preventive resin restorations have been reported since 1977, there is little uniformity concerning the indications for this procedure, nor is there a standard technique. This article proposes diagnostic criteria for pit and fissure occlusal caries and diagnosis-related considerations for treatment planning for preventive resin restorations. A step-by-step "laminar" technique, which includes, successively, a glass-ionomer cement liner, a posterior composite resin, and a sealant, is described.

Regular maintenance and sealant addition when necessary is important in long-term caries protection after sealant placement. Much better effectiveness data will result if sealants are used on teeth with a true predilection to caries. Better materials and better use of

bonding agents with sealants will improve overall effectiveness on all teeth, particularly on those teeth now thought of as difficult to seal.

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Magnets As A Retentive Aid In Maxillofacial Prosthesis -A Review

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ABSTRACT

In the field of prosthetic dentistry, both attractive and repulsive properties of magnets have been used with excellent clinical results and patient acceptance. Magnetic repulsion has been used to limit the displacement of dentures by incorporating magnets into the posterior segments whereas attractive forces have been used by implanting magnets into the alveolar bone, root, or soft tissue.

An electronic search for articles in relation to maxillofacial prosthesis and magnetic retentive aids were done using databases : Medline, Pubmed, Google scholar, EBSCO; using the following descriptors: "maxillofacial prosthesis, retentive aids, magnets". The search includes only English language. Inclusion criteria : articles published between 1960 to 2020.

An adequately retained prosthesis not only improves comfort, function, and confidence but also improves the quality of life. This article reviews the different types of magnets available, their applications in prosthetic dentistry, effects on tissues, and their merits and demerits in maxillofacial prosthesis and their advances.

Key words : *prosthetic dentistry , maxillofacial prosthesis, magnets, retentive aids*

INTRODUCTION

Maxillofacial prosthesis helps in the esthetic and functional rehabilitation of acquired and congenital defects in the maxillofacial region. Any prosthesis fulfills its purpose only when it is retentive. Retention is intrinsic quality in the dental prosthesis which acts to resist the force of dislodgment along with the path of placement. A magnet is defined as a material, which can attract iron and lie in a north-south direction when suspended. The particular areas of interest in a magnet are their pole, each of which is equal in strength and is termed north or south in respect to its orientation to the earth's magnetic field.

REVIEW OF LITERATURE

Conventional magnets were applied in restorative dentistry in the year 1960 as retentive devices for overdentures, removable partial dentures, and maxillofacial prostheses. Alnico magnet contains

alloy of iron, cobalt, nickel, and aluminum which has been used to retain the complete dentures with the help of its repulsive property.¹ The magnets were implanted within the bases of the dentures with like poles directed towards one another.¹ But the disadvantage of this system is that large sized magnets required for the adequate repulsive force to retain the dentures in place. Also, the constant repulsive forces stimulate the resorption of the bone and the alveolar ridge.

In the late 1960s permanent magnet in which cobalt was alloyed with Samarium (Co5Sm) was introduced.² The outstanding property of Co5Sm is its exceptionally high magnetic permanence. These magnets might be produced in very small proportions and almost one-fifth of Co-Pt magnets and still could provide a corresponding force.

A proplast (Polytetrafluoroethylene and pyrolytic graphite) coating was given for protection in vivo.¹ Nowadays, proplast is no longer used as coating material but polytetrafluorethylene (PTFE) is being used as a binder in polymer-bonded magnets.¹ But they are not suitable for long-term usage of magnets within the body as dissemination of moisture through the polymer leads to loss of corrosion resistance.

Classification

Based on alloys used

·Magnets containing cobalt - Alnico, Alnico V, Co-Pt, Co5Sm.

·Magnets not containing cobalt - Nd-Fe-B, samarium iron nitride.

Based on the ability to retain magnetic properties³

·Soft (easy to magnetize or demagnetize and less permanent):-Pd-Co-Ni alloy, Pd-Co alloy, Pd-Co-Cr alloy, Pd, Co-Pt alloy, Magnetic stainless steels, Permendur (an alloy of Fe-Co), Cr-Molybdenum alloy.

Hard (retain magnetism permanently):-Alnico alloys, Co-Pt, Co5Sm, Nd-Fe-B.

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Based on surface coating

- Coated (stainless steel, Titanium, or palladium)
- Uncoated

Since the magnetic system is constantly subjected to the oral environment, which contains electrolyte-rich saliva, complex microbial flora, and is subject to chewing behaviors, its ability to withstand corrosion, such as tarnish, rust, peeling, and cracking, is a key factor in the overall survival rate of a dental magnetic attachment system. 4 To protect magnets from corrosion and to strengthen the brittle magnetic material, it is usually preferable for the magnets to be coated. There are different options for coatings, but nickel is the most common and usually used. Other options for coating are zinc, tin, copper, epoxy, silver, and gold.

Based on the number of magnets in the system

- Single
- Paired

Based on the arrangement of the poles

- Reversed poles
- Non-reversed poles

Based on the type of magnetism

- Repulsion
- Attraction

Based on the type of magnetic field 3

- Open field:- Dyna
- Closed field:- Gilling's and Jackson closed field sandwich design

Types of magnetism: Hard and soft

HARD MAGNETS	SOFT MAGNETS
Materials that retain their magnetism and are difficult to demagnetize	Soft magnetic materials are easy to magnetize and demagnetize.
Retain their magnetism even after the removal of the magnetic field	Does not retain the magnetic property after the removal of magnetic field
For making permanent magnets	For making temporary magnets
Low Susceptibility and permeability	High Susceptibility and permeability
More Impurities and defects	Fewer impurities and defects
High retentivity	Low retentivity
Examples: Alnico, Chromium steel, Tungsten steel, carbon steel	Examples: Ferrous nickel alloy, Ferrites garnets

Magnetic systems: open and closed field system

Open-field systems

In these systems, a magnetic field is experienced outside the specimen, since the magnet is encased in a non-magnetic housing. An open field system consists of a cylindrical magnet with open ends. It can be either paired or single. 1

Closed-field systems

Many commercial systems available now are of the closed-field type, these attempt to reduce the magnetic field effects in the oral cavity. The open-field systems offer less retentive forces compared to closed-field systems. Even though the closed-field systems provide higher retentive forces, the retention reduces rapidly with increasing separation. 1 Among closed-field systems, a circular closed-field sandwich-type provides a greater amount of retention.

TYPES OF MAGNETS

- a) Alnico magnets
 - Cast alnico
 - Sintered Alnico
- b) Cobalt-platinum magnets
- c) Chromium-cobalt-iron magnets
- d) Ferrite magnets
- e) Rare earth magnets
 - Samarium-cobalt magnets
 - Neodymium-Iron-Boron Magnets
- f) Samarium-Iron-Nitride magnets

Alnico magnets: alloy consists primarily of aluminum, nickel, and cobalt. They embrace copper, and sometimes titanium. They are ferromagnetic and are used to make permanent magnets. Before the development of rare-earth magnets they were the strongest form of permanent magnet. They can be either cast or sintered. 3

Cobalt-platinum magnets: -

Cobalt-platinum alloys are employed primarily for magnetic purposes and various applications exist in which the outstanding performance of the equiatomic alloy justifies its high basic cost, No other alloys of comparable magnetic properties are capable of being worked, and therefore the incontrovertible fact that cobalt platinum is often supplied in the form of a rod, sheet, foil or wire ensures for this material a unique position in the instrument field.

Chromium-cobalt-iron magnets: -

In 1971 Tohoku University announced the discovery of ductile permanent magnet alloys in the Cr-Co-Fe

system. Because of their similarity in magnetic properties to the Alnicos, particularly Alnico, and their added advantages of ductility and lower Co contents, the CrCo-Fe alloys are possible substitutes for Alnicos in many situations.

Ferrite magnets: -

Ferrite magnets are also known as ceramic magnets are a type of permanent magnets and are made of a chemical compound, which consists of ceramic materials and iron oxide. Because of their low cost and their resistance to heat (up to 2500C) and corrosion, ferrite magnets are among the most popular for everyday applications.

Rare earth magnets: -

Rare earth magnets are representation of precision and high performance. The term 'rare earth' is often misleading as rare earth element metals are relatively abundant in the Earth's crust. However, they are rarely found in large deposits, but distributed among other elements instead. Rare earth magnets are the strongest permanent magnets accessible and have significantly higher performance than ferrite (ceramic) and alnico magnets.

There are two types - Neodymium (Nd-Fe-B) and Samarium Cobalt (SmCo). Both materials are available in different grades (strengths) and have different magnetic and physical properties.

Neodymium magnets-Most commonly used magnets.

The stronger of the two is composed of alloys primarily of neodymium, iron, and boron. These magnets tend to be brittle and are susceptible to corrosion. Small sizes and shapes are available so better for prosthetic concerns.

Samarium Cobalt- Magnets are made primarily from an alloy of samarium, cobalt, and iron. Typically difficult to demagnetize, samarium cobalt magnets have moderately high operating temperatures and high corrosion resistance. These magnets can be coated as well.

Samarium-Iron-Nitride magnets: - Sm₂Fe₁₇N₃ was discovered in the exploration for even better iron-based rare earth magnets following the discovery of Nd₂Fe₁₄B, this nitride appeared to offer superior magnetic properties or comparable magnetic properties, Samarium iron nitride is a promising new material for permanent magnet applications because of its high resistance to demagnetization, high magnetization, and better resistance. The drawback was its instability.

Applications of magnets in maxillofacial prosthesis

The use of magnets is the most effective means of

providing combined prosthesis with retention and stability in patients with abnormalities requiring multifaceted rehabilitations. Magnets are used in the orbital and auricular prosthesis, large and small maxillary defects, and intra-oral extra-oral combination prosthesis.

Magnets in the coin form have more advantages in the maxillofacial prosthesis than in the other forms.⁴ Retention by mini magnets is preferred for cases of orbital exenteration and nasal prostheses. Retention by ring and maxi magnet retention systems are preferred for auricular prostheses. Magna caps have the advantage of improved hygiene due to easy access, easier patient placement, less direct stresses, and elimination of the prerequisite of parallel implant and abutment placement.⁵

Robinson used horseshoe magnets for the retention of an upper denture and obturator for a patient with a complete maxillectomy.⁶ Zeno et al. described a combination lower lip prosthesis retained by two Micro-ERA attachments as an intraoral component.⁷ Birnbach and Herman described the use of magnetic devices to rehabilitate orofacial defects.⁸ Magnets were used to attach the oculopalpebral prosthesis to the maxillary denture or obturator.⁹

Magnets and their biocompatibility 1

There are potential ways by which magnets can cause damage to the tissues :

1. Physical effects due to the constant magnetic field around them
2. Chemical effects of alloys and their corrosion products

Behrman reviewed the physical effect of bone and soft tissues of subjects and concluded that magnetism is completely harmless to tissues.¹⁰ Cerny in 1979 concluded that embedded magnets do not cause adverse effects in experimental animals.¹¹

A magnet has less corrosion resistance in the oral fluids. The rare earth element magnets are inelastic and are prone to corrosion. These corrosive products have been found to possess cytotoxic effects on the tissues. Hence, they ought to be encapsulated before placement within the mouth. Stainless steel and Titanium have been the most frequently used materials. However, the constant wearing of these coating materials results in the exposure of the magnets.

It was found, by Gilling's that, a metal of 0.0015-inch-thick wore about only 6 months. The pole pieces used at present are 0.25 mm thick and have a life span of

about at least 10 years before perforation (Gilling BRD 1 and 2).¹² In polymeric materials diffusion of moisture and ions attack the magnets through the interface between them. To avoid this problem non-permeable sealing techniques like laser welding are being tried lately. One such system, which uses laser welding, is the open field system Dyna of Netherlands and the other being the Steco of Germany.

A Recent material, which is being investigated as a new candidate for static magnet applications is samarium iron nitride. It has better corrosion resistance than even Nd-Fe-B.

Merits of magnets

- The lateral stresses are minimized since the magnets slide relatively freely across each other.
- The retentive force is constant and does not deteriorate with time and use
- There is a reduction of the trauma to the retained roots
- Freedom of lateral movements is allowed
- Superior esthetics and easier maintenance are provided
- Effortless placement
- Automatic reseating
- Constant retention
- Easy replacement if required
- Small proportions with solid attractive forces
- Can be placed within the prosthesis
- Less need for parallel abutments
- Can be used for implant-supported prosthesis
- Ease of cleaning

Demerits of magnets

- Low corrosion resistance & high cost.
- Cytotoxic effects of the leaching

Newer generation of magnetic attachment

The Magfit series have effectively met clinical demands with its small proportions, perfect corrosion resistance, and acceptable retentive force.¹³

Magfit series:- The principle of magfit dental magnetic attachment system is it consists of a strong ultra-compact embedded magnet that retains a prosthesis onto a magnetic attractive keeper set on the abutment tooth.¹⁴

Advantages :

- Protects the abutment tooth from excess stress
- Easy instrumentation
- Easy maintenance
- Superior aesthetics

Clinical uses:

- Retention enhancement in complete denture cases
- Replacement of deteriorated clasps and insertion path free designs in partial denture cases

Dental Magnetic Attachments for Implants Use Compatible with Major Implant Systems:

By using a magnet for the implant, harmful lateral forces are often released, reducing the burden on the abutment. Dome type with a spherically shaped attraction face or resin capped SX type responds to the oscillation of the free end denture at the time of occlusion.

Advantages :

- Suitable for edentulous cases
- The number of implants required is often minimized
- simpler superstructure design can be achieved
- Magnet Type variation expands the application possibilities
- Can be utilized in conjunction with MAGFIT magnetic attachments for natural tooth roots

Conclusion:

Decades ago the utilization of intraoral magnets was unsuccessful due to the massive size of the magnets and therefore the inadequate forces they provided. Since the arrival of samarium-cobalt and neodymium-iron-boron (rare earth magnets), it has become conceivable to use small dimension magnets in dental applications. Their advantages include simplicity, inexpensive, self-adjustment, freedom of lateral movement and minimal trauma to the retained root, and also the exclusion of the need for service adjustment. However the future durability of magnets is still a complication, further research is required for the biological compatibility and corrosion resistance that is unaffected by the adverse oral environment.

Conflict of interest: nil

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Delayed healing after extraction in diabetic patients: Review of literature

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ABSTRACT

Diabetes mellitus is a common systematic chronic disease amongst dental patients. The elevated glucose microenvironment can prolong the healing of tooth extraction sockets. Therefore, the promotion of healing up tooth extraction sockets is of great clinical importance to the patients with diabetes mellitus.

INTRODUCTION

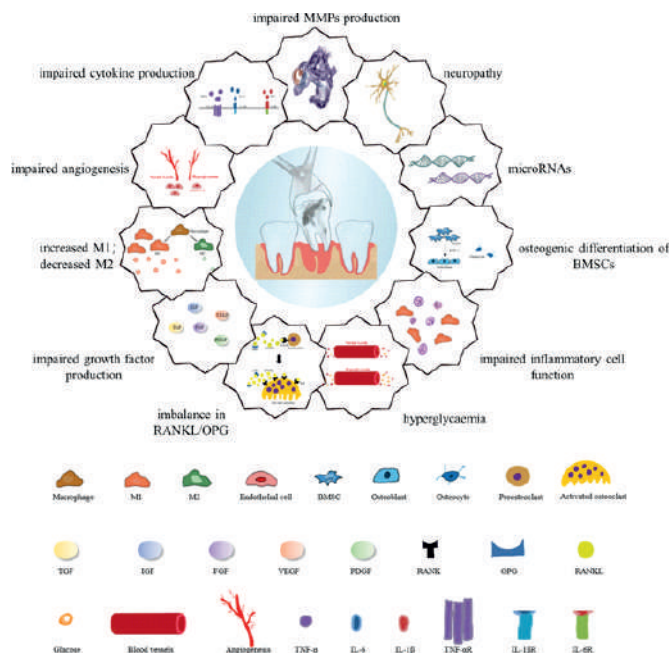
Diabetes mellitus (DM) is a metabolic disorder of multiple aetiology, characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. It is either characterised by deficient insulin secretion or peripheral insulin insensitivity or both, which can give rise to several metabolic disorders. DM is rapidly gaining the status of a potential epidemic in India, with more than 62 million people affected.¹ Considering that diabetes ranks 3th in the most prevalent chronic disease in the oral field, number of diabetic patients experiencing oral manifestations exceeded 90%.⁵ In diabetics, changes to the capillaries such as thickening of the basement membrane result in altered permeability, impeded migration of leucocytes and impaired hyperaemia, causing underperfusion during tissue stress and tissue hypoxia.⁴ These changes can adversely affect the outcome of surgery, resulting in poor wound healing and wound infection. Maximum acceptable levels of blood glucose for removal of teeth in diabetics are 180 mg/dl (before meal) and 234 mg/dl (2 h after a meal). High blood glucose levels reduce the secretion of nitric oxide (powerful vasodilator) in the body which leads to poor circulation and slow-healing socket. Uncontrolled diabetics are at high risk of infection because of the high ketone levels in the blood.⁹

The present study aimed to evaluate the effect of diabetes on healing of extraction socket.

Factors responsible for the healing process of diabetic extraction sockets

Diabetes inhibits mitotic growth factor expression through epigenetic mechanisms; difficulty in wound healing after tooth extraction is associated with

diminished osteogenic differentiation of mesenchymal stem cells, activation of matrix metalloproteinase-9, persistent imbalance of RANKL/OPG ratio, and reduced expression of neuropeptides. Hyperglycemia affects hormone receptor conversion as well as the formation of new blood vessels, and impaired angiogenesis not only hinders bone formation but also affects the rate of wound healing. Diabetic wounds are characterized by chronic inflammation due to high levels of reactive oxygen species, dysregulated M1/M2 macrophage polarization, and pro-inflammatory chemokines. High glucose levels have a negative impact on macrophage function, mainly in the form of dysregulated levels of cytokine secretion such as TNF- α , IL-6 and IL-1 β , in addition to the inability of neutrophils to function in the inflammatory response phases of wound healing, migration, chemotaxis and adhesion. MicroRNAs also influence the different phases of diabetic wound healing.⁵



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DISCUSSION

Gadicherla S et reported that the diabetic group was found to have a larger socket size than the non-diabetic group on postoperative day 7, which suggested a slow healing process than non-diabetic and prediabetic patients. It was evident with additional analysis after adjusting the socket size of postoperative day 0. Thus, the study supported the fact that higher the glycemic levels could delay healing.1 Aronovich et al reported that preoperative glucose and HbA1c levels do not influence the healing of the extraction socket.2 Fernandes et al reported lack of correlation between delay in epithelization and glycemic control.3 Few researchers reported that there was no significant difference in the healing between diabetics and controls.4

There are several miRNAs involved in the regulation of inflammatory phase of wound healing in a hyperglycemic environment. For example, inflammation in unhealed wounds of patients with T2DM affects plasma miRNA concentrations, whereas miR-191 affects angiogenesis through its target zonula occludens-1 in order to slow down the tissue reparative process 5. MiR-497, with its down-regulation activity for pro-inflammatory cytokines, to such factors as TNF-α, IL-1β, IL-6, is considered as a promising curative factor for diabetic wound healing in mice 6. MiR-129-2-3p at wound sites in type 2 diabetic mice may expedite wound healing by mediating the function of neutrophils 7.

Potential interventions in the management of extraction sockets healing in patients with diabetes 8

Intervention	Year	Study design	Results	Reference
PRGF	2014	Retrospective, split-mouth study	PRGF reduced residual socket volumes and improved Healing indices	(99)
L-PRF	2019	Prospective, double-blind, split-mouth study	L-PRF enhanced bone density (p=0.007)	(100)
	2019	Prospective, randomized, double-blind, controlled study	L-PRF and HA mucosa improved healing scores within 3 weeks	(101)
A-PRF	2019	Randomized, split-mouth, double-blind Study	A-PRF slightly affected PD positively	(102)
HA	2020	Randomized controlled split-mouth study	The sockets healing was better in the HA group, especially on day 10 (p=0.006) and day 15 (p=0.021)	(103)
MICD	2016	Prospective study	MICD reduced SOD significantly and improved chewing ability within 3 weeks	(104)

L-PRF leukocyte- and platelet-rich fibrin, A-PRF advanced platelet-rich fibrin, HA hyaluronic acid, PD pocket depth, MICD maxillary immediate complete denture, SOD socket opening diameter.

CONCLUSION

The incidence of complications was minimal in optimally controlled diabetic patients. Empirical antibiotics, appropriate care, and monitoring are required in patients who have an additional risk of postoperative infections and delayed healing. Fasting blood glucose level of 180 mg/dl is a cut-off point for any selective dental extraction. However, Random blood glucose level of 234 mg/dl (13 mmol/l) is a cut-off point for an emergency tooth extraction. 9It is safer to not undergo any dental surgery when a patient is in an uncontrolled diabetic.

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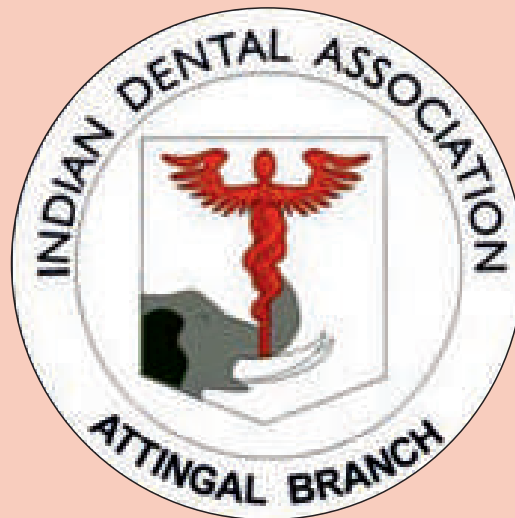


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