

OSTEOID OSTEOMA OF JAWS: REVIEW ARTICLE

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Abstract

Osteoid osteoma (OO) is known to be a neoplasm with low growth or, even more, an inactive neoplasm. It is the third most commonly diagnosed benign bone tumor and has distinctive symptomatology, nocturnal pain that relieves with nonsteroidal anti-inflammatory drugs. Osteoid osteoma is an osteoblastic benign bone tumor that is more common in young male patients with long bones. Less than 1 % of OO have been reported in the jaws. To our knowledge, all the cases of osteoid osteomas in the jaws that are documented in the scientific literature have been reviewed in this article.

Key words: Osteoma, Osteoid, Bony Lesions, Jaws.

Introduction:

Osteoid osteoma is a benign, solitary, painful well confine tumor of spongy bone and having osteoblastic origin.⁽¹⁾ Jaffe in 1935 described OO as a specific benign bone tumor having nidus of 2 cm in diameter. He also identified the tumor as an atypical hard osseous core made of tightly set trabeculae of newly formed bone. It represents 3% of all primary tumors of bone, and about 10% of benign bone tumors. Approximately 80% of osteoid osteoma (OO) occurs in long bones, while < 1% occurs in jaws.⁽²⁾ It's commonly seen between age of 5 to 25 years.^(1,2) It is particularly rare in patients more than 30 years of age. However OO has been reported in patient aged 69 years.⁽³⁾

Etiopathogenesis

Jaffe and Lichtenstein have proposed that OO is a true bony neoplasm derived from osteoblastic origin. However other workers have reported that

the lesion occur due to trauma and inflammation.⁽⁴⁾ Some have also suggested it to be variants of chronic sclerosing osteomyelitis.⁽⁵⁾ It is debated that the root of osteoid osteomas may be neoplastic or infectious at source.⁽⁶⁾

Clinical presentation:

Osteoid osteoma frequently seen in the second and third decades of life. osteomas occur most often in the femur, tibia and phalanges. They are very infrequent in the jaws but if occur, there is mandibular predominance.⁽¹⁾

Eventually 31 articles reporting of an osteoid osteoma in the jaws were selected. Such cases are summarized in Table 1.

Most cases of osteoid osteoma in the jaws occurred during the mean age (36.5 years). It happens in women more frequently than in men (female to male ratio of 2: 1.75). After reviewing the OO cases of jaws, it was clearly found that mandible was

more common than the maxilla (n=25). Within the mandible, the most frequently affected site was the body of the mandible. The most common complaint presented in the reported cases was pain and swelling. And very few cases also clinically documented with tenderness, restricted mouth opening & hearing loss. In the literature clinically size of OO were presented ranging from 0.8 - 7.0×6.5 cm.

Most characteristic clinical feature of osteoid osteoma is pain. The lesion consists of a small nidus containing nerve fibers, vascular components and very high prostaglandin levels that induce a chronic reactive alteration in the surrounding bone, resulting in marked periosteal sclerosis and synovitis surrounding it. ⁽⁶⁾

Pain in the OO is usually considered due to the vasodilation of the prostaglandin within the nidus results increased pressure in the intra-cortical bone in turn stimulates the peripheral nerves. The prostaglandin in turn, also stimulates the bradykinin system, a powerful vasodilator, which in turn adds the pain to the lesion. It has been noticed that production of prostaglandin was decreased by the Nonsteroidal anti-inflammatory drugs and salicylates and improved the symptoms. ^(7,8,9)

Radiographic features:

In general, OO's shows classical radiological appearance as a thin, intracortical radiolucent nidus, which is usually < 1 cm in diameter. A wide and dense cortical bone thickening is seen surrounding the nidus sclerotic region. According to the Jaffe such radiological characteristics are the definitive diagnostic feature of this lesion. The nidus radiodensity is usually surrounded by a variable thickness of radiopacity. Radiopaque nidus is considered to be a less mature lesion, while radiolucent nidus as fully mature.⁽¹⁰⁾ On review of OO of jaws, radiographically radiopacity was more

seen than the radiolucency in all documented cases in the literature.

In the diagnosis of OO lesions, advanced imaging modalities such as computed tomography and scintigraphy are considered a valuable adjunct.⁽¹⁰⁾

Histologic features:

Huvos has explained distinct three histological stages of OO. In a highly vascularized stroma, tightly packed and actively proliferating osteoblasts are seen in the initial stage. The osteoid deposition of the intermediate step between the osteoblasts is seen. The osteoid slowly turns into a well-calcified compact atypical bone at the mature stage, which is generally neither woven nor lamellar in nature. ^(11,12)

Diagnosing Criteria:

Jaffe in 1935, had established certain criteria to diagnose OO: a) benign neoplasm; b) formed large amounts of osteoid which became calcified; c) an inflammatory process; d) characteristic radiographic changes, such as focal rarefaction and reactive bone formation; e) occurred most frequently in young adults; f) an outstanding feature of pain; and g) complete removal as the treatment of choice.

Differential diagnosis:

For the above-mentioned case, ossifying fibroma, peripheral osteoma and osteoblastoma are considered as differential diagnosis. Ossifying fibroma and peripheral osteoma are typically asymptomatic in nature, and these lesions increases in size, causes displacement and resorption of teeth. Moreover they lack lesional nidus which is characteristic of OO. Osteoblastoma and OO are very similar lesions clinically, radiographically and histologically. ⁽¹⁰⁾ The radiographic features of osteoblastoma are variable and nonspecific.⁽¹¹⁾ While pain is a common feature of both lesions, pain associated with OO subsides to aspirin and

other non-steroidal anti-inflammatory medications, while osteoblastoma is not.⁽¹⁰⁾

Treatment:

Complete excision is the treatment of choice for the OO which relieves pain. Recurrences of OO are rare after complete excision of the lesion, But recurrences have been reported in some cases. However, some of the reported cases of OO have shown spontaneous regression.^(13,14,15) Such cases are difficult for the diagnosis in the later stages of the lesion. Sarcomatous or local malignant transformations are very rare.⁽¹⁶⁾ After reviewing the cases of OO of jaws, Only in a single case has the malignant transformation of osteoid osteoma been

reported.⁽¹⁷⁾ Hence, follow-up for long period of time is suggested to identify Sarcomatous or local malignant transformations.

Conclusion:

Very few cases of OO of jaws have been reported in the literature. Knowing the OO by the dentists, oral surgeons and pathologists is important so as to improve the identification, diagnosis and treatment. OO should always be considered in differential diagnosis if bony growths are observed in the jaws of adolescent and young adults. This article with its clinical findings, diagnosis and management provided a thorough review of this rare lesion.

Table. 1 Documented cases of osteoid osteoma in the jaws previously published in the scientific literature.

Case No.	Reference	Age (yr)/ gender	Site	Clinical manifestation	Radiographic feature	Radiographic size (cm)	Clinical size
1	Rushton et al.(1951) ⁽²⁰⁾	27/M	Left posterior mandible	Tender	No findings	NS	NS
2	Foss et al. (1955) ⁽²¹⁾	36/F	Left posterior mandible	Pain	Translucent nidus surrounded by sclerotic bone	1.5×0.7	4.0×1.7
3	Nelson et al. (1955) ⁽²²⁾	17/M	Right posterior maxilla	Pain, swelling	Radioluscent center with radiating spicules of trabecular bone	NS	2.5
4	Stoopack et al. (1958) ⁽²³⁾	25/M	Left posterior mandible	Asymptomatic	Central radioopacity with surrounding thin radiolucency	NS	NS
5	Lind et al. (1965) ⁽²⁴⁾	48/M	Right condyle	Pain	NS	NS	NS
6	Hillman et al. (1965) ⁽²⁵⁾	4/F	Left posterior maxilla	Swelling	NS	NS	NS
7	Greene et al. (1968) ⁽²⁶⁾	45/F	Right posterior maxilla	Pain, tender	Central radioopacity with surrounding less dense trabeculated bone	NS	NS
8	Brynolf et al. (1969) ⁽²⁷⁾	77/M	Anterior maxilla	NS	Central density with radioluscent ring surrounded by increased radioopacity	0.4	NS

9	Dechaume et al. (1985) ⁽²⁸⁾	22/M	Mandibular left angle	NA	NA	NA	1.0
10	Gupta et al. (1985) ⁽²⁹⁾	18/F	Left posterior mandible	Pain, swelling	Ill-defined radiolucency surrounded by sclerotic bone	NS	3.0
11	Lolli et al. (1987) ⁽³⁰⁾	46/F	Left mandibular angle	NA	NA	NA	1.0
12	Zulian et al. (1987) ⁽³¹⁾	17/F	Right mandibular ramus	Pain	Mixed nidus	NS	1.0
13	Festa et al. (1992) ⁽³²⁾	50/F	Left mandibular ramus	NA	NA	NA	1.5
14	Yang and Qiu (2001) ⁽³³⁾	24/F	Left articular eminence	Pain, swelling	Central radioopacity with alternating zones of sclerosis and radiolucency	1.2	4.0×3.5
15	Tochihara (2001) ⁽³⁴⁾	21/F	Left condyle	Pain	Sclerosed nodule	0.8	0.8
16	Ida et al. (2002) ⁽³⁵⁾	26/F	Left posterior mandible	Pain	Diffuse sclerosis with an ill-defined circular radioopacity	1.0	0.8
17	Liu et al. (2002) ⁽³⁶⁾	18/M	Mandibular symphysis	Pain, swelling	Mixed Radioluscent/radiopaque lesion	1.5	1.2
18	Badauy et al. (2007) ⁽³⁷⁾	26/M	Left posterior mandible	Pain, swelling	Central radioopacity surrounded by sclerotic border	NS	1.0
19	Chaudhary and Kulkarni (2007) ⁽³⁸⁾	43/F	Left posterior mandible	Pain, swelling	Well-defined radiolucency surrounded by corticated border	2.0×2.0 (CT scan)	NS
20	do Egito Vasconcelos et al. (2007) ⁽³⁹⁾	23/F	Right condyle	Pain, limitation of mouth opening	Dense nidus, surrounding sclerosis	0.8×1.1	NS
21	Manjunatha and Nagarajappa (2009) ⁽⁴⁰⁾	43/F	Right angle of mandible	Pain, swelling	Well-defined radiopaque mass	NS	1.0
22	Rahsepar et al. (2009) ⁽⁴¹⁾	21/M	Right subcondyle	Pain, swelling, limitation of mouth opening	Well-defined circular radioluscent lesion	0.6×0.8	NS
23	Karandikar et al. (2011) ⁽⁴²⁾	14/M	Left angle of mandible	Pain, swelling	Well-defined mixed lesion	3.5×3.5	NS
24	Singh A and Solomon C M (2013) ⁽⁴³⁾	20/M	Left posterior mandible	Swelling, pain	Well-defined radioopacity with radioluscent border	3.5	3.0

25	An et al. (2013) ⁽⁴⁴⁾	10/M	Right posterior mandible	Swelling	Multiple sclerotic masses with radiolucent rims surrounded by diffuse bony sclerosis	0.7×2.0	NS
26	Mohammed et al. (2013) ⁽¹⁶⁾	20/NS	Left body of mandible	Swelling, tenderness	Mixed radiopaque/radioluscent lesion	2.0×3.0	2.0×3.0
27	Khaitan T et al. 2016 ⁽¹⁰⁾	40/M	maxilla	Swelling, pain	well-defined radiopaque nidus surrounded by thin radiolucent border in 22, 23 regions	2 x 1	NS
28	Infante-Cossio P et al. 2016 ⁽¹⁸⁾	42/ F	right mandible	pain	solitary, oval-shaped, well-defined radio-opaque lesion at the right mandibular ramus, surrounded by a thin radiolucent rim and a diffuse bony sclerosis,	NS	1.0
29	Richardson S et al. 2017 ⁽¹²⁾	41/F	Right condylar neck	Swelling, pain, conductive hearing loss, restricted mouth opening	Well-defined radiopaque mass with thin radioluscent rim	7.0×6.8×6.4 (CT scan)	7.0×6.5
30	MATTHIES L et al. 2019 ⁽¹⁹⁾	18/M	right lower jaw	Pain	unclear tumor mass	NS	0.9×0.8×0.5 cm ³
31	Díaz-Rengifo I A et al. 2019 ⁽³⁾	69/F	upper left maxilla	NS	well-delimited radiopaque mass	NS	4 mm × 8 mm
32	Takashi Maehara et al. 2019 ⁽⁴⁵⁾	24/F	Right lower jaw	pain and tenderness	oval, internally non-uniform, somewhat obscure boundaries in the right mandible	NS	NS

(M: male, F: female, NS: not specified, NA: data not available, CT: computed tomography)

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FLOURIDES AS DOUBLE EDGED SWORD-A REVIEW

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Abstract

Dental caries is a public health problem as it hampers the quality of life of an individual. It is basically an imbalance between the etiological factors that leads to dissolution and preventive factors that results in remineralization of tooth structure. It is necessary to maintain the optimal level of fluorides in water since its low as well as high concentration both effects the structure of the teeth. Concentration of fluorides lower than the optimal level results in dental caries whereas higher concentration at developing stages of teeth results in fluorosis. That's why it is very important to identify the proper concentration of fluorides depending upon the age, frequency of taking water and pathway of absorption.

Key words: Dental Caries, Demineralization, Remineralization

Introduction

Fluoride is widely available in the nature and is derived from an element known as Fluorine. Fluoride is available in almost drinking water sources especially underground water. Fluoride is one of the most electronegative elements found on the earth and attracts positive ions. In human body nearly 96% of fluoride is present in bones and teeth in the form of crystals. Tooth enamel is composed of 96% minerals like Hydroxyapatite, free(1%) as well as bound (2.6) water and organic compounds (0.4-0.6%) together with proteins and lipids[1,2].

Fluoride is necessary for both humans and animals. The daily intake of fluoride is equivalent to 1.0-3.0 mg. Mostly fluoride is ingested into the body through drinking water. Fluoride is routinely absent in soft water where as hard water might hold above 10.0 ppm of fluoride. Since, fluoride is present in bones and teeth in small amount and prevents tooth decay gives a justification for its inclusion as a necessary constituent in nutrition. Various studies conducted in 19th century showed that fluorides possesses an attraction for calcified tissues (

bones and teeth). Many studies showed that the inclusion of fluorides in diet results in the reduction of dental caries and strong teeth. Fluorides reduces the decomposition of mineral by improving its resistance towards acid dissolution [3,4]. Keeping all these things in mind various agents like tooth-powders, tooth-pastes, mouth washes were launched to increase the consumption of fluoride. With time lot of incidents grabbed attentiveness towards the dangerous side effects of fluorides. The first case was seen in Naples, Italy where people had scarification of teeth due to an element in the water. After some time same conditions appeared in other countries also. Recurrent efforts were made to connect these imperfections with constituents of drinking water. Since various studies had shown that fluorides were responsible for mottling of enamel renowned analyst Black and Mckay noticed that these teeth were less susceptible to decay. In this paper we will discuss the benefits as well as side effects of fluoride.

FLUORIDES IN PREVENTION OF DENTAL CARIES

Tooth decay destroys the tooth structure locally and progressively. Bacteria present in oral cavity like *Streptococcus mutans* and

lactobacilli releases acids which acts on carbohydrates and demineralizes the tooth structure [5]. Tooth decay is a universal problem characterized by carious lesions responsible for ache, discomfort and poor quality of life. However, at initial stages the lesions can be treated through agents rich in fluoride, calcium and phosphate [6]. Hypersensitivity is designated by sharp shooting pain caused on exposure to external stimuli (hot, cold or chemical) due to exposed dentinal tubules. Varnishes, liners, dentifrices, mouth rinses and restorations can reduce hypersensitivity [7]. Around 60-90% of the school going children and adults are suffering from dental caries in developed nations[8]. Topical application of fluorides makes alterations in saliva and buffer pH of saliva which results in remineralization of lesion [9]. Since topical application of fluoride is a non-invasive therapy and can play a major part in control of the disease [10]. Presence of fluorides in community drinking water, incorporation of dental hygiene aids contingent on fluorides improves the awareness of people towards oral health [11]. World Health Organization directed the systemic as well as topical application of fluorides in order to prevent tooth decay. The main causes of carious lesions in children is substandard quality and amount of saliva, malaligned teeth, immunocompromised and diet. Thus, fluorides application decreases the dissolution of enamel at lower pH [12]. Prevention is primarily based upon remineralizing technologies. Amorphous Calcium Phosphate present on the outermost surface of teeth (enamel) acts as a pool of calcium and phosphate and helps in remineralization [13].

Table1. Concentration of fluorides in prevention of dental decay [14,15]

Method/vehicle	Fluoride concentration (ppm F)
Water supplies	0.7-1.2
Fluoridated salt	200-250
Mouth rinse, daily	230
Dentifrices, children	250-500
Mouth rinse, weekly	920
Dentifrices, adult	1,000-1,500
Self-applied gels or rinses, prescription	5,000
Professionally applied solutions (NaF)	9,200
Professionally applied solutions, gels, foams (APF)	12,300
Professionally applied solutions (SnF ₂)	19,500
Professionally applied varnishes	22,600

FOETAL EFFECTS OF FLUORIDE

In 20th century proposal was made to give fluoride to expecting mothers. Clinical records showed that fluorides works best when administered during calcification and other developmental phases of foetus. Although others studies showed that utmost profit can be obtained by administering fluorides during ending stage of calcification or during enamel maturation before eruption. Researches showed that pits and fissures and smooth surfaces can be prevented from carious lesions by exposing them to fluorides at initial phases of calcification and 2-3 years prior tooth eruption respectively. However, study conducted by Carlos(1972) showed that there is no correlation between foetal exposure of fluorides and dental caries. Thus, managing fluoride intake in expecting mothers cannot prevent dental caries.

METHODS OF FLUORIDES ADMINISTRATION

1. **Toothpaste/ Mouthwash:** Dentifrices is the most frequent method of fluoride administration. It is one of the most popular methods because it has easy application, convenient and does not require professional assistance.

2. **Fluoridation of water:** Community water fluoridation for the first time was carried out at Grand Rapids in USA (1945).Fluoride consumption at optimal level reduces the chances of dental decay. The consumption of water depends upon the climate of a particular

region due to this the concentration of fluorides varies in different areas. People living in hot region consumes more water as compared to those living in cold regions. Studies suggested that a drop of 0.3 mg/l below standard fluoride concentration can lower the useful effects of fluoride by as much as two thirds. On the other hand, range of fluorides above 1.5 mg/l shows toxic effects.

3. Salt fluoridation: After community water fluoridation the best method to incorporated fluorides is salt fluoridation. In salt fluoridation sodium and potassium fluoride are added during manufacturing of salt. By this methods we can prevent dental caries in large population.

4. Fluoridation of milk: Initiated by Zeigler. It is an alternative method of fluoride delivery. In this methods fluoride is added in calculated amount in milk consumed by children.

PROFESSIONAL APPLICATION OF FLUORIDE

Fluorides are applied by dentist in a dental clinic at higher concentrations for therapeutic use.

- 1. Foam/ Gel:** These are composed of different constituents. Acidulated phosphate fluoride (APF) can be prepared by using sodium fluoride at neutral pH or acidulating and buffering it with phosphate. For application, material is carried out in a tray then inserted into oral cavity covering the teeth. Time for the procedure is usually 4 minutes and then patient expectorate the leftover material.
- 2. Varnishes:** It is non-aqueous in nature. It is applied directly on the tooth surface with the help of a brush. Adhesion to the tooth surface is carried out in the presence of saliva.
- 3. Fluoride Solution:** Since long time silver fluoride or silver diamine fluoride is used to prevent dental caries in deciduous teeth.

FLUOROSIS

Ground water contains fluorides at optimal concentration whereas surface water contains only traces of fluorides. Sometimes well water

contains four to five times more concentration of fluorides than the optimal level. A condition called as fluorosis appears on exposure to excessive concentration of fluorides especially in case of children. Fluorosis in milder form is often seen as small, opaque white regions on the surface of teeth also known as mottling. In this condition the colour of the tooth surface changes from chalky white, yellow brown to black. Due to fluorosis tooth loses its enamel forever. Research showed that fluorosis was seen more in those children who were consuming water containing water more than two times of optimal concentration of fluoride at age below eight years.

Skeletal fluorosis influence the bone, ligament and tendons. It is an endemic disease. People affected with skeletal fluorosis complaints of painful and stiff neck, backbone, joints, restriction in the movement of knee and shoulder joint. Moreover, it is not easy to diagnose skeletal fluorosis at initial stage. The cases of chronic fluoride poisoning is seen in many states of India, Argentina, China etc. when the concentration of fluoride in water is above 10.0 ppm. Also seen among workers of cryolite industries. On clinical examination people suffering from chronic fluoride poisoning shows sclerosis of bones.

Cases of acute fluoride poisoning are seen in US, due to improper design or functioning of equipments containing fluoride. Sometimes concentration of fluoride above optimum level makes people sick.

HOW TO PREVENT FLUOROSIS:

1. Concentration of fluorides in community drinking water should be less than 1.0 ppm.
2. Use of dentifrices, mouth rinses, drops etc. under the guidance of experts.
3. Consumption of food rich in fluorides(sea-fish, tea).
4. Immediate consultation with a doctor in case of pain and stiffness in neck and joints.

5. Follow proper measures while working in industries dealing with fluoride content.
6. Adequate consumption of calcium and vitamin – C.
7. Consumption of defluoridated water in case of expecting mothers.

CONCLUSION

Fluorides plays an important role in the prevention and conservative treatment of dental caries. Oral health is very important for the overall well-being and quality of life. Topically applied fluoride varnishes, gels showed good success rate in the prevention of carious lesions. In India the main source of fluorides is community water only so it is important to keep an eye on the optimal concentration of fluorides in water. In case if the concentration of fluorides is above optimal level, defluoridation of water should be carried out in order to prevent any kinds of toxic effects.

Conflicts of interest: Nil

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PECTORALIS MAJOR MYOCUTANEOUS FLAP: THE WORKHORSE FLAP IN HEAD AND NECK RECONSTRUCTIONS

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Abstract:

Ablative surgeries in the head and neck requiring reconstruction are mostly challenging due to the complicated three dimensional nature of defects in this region. Such defects can have drastic consequences on aesthetics as well as function which in turn may result in a substantial toll on patient's standard of life. Pectoralis major myocutaneous flap (PMMF) has widely been employed in the form of the workhorse flap in the reconstructive surgery of head and neck region over next few decades since it was first introduced by Ariyan in 1979. PMMF has become one of the most regularly used regional flaps, greatly enhancing the protection as well as functional results for head & neck reconstructive surgery. The distinctive benefit for PMMF exists in the sense that it is dependable, simple to obtain, could be elevated within relatively shorter period of time, offers lesser morbidity of the donor area, provides optimal bulk, can also be coupled with various flaps like free flap, and employed in head and neck area for the single-stage reconstructive surgery of internal mucosa/external dermis defects. In this article we will discuss various aspects of the pectoralis major myocutaneous flap (PMMF) like indications, relevant anatomy, flap design, operative technique, and pitfalls.

Key words: Pectoralis major myocutaneous flap, vascular pedicle, regional flap, reconstruction

Introduction

It has always been a surgical challenge to perform reconstruction as structure; function and esthetics have to be restored. Ablative surgeries in the head and neck requiring reconstruction are mostly challenging due to the complicated three dimensional nature of defects in this region.¹ In addition, the recent intensive chemotherapy and radiotherapy protocols, warrants the necessity for bringing an oxygenated flap having adequate vascular supply to reconstruct the defect.² Over a period of time, reconstruction in the area of the head and neck has progressed with better expertise and techniques. In due course various pedicle regional flaps have been proposed, such as PMMC flap, forehead flap, deltopectoral flap. Currently free tissue transfer is being practiced in many centers and hence given first preference for reconstructive surgeries of head & neck. However certain specific requirements like specialized techniques, expertise, microsurgical equipment, limits the ability to carry out such a free tissue transfer to only highly specialized centers. Stephen Ariyan initially presented the pectoralis major myocutaneous flap in 1979.³ Since then various regional flaps have gradually emerged namely latissimus dorsi, platysma, sternomastoid, trapezius. Despite this PMMF has continued to prove its worthiness over the years and therefore till date recognized as the workhorse flap in head and neck reconstruction with some amount of acceptable morbidity.⁴ The main advantages of this flap includes its reliability, vascularity and good viability, ease of harvest, comparatively shorter operating time, protection of carotid artery and acceptable cosmetic appearance in cases where bulk of tissue is required. In addition, this flap could be coupled with various other flaps like free flap, also it can be easily used in irradiated areas, and lastly even a large cutaneous island of donor site is closed primarily.

In this article we will discuss various aspects of the pectoralis major myocutaneous flap (PMMF) like indications, relevant anatomy, flap design, operative technique, and pitfalls.

Indications:

Oropharynx: Resection of the lateral floor of the mouth, alveolar ridge, posterior half of the tongue, and piriform sinus requires sufficient skin and bulk for reconstruction. This can be achieved with a pectoralis major musculocutaneous flap in one stage. The bulk provided by this flap appears to be sufficient to avoid aspirations, either by directing fluids past the airway or by diverting fluids to the contralateral normal piriform sinus, as a result of fullness on the operated side.⁵

Orbital Exenteration: The pectoralis major musculocutaneous flap is particularly useful for reconstruction in this area because it provides bulk and well-vascularized tissue to fill the cavity, seals any cerebrospinal fluid leak, and offers greater bacterial invasion defense.⁵

Temporal Bone Resection: The pectoralis major musculocutaneous flap is ideal for these reconstructions because it provides sufficient bulk and soft tissue coverage of duramater and seal it against CSF leaks and it offers a rich vascular supply to permit uncomplicated healing even with bacterial contamination of wounds.^{5,6}

Mandibular Reconstruction: Extended pectoralis major flap may be used for reconstruction of segmental resections of the mandible, it does not appear to be suitable for reconstruction of the entire mandible.^{5.}

Anatomical Considerations:

Pectoralis major muscle: The clavicular head originates from the anterior surface of the medial half of the clavicle. The sternocostal head originates from the anterior surface of the sternum; the superior six costal cartilages and from the aponeurosis of the abdominal external oblique muscle. These muscle fibers converge to form a flat tendon which inserts on the humerus.⁸ (Fig-1)

Deeper relations of pectoralis major: Deeper to pectoralis major lies its vascular pedicle. Besides that we also find the pectoralis minor muscle, the costal cartilages, and towards the inferior aspect we have the costal attachments of the abdominal external oblique muscle.^{8,9} (Fig-2)

Blood supply for PMMF: Although the thoracoacromial artery had been previously described in the literature as running along the undersurface of the pectoralis minor muscle, fresh cadaver dissections confirmed the consistent presence of this vessel along the undersurface of the pectoralis major muscle, with a branch from this vessel to the pectoralis minor. Nevertheless, the dominant blood supply is the thoracoacromial artery, branching off from the subclavian artery. The thoracoacromial artery is accompanied along its course by its corresponding vein.^{8,9,10} (Fig-3)

Nerve supply: The innervation to the pectoralis major is provided by the lateral pectoral nerve which is present inferiorly from the clavicle and in close relation to the pectoral branch of thoracoacromial artery. The pectoralis major also receives 2-3 branches from medial pectoral nerve which transverses through pectoralis minor muscle. While raising the flap these innervations are usually divided which causes the denervated muscle to lose bulk over time. This may be either advantageous or disadvantageous, in view of desired functional and esthetic outcomes.⁵

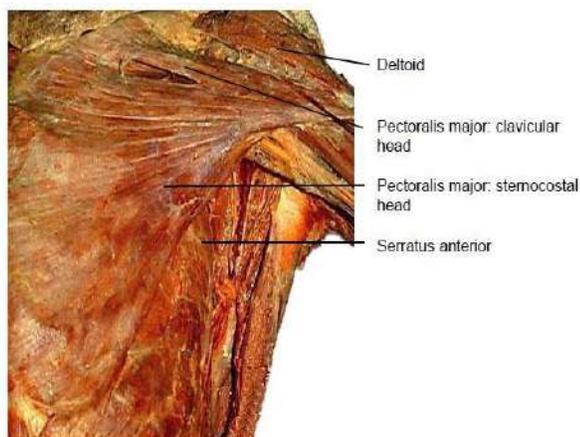


Figure 1: Superficial dissection

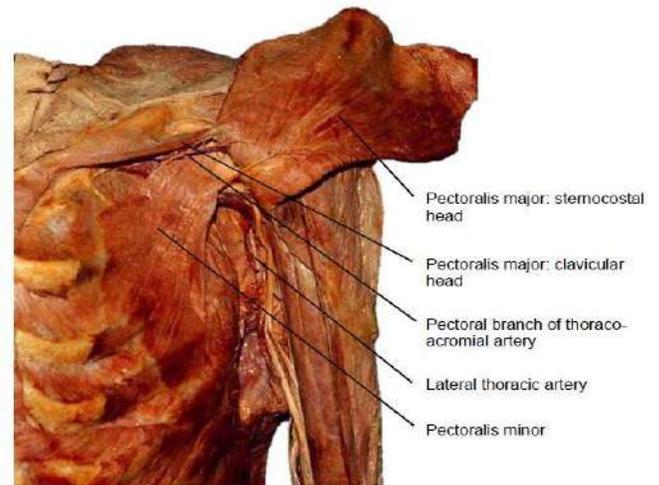


Figure 2: Pectoralis Major Deep Relation

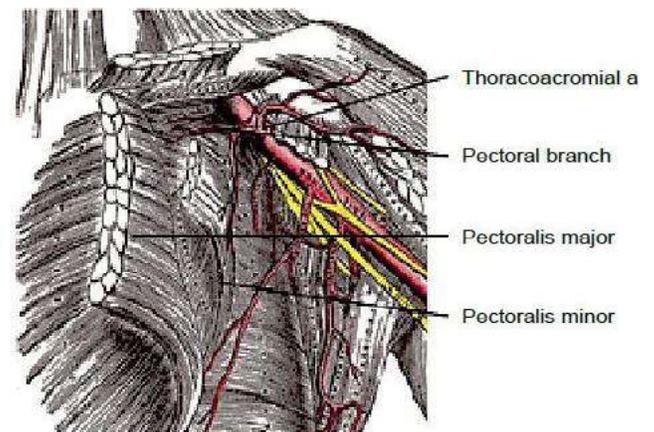


Figure 3: Blood supply for PMMF

Flap design: Depending upon the type of surgical defect to be reconstructed the flap can be raised as muscular/musculocutaneous, with or without 4th and 5th ribs.

Surface marking of vascular pedicle: Vascular pedicle is determined by drawing a line from the shoulder to the xiphisternum and another line vertically from the midpoint of the clavicle to intersect the 1st line. (Fig-4a, b)

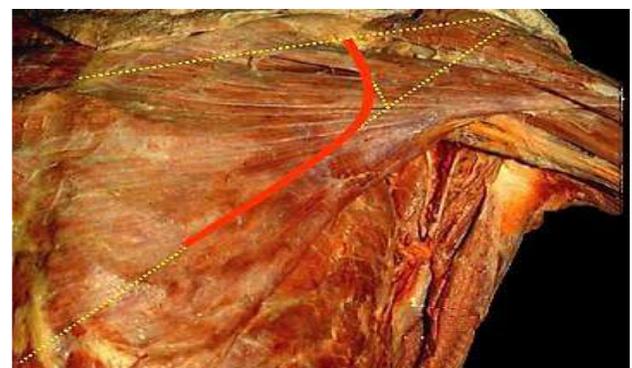


Figure 4 a: Surface marking for the vascular pedicle

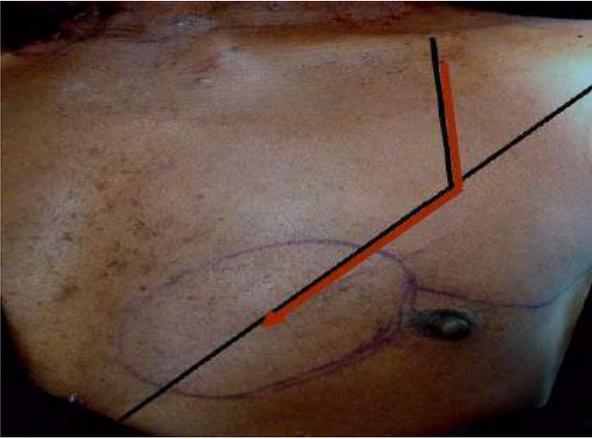


Figure 4b: Surface marking for the vascular pedicle

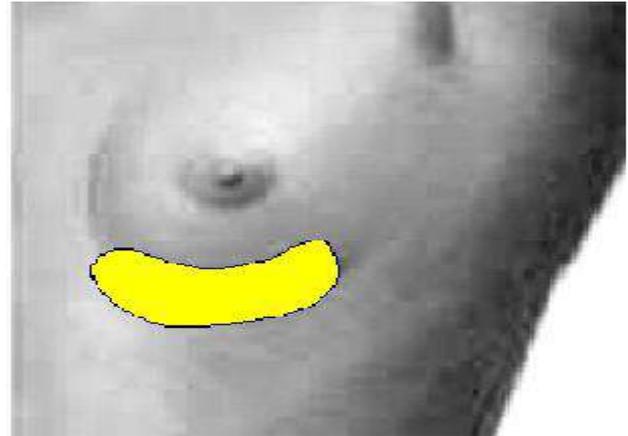


Figure-6: Inframammary skin paddle

Skin paddle: Designing of skin paddle is done such that it lies over pectoralis major along with pectoral branch of thoracoacromial artery coursing beneath (Fig- 5). To ensure an adequate length of the pedicle, the distance from the inferior margin of clavicle to top of skin paddle should be equal or greater than the distance from inferior margin of the clavicle to recipient site. In case of women skin paddle should be designed in the inframammary crease including dermis from either side of the crease, which would help in avoiding excess bulk by excluding the breast tissue, and at the same time would not interfere majorly with esthetics at the donor site (Fig- 6). In some case where there is requirement of additional pedicle length, the flap may be designed even more inferiorly up to 2.5cm at costal margin, however in such cases the flap turns into a random pattern flap with precarious blood supply. In order to include maximum myocutaneous perforators in the skin paddle, the dissection at the edges should be beveled radially and care should be taken to avoid undercutting the paddle.



Figure-5: Dissection of the skin paddle

Exposing pectoralis major: Incision is made which extends laterally from the periphery of skin paddle towards anterior axillary fold that also demarcates the lateral boundary of pectoralis major. Skin and tissue is then separated from the pectoralis major and widely elevated in the region above the skin paddle, going superiorly up till the clavicle. (Fig- 7)

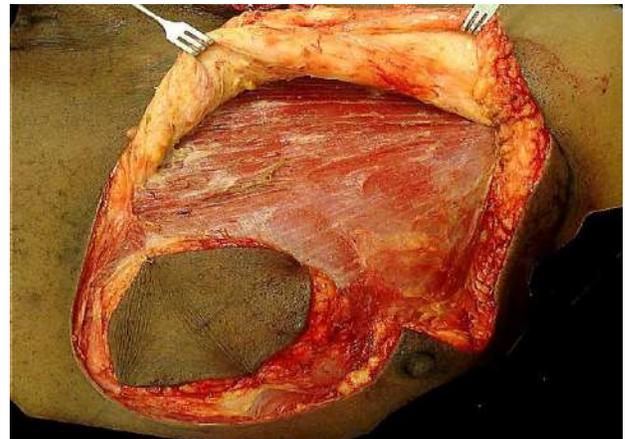


Figure-7: Pectoralis major muscle exposure

Elevating the flap: Incision of pectoralis major is carried out with the help of an electrocautery medial and inferior to skin paddle to dissect it from underlying rib and the intercostal muscle. Care should be exercised to not dissect the muscle in the region superior to skin paddle as it may lead to transection of the vascular pedicle. Following this the pectoralis major is further freed with cautery along the sternum. The perforator vessels get transected and cauterized during the process. To distinguish and reach the dissection plane in between pectoralis major and pectoralis minor dissection is done on the later margin of the pectoralis major till the intermuscular plane is identified. Pectoralis major muscle along with its vascular pedicle is raised by stripping towards the clavicle (Fig- 8).

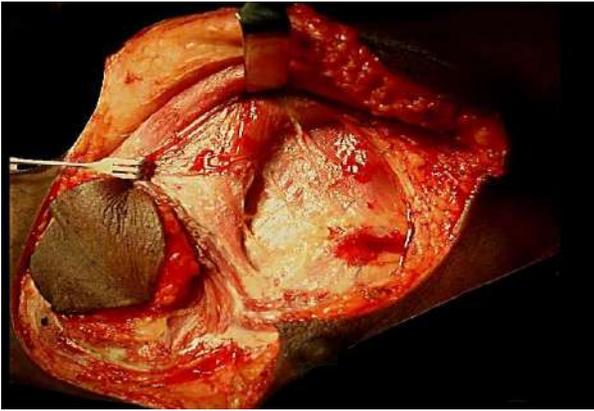


Figure-8: Elevating pectoralis major

Now the pectoral branch of thoracoacromial artery is clearly visible on deep surface of pectoralis major coursing within the fascia (Fig- 9). This pedicle is maintained in sight and saved from any sort of injury. Few structures are transected like lateral thoracic artery, and also medial pectoral nerve branches which pass through pectoralis minor to supply deeper surface of PMMF. Muscle fibers of the pectoralis major is then dissected laterally to the pedicle to free it from humerus, at the same time without disturbing the structural integrity of the vascular pedicle.

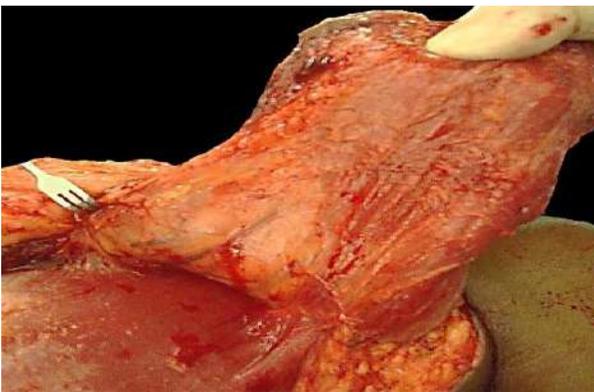


Figure-9: Vascular pedicle

Skin tunnel: A wider subcutaneous passage is made over the clavicle through which the PMMF is usually passed upwards towards the head and neck (Fig- 10). The width of this passage should be enough to allow convenient repositioning of PMMF avoiding strangulation of the main vascular pedicle as well as protecting the musculocutaneous perforators from shearing forces. For gaining additional space subdermal connective tissue fibers in the region of the skin tunnel can be divided using an upturned scalpel. Care should be taken to avoid any sort of twisting of the flap after passing the tunnel.



Figure-10: PMMF passing over clavicle

Closure of donor site defect: A closed suction drain is placed and donor site is closed using primary closure. To enhance the ease of primary closure the surrounding skin can be undermined to some extent. Sometimes a split skin graft may be required.

Pitfalls: PMMF has some of its own disadvantages which includes resultant thoracic wall deformity, more than desired bulk in some circumstances, incidences of complications at donor site, functional neck and shoulder impairment, partial necrosis of the skin paddle, and less that optimum recipient site functional outcome.¹¹⁻¹⁵

Conclusion: The value of the PMMF still remains irreplaceable, despite the fact that recent focus in tissue reconstruction has transitioned towards microvascular free-tissue flaps. PMMF offer an easier, faster, reliable option for reconstruction in post-ablative head and neck surgery. It is still considered as workhorse flap in developing countries with limited resources, while it can play the role of a salvage flap in countries with more advanced centers for microvascular free tissue transfer.

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DENTAL INSURANCE- AFFORDABLE DENTAL PLANS – A REVIEW ARTICLE

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Abstract

Dental protection is protection intended to pay the expenses related with dental consideration. The Foreign Direct Investment (FDI) charge which was advanced in the colder time of year meeting of the Lok Sabha (2008) zeroed in on expanding the unfamiliar speculation share from the current 26% to 49% in the insurance agencies of India. This will permit the multibillion-dollar global insurance agencies to enter the Indian market and accordingly cover all parts of protection in India. Dental protection will be a necessary a piece of this framework. Dental protection is another idea in Southeast Asia as not many nations in Southeast Asia cover this part of protection. It is significant that the dental specialists in India should be familiar with the various kinds of plans these organizations will offer and about another relationship which will arise in the coming a very long time between dental specialist, quiet and the insurance agency.

Key words: Dental insurance, Health insurance, Insurance company

Introduction

According to IRDA which is known as Insurance Regulatory and Development Authority of India gives the definition of health insurance the insurance contract which provides for ailment advantages or clinical, careful, or medical clinic cost benefits, including assured benefits and long-term care, travel insurance, and personal accident cover.[1] Good general health is most integral fundamental right good general health help is to maintain good oral health . as teeth are very important good smile not only gives us confidence but it also helps in giving self-pride. All over there are 289 dental colleges with around 25000 graduated dentists but so many people in Indian are not able to get basic dental treatment. [2].

In urban area there is 1:10,000 is the dentist to population ratio. [3] In 21 century dental insurance is the most un explored business. The cost of dental treatment is so high dental insurance will protect people from the high cost of dental treatment dental insurance covers dental disease and the treatment of dental disease, dental trauma, regular dental checkups as the cost of dental treatment is so high dental insurance are made, {4, 5}. In our country general health insurance covers dental insurance. In India the first mode of payment is fee for service.

Louis USA started prepaid comprehensive dental care. In 1949

Washington Group Health Association, established a clinic dental service, which further change fee-for-service to prepayment. In the year 1989- Delta Dental Plan and other agencies covers 107 million beneficiaries.[6]. fee for service is main mode of payment in many countries but dental insurance will be a great success for everyone.

Other dental insurance plans in other Countries: -

1. **Indemnity Plans** – In this dental plan 50 -80 % of the dental fess is paid by the insurance company and remaining is paid by the client itself. This dental plan is based on the fee for service plan. monthly premium is paid by the client to the insurance company. there are various types of plans in which have set deductible amount. The monthly deductible amount is approx. 15-20 \$ [7]
2. **Dental health maintenance organization** – This plan is also known as capitation plans, the A Dental Health Maintenance Organization i.e. DHMO is the example of capitation plan DHMO dentist give the dental care to the to the registered patient. in capitation plan dentist is paid on the per person bases. Fixed monthly fees is paid to the dentist who is participated in capitation plan [7]

3. **Preferred provider organizations** – This is one of the other forms of true insurance its same as indemnity and DHO in this dental plan registered dentist provide dental care to a particular patient group. Dentist have to charge less than their usual treatment fess to these registered group of people. If in case these registered group of people want their treatment to be done from other dentist who is not registered in this group ie "preferred provider then patient have to pay good amount of share foe fee for service.
4. **Dental discount** – The managing organization have words with the local dentist to give discount on the dental treatment there are many several advantage of dental discount then dental insurance dental discounts is not a form of dental insurance. there is no as such previous condition's patient receive immediate dental treatment without any kind of waiting period.
5. **Direct reimbursement plans** – DRP is the new upcoming dental care plan. It is a self-funded benefit plan. In this patient can pay their own money despite of giving premium to the insurance company or third-party administrator. patient pay their dental treatment bill then take the receipt of the dental treatment and then the employer pay all the cost of dental treatment to the patient.

Current scenario and future prospects –

Dental insurance plan is not so common in our country like other western country. in our country dental insurance come under general health insurance. General insurance company gives dental insurance as a part of general insurance. one can claim the cost of dental treatment or the cost of other things like medicine or hospitalization. The general insurance plan which include dental plans help in tax benefit (to a certain limit) in income tax . Indian dental insurance scheme is a decent initiative taken by the Indian dental association of India. there are some Stand-alone dental plans in which general dental problems are covered to a fixed time period. These types of dental insurance

are made by the dental products company in association with health insurance company [8].

Dental insurance scheme in India

In year 2002, 9 October the first dental insurance scheme pepsodent dental insurance scheme was launched by the Hindustan lever limited [9] with the purchase of every pepsodent tooth paste 1000 Rs free dental insurance was given to the costumer in this scheme general dental procedure permanent tooth extraction, periodontal diseases and the cost of the medicine is given to the consumer. for the consumer have to send a proposal form which is present in the 100 and 200 gm and the three wrappers of the tooth paste medical certificates and bills which was assessed by New India.[9].

ICICI Lombard dental insurance is a standalone dental insurance In the Indian market. it covers i health advantage plus policy of general health insurance. ICICI was first in India who covers dental insurance under general Insurance this dental insurance cover cost of dental consultation dental treatment and medication. In this insurance the OPD reimbursement is up to 9500 RS the demerit of this dental insurance is orthodontic treatment and prosthetic treatment are not included [10]

What is a good dental plan?

The first and the foremost important thing is that the patient should be allowed and have freedom to choose his or her own dentist or is the dentist [11] in the good dental plan dentist and patient trust relationship should be maintained and dentist should control treatment decisions if there are multiple treatment option dentist should follow Least Expensive Alternative Treatment (LEAT) approach. A good dental plan should cover diagnostic, preventive and emergency services these services are made for the maintenance of good oral health, the treatment without cost includes: [11]

- Initial oral examination – once per year

- Recall examinations – twice per year
- Complete X-ray survey – once every 3 years
- Cavity-detecting bite-wing X-rays – once per year
- Prophylaxis or teeth cleaning – twice per year
- Topical fluoride treatment – twice per year
- Sealants – for those under age 18 years

Conclusion

Dental disease is considered to be a serious public health problem among all age groups. dental treatment is bit expensive to remove this barrier and make dental treatment accessible and affordable dental insurance is introduced. we all should motivate people for the good oral and general health and we should also spread the awareness regarding dental insurance we as a public health dentist should come forward and educated people by the help of guest lectures. seminars educational articles, and debate about the dental treatment and dental health insurance. the focus of the insurance should be on low cost of treatment cashless treatment facility, coverage of all illnesses, and coverage of all service.

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WASTE MANAGEMENT THE THE FUTURE NECESSITY – A REVIEW ARTICLESupurna Pandit¹, Pradeep Tangade², Ankita Jain³, Jeevan Josh⁴,

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Abstract

All kind of biomedical waste that are produced in dental clinics and hospitals if are not managed properly, can cause various health hazards to dental professionals, dental auxiliaries, patients and other dental health care service providers who work in dental office. Every one working in the health care sectors should have knowledge about handling and disposal of biomedical waste. This review article is an attempt to discuss different kind of biomedical waste and the different methods for management and disposal of biomedical waste

Key words: Waste Management, Bio medical Waste, dental waste,

Introduction

According to Biomedical Waste (Management and Handling Dental Rules, 1998 of India), “Any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals [1], one of the main ecological challenges currently face by modern era is waste management . our activity produces waste, our activity show our basic manners and how much waste we can create the waste which we create shows our finical and social way of living [2]

Dental profession is noble profession which is committed to encourage and reinforce oral health. To achieve this goal dental professional use different type of materials and equipment. Dental professionals in dental procedure produces small as well as large biomedical waste , these biomedical waste should given equal importance and management , biomedical waste (BMW) from dental clinic include latex ,cotton, glass and other contaminated with body fluids [3] . the other BMW produces in dental offices are plastic glasses and plastic bottles ,X ray processing solutions [X ray developer , X ray Fixer] lead foils , disinfectant chemicals, impression material , dental cast waste sharps like lancet surgical needle disposable syringes BP blades extracted tooth expired medicine

human cells and tissues as these above materials are at great risk because they are contaminated with Patients blood and saliva and they have great chance of spreading infections and the microbes which causes disease which may effect both the dental professional and the ecosystem

The procedure of taking care of BMW are generation , sorting , segregation, use of color coded waste dustbins dental waste collection, dental waste storage, dental waste packaging ,dental waste loading, dental waste transportation, dental wasted unloading, dental waste processing, dental waste treatment, dental waste destruction, dental waste conversion, or offering for sale, transfer, disposal of such waste.[4].All dental professionals should take training in taking care of BMW and all the dental professionals should make themselves updated annually .immunization of all health care workers should be done so that they stay protected by the disease which cause by handling of BMW. [4]

Bio-Medical Waste Rules (1998)

Bio-Medical Waste (management and handling) rules in July 1998 was given by The Ministry of Environment and Forests. According to the guideline of these Rules, it is the duty of every “occupier” i.e. a person who look

after or take care of the school college hospitals institution and or its premises

<p>lead foil ,X Rays solutions]</p>	
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have to take all foremost procedure or steps and make sure that waste which is produce should be handle properly and that waste should not create and poor or harmful effect to the nearby living habitat and the nearby ecosystem [5,6]

According to the law 2016 BMWM limitation were enforced on caretaker for proper treatment and disposeoff of waste generated in the industries within the radius of atleast 75 km and the health care facility have install individual treatment plant for the proper waste disposal

Classification of Bio Medical Waste

Bio Hazardous waste	Non-Hazardous waste
<ul style="list-style-type: none"> • Infectious waste [laboratory culture cotton swabs] • Waste by pathology [human tissues or body liquid] • Pharmaceutical waste [expired medicine] • Geno toxic waste • Sharps [BP Blade ,Needle , disposable syringes] • Chemical waste disinfecting solutions] • Cytotoxic waste • Radioactive waste{ X Ray foils covers 	<ul style="list-style-type: none"> • Disposable paper towels • Paper mixing pads • Disposable covers of operating surfaces

Classification of Medical waste [8] :

1. Common Waste:- Is anything which cannot be recycle easily. Ex- expanded polystyrene, tissues , contaminated packaging.
2. Pathological:- Is defined as a bio-hazardous waste that can be contained with any type of infectious biological fluid, blood.
3. Radioactive:-It is a by-product of various nuclear technology processes.

Chemical:- These are waste products that are produced by harmful chemicals.

4. Infectious to potentially infectious waste
5. Sharps:-It is a form of biomedical waste composed of use of sharp instruments which can puncture or lacerate the skin which can cause infection.
6. Pharmaceuticals:-Includes used and unused expired prescription pharmaceuticals.
7. Pressurized containers

Source of waste

The source of biomedical waste are as follows[9] :-

- Government hospitals
- Private hospitals

- Nursing home
- Dental office / clinic
- Primary health centers
- Blood banks
- Laboratories
- Vaccinating center

Type of dental waste

Several type of dental waste are as follows [10] :-

- Dental Amalgam Waste [amalgam traps, Bulk Mercury]
- scrap heavy metals [Lead foils waste produce in processing of X rays]
- Silver containing Wastes [X ray fixer and developer]
- Chemical disinfectants and sterilizing Agents,
- Medical Waste,
- Sharps waste
- Bio hazardous waste.

Steps for Waste management procedure

- **Waste Survey:** Water survey a deceive component of the waste management method.it is use to Quantify and differentiate waste , survey conducted helps in evaluation quality and quantity of waste created . [9,11,12]. Water survey in the process of proper waste disposal [13.14]
- **Segregating waste :** Segregation is an elementary method of categorization of waste created in day to day life Waste segregation means keeping waste in different colour coded plastic dustbin containers or color coded plastic bags . It play a vital role in the reduction of amplitude of contagious waste and cost of treatment The BMWs have to be segregated by following the guideline schedule 1 of BMW Rules, 1998
- **Accumulation and storage waste :** Accumulation and storage waste is the area between waste generation point and disposal site , containment of small amount of waste on the site of its production fore a small duration of time Accumulation of wastage means holding of

small quantities of waste near the point of generation for very little duration of time span , There are different type of waste holding containers or plastic bins to store waste. These waste holding containers or bins should be kept in area of 100 percentage waste disposal is achieved. Sharps should be thrown into a puncture proof container so these sharps should not injure the person who is handling them .once the collection is done the collected biomedical waste should be placed in an appropriate area with each colour coding and labeled bins or plastic but for not more than 8-9 hours in big hospitals or 24 hours in dental clinic and nursing home .In storage area 'EXPLICIT sign should be posted

- **Transportation of waste :**Untreated biomedical wastage should be transported to the treatment site. Untreated biomedical wastage is transported by carts trollies Biohazard sign should be dyed on these cart and trollies before disposing plastic bags its should be shredded .Unprocessed biomedical wastage should not be kept more than 48 hour.[15,9]
- **Treatment of waste:** Treatment of waste is important for regulating environmental pollutants. Waste treatment is a process of converting waste into some way before dumping it into its final resting place ,before discarding needle it should be destroyed by cutting needle from the whole syringe with help of needle cutter and needle nozzle should be shredded in syringe cutters. In dental clinic sharp instrument like Broken glass /Scalpel blades/ Lancet/ in minor or major surgical procedure before discarding them these items should be kept in bleech in a container . when we discard extracted tooth in which amalgam is filled as a restorative material these tooth must be kept or dipped Gluteraldehyde as gluteraldehyde is a high level disinfectant for half an hour .dental office waste which is dissolvable should be kept in 1% sodium hypochlorite for half an hour to an hour
- **Minimization of waste:** As we know disposal of contagious waste is more costly then disposal of normal waste so treatment of contagious waste should be done by any method through which quality of infection is reduce the cost of disposal of infectious

waste will automatically reduce cost of infectious waste disposal

Act in relation to biomedical waste management

- In year 1974 The water Act
- In year 1981 The Air Act
- In year 1986 The Environment Act,
- In year 1988 The hazardous waste rules,
- In year 1998 The Biomedical waste rules,
- In year 2000 Municipal Solid waste rules,
- In year 2000 and 2003 The Biomedical waste rules Amendment,
- In year 2011 The Biomedical Waste Rules,
- In year 2016 Plastic Waste Management Rules,
- In year 2016 E-Waste (Management) Rules,
- In year 2018 The Bio-Medical Waste Management (Amendment) Rules

Effect of dental waste on environment

Amalgam

Mercury is the main component of dental amalgam as we all know that mercury is neurotoxic and nephrotoxic as well . mercury is more dangerous to embryo and new born as compare to the adult new born baby is more sensitive than adults [16].vacant amalgam plastic box or vacant amalgam capsules are thrown carefully in the trashes[17] .there should be proper disposal of amalgam scraps as amalgam come inn hazardous waste or we can recycle it [18 ,19,20].by heating amalgam scraps amalgam can be disposed while heating waste dental amalgam toxic vapours are the by products,by the guideline recommended by ADA waste amalgam should be kept in small amount of photographic fixer in closed air tight container [17].

X ray waste

X ray fixer contain heavy silver content[20] it is hazardous waste as it contain free ions , these free silver ions of x ray fixer act as an enzyme inhibitor . this enzyme inhibitor interfere with the metabolic process of organism [18] . free silver ion disposed off a

bio hazardous waste we can send to a silver collection system .X ray developer solution can be disposed of directly

into the water stream. X ray cleaner solution contain chromium and it should be disposed of as hazardeouswaste . or we can switch to non chrome cleaner .lead is a heavy metal as lead effect in neurological development and dental x ray lead foil or lead shield contain pure lead [21]these lead foil or x ray shield are hazardous waste it should be recycle as scrap metal content or disposed as hazardous waste[18]

CONCLUSION

Inappropriate discarding of biomedical waste in open space and water bodies can further leads to the spread of hazardous diseases. In modern dentistry the clinical practitioners should take extreme care about the safe disposal of dental waste in order to safeguard other workers and patients along with natural environment. If these hazardous biomedical wastes are not properly discarded they can affect not only the people in contact with it but also pollute the environment. So safe and proper waste management is not only a judiciary need but responsibility of dental professional and the other health care workers for safe wellbeing but reduction in motivation, awareness about waste and its management and cost factor are may be some of the reasons for negligence. To overcome all this factors necessary measures have to be kept in mind to make sure that biomedical waste is disposed in safe manner

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AESTHETIC RESTORATIVE MATERIALS IN PROSTHODONTICS

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ABSTRACT

The word Esthetics comes from a Greek word that is “aisthetikos” meaning insightful. It refers to beautiful or the science which leads from nature and taste the rules and principles of art. Around the year 1950 the word esthetics was invented and later on it was related to the theory of beauty as fine arts. The esthetic revolution started during 1970s. Esthetic restorative materials have quickly developed in number and use. Ceramic materials are mainly the restorative choice since they can recreate the color and shape of the natural dentition. The most extensively used type of ceramic system is still the metal ceramic. Patients interest for dental restorations that replicate the beauty of natural teeth has invigorated the further advancement of composite and ceramic materials.

Key words: esthetics, restorative materials, ceramics, composite, zirconia.

INTRODUCTION

The fabrication of Dental materials is particularly designed for use in dentistry.¹ An ideal restorative material would be biocompatible and also similar to the natural tooth in terms of strength, appearance and bonding to the tooth structure. It should have properties which can be compared to the natural tissues of the tooth and should be able to fix or restore the missing or impaired tissue. Preventive materials and Restorative material are the two types of category for materials in dentistry. Dental materials in preventive category include sealants for filling the pits and fissures etc. In clinical dental practice restorative dentistry is one of the major specialties. For restoring or replacing the tooth structure, dental materials in Restorative category are used. Different types of dental restorative materials with varieties of characteristics according to their intended purpose are available and include compomers, resin modified glass ionomer cement, composite resin, amalgam that falls into the direct restorative materials category whereas gold, ceramic-resin hybrid, composite resins falls into indirect restorative material category.² One of the patients' demands is esthetic dental appearance. Webster has defined 'Esthetic' as having wisdom about the beauty or fine culture and being responsive or enthusiastic or passionate towards it. Perception for beauty differs for every individual and it depends on culture experience and self image.³

Around the year 1970s the evolution of esthetics started unintentionally as during the process of mastication the mercury that is being liberated from the amalgam could be taken in. The tooth colored materials replaced the amalgam restorative materials since it releases mercury which is toxic for the health. There is rising requirement for tooth colored restorations since last ten years.⁴ Both the number and use of esthetic restorative

materials have quickly grown over the past decade. The frequently used restorative material choice is ceramic as they can exactly mimic the natural dentition. The most commonly used type of ceramic system is porcelain fused to metal. But, there has

been rapid all round development of all-ceramic restorative systems which do not require a metal base. The objective is to produce a natural restoration that imitates the translucency of our teeth. There are a wide variety of systems which are available in the market that aids us in the fabrication of materials with raised strength and translucency.

The development of restorative materials such as resin-based composites has helped a lot for the clinicians in moving towards an ideal restorative material. Removing the caries and then filling it with an ideal restorative material is ideal for treating the dental caries. One of the treatment modality is using resin-based composite filling material which is a type of tooth-colored light cured restorative materials and is more clinically accepted from the year 1970 after which evolution took place and has since been used largely as a restorative material. Rate of success for resin composites is becoming popular day by day in the field of dentistry, so it is being widely used in recent times. The increasing demand for dental restorations that mimic the exquisiteness of natural teeth has stirred the gradual development of composite and ceramic materials.

CURRENT TRENDS IN ESTHETIC DENTISTRY

The significance of technology evaluation in dental practices has been recognized by many countries. A review for dental advancement is required cause there is rising dental-care expenditures and increase of published research for the latest variety of dental management choice available. The speed of progress with which the dental clinicians are adapting up every

day in their practices has greatly increased. A major role in a dental practice is done by taking, evaluating, adopting, and implementing new technologies. Few of the advances in the field are the use of Tooth colored and metal free Post systems, Ceramics , CAD –CAM porcelain Veneers and Dental Composite Restorations.

Aesthetic Posts

Because of the start of aesthetic posts, it has greatly helped in the restoration of teeth that are endodontically treated. Due to the advancement in technology there is better modification and also more enhancements of the post shape and materials since their introduction. As the utilization of advanced adhesive systems and cementation techniques are increasing day by day, it has given us the opportunity to get a good bonding within the canals of the root, thereby helping in the development of new posts which make sure that the dental tissue conservation is achieved. Polyethylene fibers which are almost undetectable in the matrix of the resins and helps to enhance with the toughness of the composite materials therefore they are the most suitable fibers for giving the strength to the composite.⁵

Ceramic Crowns

Metals are being substituted by the ceramics for fabrication of crowns and also in other biomechanical prostheses. Even if crowns that are alumina-based which are substituting the crowns that are metal-based but there is increase in the failure rates which stills remains as a problem. The main reported issue of failures of ceramic crowns is the fracture of the bulk even if it is a layered otherwise monolith structure.⁵

Ceramic Veneers

During the start of the year around 1990's the beginning of Ceramic veneers as a major mode of restoration have got a huge recognition in the field of esthetic dentistry. Since the patient's aesthetic expectations are continuously increasing day by day so the dental teams are challenged to formulate and work on a organized proposal for getting more natural facial as well as oral aesthetics when we are using or working with porcelain veneers. The progress in techniques that includes the materials such as ceramics and veneering have allowed the dentists for re-establishing the purpose and esthetics of the patient by following the methods that are more conventional and biologically sound along with giving us a lasting good dental health of the patient.⁵

CAD/CAM FOR CERAMIC CROWNS

All-ceramic Posterior crowns using CAD CAM generated copings are usually made either as core crowns that are veneered manually by the lab technician or computer-generated as

monolithic crowns. Dentists have been using the CAD-CAM system for almost two decades for intraoperative dental restorations using prefabricated ceramic mono blocks. For the development of fixed prosthetic restorations such as inlays, onlays, veneers and crowns, CAD/CAM systems have been used. CAD/CAM system can give advantage of both stock and laboratory processed custom abutments with negligible shortcomings using the custom abutments. For the fabrication of implant abutments, technology related to CAD/CAM technique has been using various metal alloys including Ti and its alloys, ceramics including ZrO₂ and Al₂O₃.⁵

TYPES OF ESTHETIC RESTORATIVE MATERIALS

GLASS IONOMER CEMENTS

GIC falls into the category of materials that are called as acid-base cements. They are based on the reaction product of weak acids that are polymers along with a base containing powdered glasses which is an ionomer. GIC mainly consist of a polyacrylic acid, silicate glass powder and water. The acid, base and water are present as an aqueous solution of polymeric acid and glass powder that are blended together by a correct method in order to form a paste which is viscous. GIC usually releases fluoride which has significant advantages. It usually shows an alternating patterns of fast release initially and then followed by sustained one having a lower diffusion release.⁶

There are nine types of GIC which includes the following:

1. GIC used as a luting material
2. Restorative type of GIC
3. GIC for Liner or bases
4. GIC used as sealants for Pit & fissure
5. GIC used as Luting agent for orthodontic purpose
6. GIC used as material for Core buildup
7. GIC that releases High fluoride
8. GIC used for Atraumatic restorative treatment
9. Pediatric Glass Ionomer Cements.

RESIN CEMENTS:

Newest category of cements for indirect restorations are resin cements. The capability to attach to the structure of the tooth as well to the restoration is excellent. Restorative material such as composite and cements such as resins includes similar type of basic component but resin cements have lower concentration of filler particles in them. They have superior tensile, compressive as well as flexural strength than most of conventional cements and can be utilized for variety of dental restorations. The most important thing which affects success rate of resin cements is its bond strength. Bond strength gets influenced by pretreatment measures along with the curing steps along with the amount of polymerization of the resin cement etc.⁷

ORMOCERS

A novel kind of restorative material which is termed as Ormocer, which is a short form for organically modified ceramic technology that was introduced for deal with the shortcomings as well as issues which were linked with commonly used conventional composites. These materials consist of inorganic and organic co-polymers along with inorganic silanated filler particles. It is synthesized from thioetheracrylate alkoxy silanes and multifunctional urethane that goes through a process of solution and gelation. They are commonly narrated as cross-linked copolymers of 3 dimensions. The matrix of ormocers is a polymer earlier than the light cure resin based composites. The matrix is made up of ceramic polysiloxane, which has considerably low shrinkage. Polymerisable side chains are mixed to the polysiloxane chains in ormocer for a reaction to

occur throughout curing and hence form the setting matrix. The surplus polymerization opportunities in these materials allows them to cure without leaving residual monomers which in turn results in biocompatibility with the tissues to a much greater extent.⁸

COMPOMERS

They are included in class of aesthetic materials and they find their utilization for restoration of teeth. They were introduced to dentistry during the beginning of 90s. Compomers fall under a new category of dental material that were planned to permit and facilitate combination of aesthetics which were provided by traditional composite resins with the properties like fluoride releasing & bond of glass-ionomer cements. Compomers do not contain water and the majority of the components they contain are similar to that of composite resins. These are macro-monomers, such as bisglycidyl ether dimethacrylate or its derivatives and/or urethane dimethacrylate which are combined with viscosity-reducing diluents to improve the properties. Non-reactive inorganic powders, like quartz or a silicate glass are also filled in these polymer systems. These powders are coated with a silane for increasing the bonding between the filler and the matrix in the set material. These materials release fluorides in clinically beneficial amounts.⁹

CERAMICS

The use of dental ceramics as restorative materials has disadvantages and limitations mainly because they are not capable to resist the functional forces present in the oral cavity. For this reason, it was found that there is very limited application in the posterior region. Additional improvements in ceramics have helped them so that it can be used in cases of long span FPDs and also in super structures of dental implants when

compared with other dental materials such as metals ceramics which have less fracture toughness.

CLASSIFICATION

Based on microstructure:

1. SiO₂ containing Glass based system
2. Fillers mainly crystalline containing Glass-based system.
3. Glass filler containing Crystalline - based systems.
4. Polycrystalline solids.

Classification based on processing technique:

1. Powder/liquid and glass-based systems
2. Glass-based systems consisting of Machinable or Pressable blocks
3. Slurry or computer assisted die-processed systems.¹⁰

ZIRCONIA

Zircon is a precious stone since long. Zirconia name have evolved from zargun which means Golden in colour and it has evolved from Iranian language zar means Gold and Gun means colour. Zirconia is an oxide of zirconium. In medical field zirconium oxide was first used in the year 1969 by orthopedicians. It was used for hip replacement. In the field of dentistry, it was used in late 20s to replace the unesthetic metal based restorations with a more esthetic one. Like ceramic, the strength as well as esthetic property of this material is harnessed in the field of prosthodontic restoration. It is now utilized for the manufacturing of endodontic post, crown and bridge. It is also used for the fabrication of brackets for orthodontics. Zirconia have become a popular substitute to alumina as a biomaterial.¹¹

CONCLUSION

The interest for esthetics in dentistry has created an alarming assortment of different dental restorative materials like porcelain, composite and ceramic that are available for dental treatments. Like instance, ceramic restorations are so characteristic looking that even the clinicians may need to cautiously assess what they examine in the patient's mouth. Some constrains are present which we have to keep in mind when the restorations are done, even though it has a natural aspect and are esthetically pleasant. Because of the masticatory forces and also parafunctional habits, there is a possibility of failure cause of the brittle character even though ceramics are quite strong.

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RECENT ADVANCES IN PREVENTIVE DENTISTRY: A REVIEW ARTICLE

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Abstract: Oral hygiene is an important part of general health and affects the well being. Oral diseases remain a public health problem worldwide. Recent increase in the research field have increase the diagnostic activity surrounding Dental Caries, Periodontal disease, Oral Cancer. Dental caries has been considered as prevalent chronic disease worldwide. 90% of people have oral problems or tooth pain caused by caries. Oral Cancer is the eighth most common cancer worldwide and the prevalence of which is particularly high among men. The application of scientific knowledge in the prevention of oral diseases result in the decline of oral diseases.

Keywords: Dental Caries, Oral Cancer, Periodontal Lesions.

Introduction

There is an old saying, but true... **Diseases can rarely be eliminated through early diagnosis or good treatment, but prevention can eliminate disease.**

The Term Prevention originated from a Latin word “*praevenire*” that means to stop something from happening in the field concerned¹. The Preventive dentistry is known as the preventive measures which are necessary to prevent disease and supporting structures.

Prevention is currently receiving much attention and concept of prevention are mainly broad based. There are Four Levels of prevention which can be identified in relation to natural history of Disease. Primordial prevention, primary, secondary and tertiary levels of Prevention.

Primordial prevention consist of actions and measures that inhibit the emergence of risk factor in the form of environmental, economic, social and behavioural conditions and cultural patterns of living.

Primary prevention consists of strategies and measures to prevent the onset of disease, to reverse the progression of the disease, or to arrest the disease process.

Secondary prevention includes actions which halts the progression of a disease at its incipient stage and prevents complications.

Tertiary prevention includes measures that are necessary to replace lost tissues and rehabilitation practices.

The main target of primary preventive dentistry is to focus on the importance of Early diagnosis and prevention of dental problem.

Registered, on date is 8022.0. Thus these Statistical Ratio suggests that there is still not enough number of Dentists in India.

Recent advances in prevention of dental caries plays a very important role especially at the primary prevention level so that the disease can be detected in its earliest stages. The recent advancement in assessing caries is by the use of a cariogram and at the primary prevention level various measures to prevent dental caries are remineralizing agents like fluoride, casein derivatives, beta tricalciumphosphate, pronamel, novamin, enamelon, dicalcium phosphate dehydrate which works to inhibit incipient dental caries it can prevent the activity of cariogenic bacteria.

Similarly, Recent advances in prevention of periodontal disease plays a very important role especially at the primary prevention level so that the disease can be detected in its earliest stages. Recent various methods are available to assess the periodontal risk factors Periodontal assessment tool (PAT).

The best gold standard method to treat periodontal disease is scaling and Root Planning. But recent technologies have been introduced that not only eliminate the disease but also regenerate the lost tissue and repair it with the help of flap surgeries for the normal masticatory function.

Recent advancement in prevention of oral cancer includes photodynamic therapy based on the principal the photodynamic antimicrobial chemotherapy against various viral, fungal and bacterial infections in the oral cavity.

Early Diagnosis of cancer can lead to better prognosis and less damage by cancer treatment. It consists of screening and detection of cases.

Dentist Population Ratio of National Councils

RECENT ADVANCES IN PREVENTION OF DENTAL CARIES

CARIES MANAGEMENT BY RISK ASSESSMENT

Nowadays, the most accepted treatment is CAMBRA Caries management by Risk management.

Preventive Aspects of Dental Caries

REMINERALIZING AGENTS

Remineralization is a process for non cavitated lesions where phosphate and calcium ions promote the deposition of crystal voids.

1. Flourides

Primary prevention prevents the etiology of disease whereas secondary prevention tends to reduce progress of disease⁶. Enhancement of resistance is by increase use of flourides agents. World Health Organization has shifted its focus from alternative like salt and milk floridation to flouride gels, rinses in 21st century⁷.

Use of flouride varnish reduces caries in school children by 37%. Flouride supplements, flouride toothpaste, flouride rinses, flouride gels are very effective in prevention of Dental disease.

2. Calcium Phosphate Based Remineralisation

Calcium Phosphate based on 4 systems :

Casien Derivatives, Beta Tricalcium phosphate (TCP) , Pronamel , Novamin, Enamelon, Di calcium phosphate dihydrate are very effective remineralising agent to reduce dental caries.

3. Sugar Substitutes

Xylitol is one of the best nutritive sucrose substitute with respect to caries prevention⁸.

It acts by:

- Reduce accumulation of plaque on tooth surface
- Reduces level of streptococcus mutans
- Neutralize the acid by plaque formation
- Increase and stimulate the salivary flow
- It has an antibacterial effect

4. Replacement Therapy

The possible antagonistic organism to prevent pathogen and control Disease is called replacement Therapy. Replacement therapy has minimal immunological effect whereas the probiotic has definite immunological effect.

5. Caries Vaccine

Vaccine is an immunological substance designed to produce specific protection against any given disease⁹. Numerous advancements have been made regarding the caries vaccine, but Mutans streptococcal

glucosyltransferases and gucan binding proteins have received attention as vaccines.

6. Ozone Technology

Ozone has been considered as boon in dentistry. Its application also helps in prevention of Dental caries as a disinfectant. It has antimicrobial , antihypoxic property¹⁰. Some of the studies suggested that Ozone was effective and efficient in treatment of deep carious lesion over the conventional treatment.

7. Atraumatic Restorative Dentistry

Atraumatic restorative dentistry is known as "treatment procedure of dental caries which involve the soft, demineralized tissue by using hand instrument, followed by restrotation of the tooth with restorative material. This is modified by use of rotary instruments¹¹.

8. ROLE OF ALKALI PRODUCTION IN BIOFILMS

The protective action of oral alkali production by the action of oral bacteria was found an application of arginine containing toothpastes in the preventive dentistry. The alkali production affects the ecology of dental biofilms and neutralize the acid production from carbohydrates and plaque¹².

RECENT ADVANCES OF DIAGNOSIS OF DENTAL CARIES

The Early diagnosis and detection is important tool for prevention of dental caries. There are some conventional and advanced diagnostic methods for detection of Dental caries¹³.

These include:

- Conventional Method
- FOTI
- Fiber optic transillumination
- Endoscopy viewed filtered fluorescence
- Intra Oral camera
- Lasers
- Diagnodent
- Cariescan

RECENT ADVANCES IN PREVENTION OF PERIODONTAL DISEASES

1. Periodontal Vaccine: With rapid growth of microbial and cellular biology, we have the capacity to examine all genes from human pathogen. Vaccination is defined as

specific immune response to a viral or bacterial infection. It can be an important adjunctive therapy to mechanical debridement of bacteria to prevent colonization in the future¹⁴. The vaccine development depends upon the identification of antigens that are in vivo and produce the protective response.

2. Chlorohexidine gluconate: Chlorohexidine gluconate is the gold standard chemical agent for prevention of plaque control. Chlorohexidine is bactericidal and considered to be effective against Gram negative, Gram positive bacteria and yeast organism¹⁵.

3. Zinc Citrate Dentrifrice

The presence of some therapeutic agents can be effective in inhibitory action of plaque formation and results in improvement of gingival health. Zinc plays a major significant role in oral hard tissues, enamel formation, dentin formation, synthetic calcium hydroxide. It has an antimicrobial property which can be effective in various microbes and pathogens. Zinc citrate has new era of interest in upcoming future which can be effective in dissolution of enamel and promote remineralisation of dental hard tissues¹⁷.

4. Regenerative treatment

Due to recent research in dentistry, there is more expansion in regenerative treatment, which has the power to restore what is lost. Regenerative periodontics has emerged as upcoming and continuous challenge in the development of what has been lost. Various advances like local delivery, gene therapy and new techniques offer new chances to enhance the development of more biofriendly and advanced bio-friendly regenerative periodontal techniques¹⁷. Guided Tissue Regeneration Periodontics is an effective physical barrier for the treatment of, localized gingival recessions, periodontal pockets and furcation involvement.

5. Bisphosphonates:

It is considered as an effective mechanism for bone formation.

RECENT TRENDS IN DIAGNOSTICS IN PERIODONTAL DISEASE

1. DNA PROBES

DNA probes are found to be newer diagnostic aids in the prevention of periodontal disease. The principle of DNA

probes depends upon the sequencing of DNA. It is considered to be 100% effective in the identification of *A. Actinomyces comitans* and *Bacillus intermedius*. It is the gold standard for the identification of periodontal pathogens¹⁸.

2. IMMUNOASSAY

Neutrophil collagenase -2 immunoassay is found to be very helpful in the rapid screening of target populations.

3. POLYMERASE CHAIN REACTION

Polymerase Chain Reaction is one of the ideal methods for high yield replication of DNA. A modified PCR not only detects specific bacteria but also detects quantification. It is very simple, sensitive, rapid, reproducible and economical method for identification and quantification of cariogenic and periodontal pathogens¹⁹.

RECENT ADVANCES IN PREVENTION OF ORAL CANCER

According to the World Health Organization, oral cancer has been classified as cancer of the lip, tongue, gingiva, floor of mouth and other parts of the mouth.

Tobacco chewing in the form of smoked tobacco and smokeless tobacco is the most common cause of oral cancer. Prevention of oral cancer can be done by primary, secondary and tertiary care. Recent advances which include prevention of oral cancer can be chemoprevention, gene therapy and tobacco cessation methods and initiatives²⁰. It is of utmost need to reduce the mortality and morbidity rate of oral cancer patients if detected at early stages of intervention. It is the primary duty of every dentist to motivate, encourage the patients to quit cigarette and tobacco consumption to prevent oral cancer.

CONCLUSION

It is the upcoming challenge in the future to implement current knowledge in a systematic way to prevent the prevention of dental, periodontal and oral diseases. Dental professionals should encourage health promotion by changing the priority of treatment to prevention. They should encourage the patients to actively participate in the preventive programs.

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CONTEMPORARY APPROACHES OF RESEARCH IN CLINICAL PERIODONTOLOGY

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Abstract

Periodontitis leads to destruction of tooth attachment apparatus and hence periodontal regenerative procedures are focused much in the research field of periodontology. In the past decades, various regenerative therapies have been introduced in the field of periodontology which includes bone grafts, growth factors, stem cells and their combination using matrix-based scaffolds and proteomics. The current review discusses recent progresses of periodontal regeneration using tissue-engineering and regenerative approaches and focuses on advances in protein and gene based regenerative procedures and role of 3-D printing in periodontal regeneration.

Key words: Tissue engineering, Gene Therapy, Proteomics, Polymicrobial synergy.

Introduction

Sir Arthur Kennedy once quoted that “If necessity is mother of invention, scientifically developed production is the

mother of scientific research.” The scientific evidence that has been emerging over the last few decades brought in a loop several new advancements. Research in the field of periodontics has gained an upgrade in last two decades introducing newer innovations in mythology and armamentarium. The way to current research included tissue engineering and regeneration, Bacterial peptides, Protein based therapy, Gene therapy, Polymicrobial Synergy and Dysbiosis and Nanotechnology which include the 3D printing.

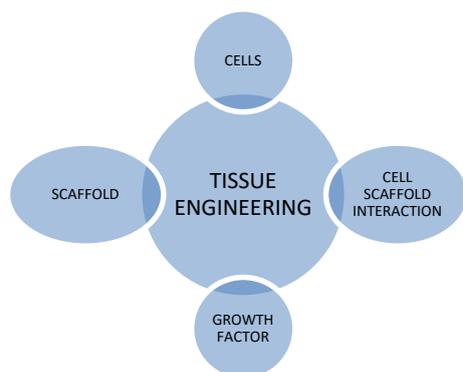
TISSUE ENGINEERING AND REGENERATION

Tissue engineering being a rapidly evolving discipline integrates the biology and engineering together to create products which may be tissue or cellular in nature to develop biological substitutes to better manage, restore, maintain and improve the functions of various organs.¹

Cell therapy is an emerging cure with high potential in which the cellular substances are used for treatment. Cell sources for the treatment includes mesenchymal stem cells (MSCs) and mature somatic cells. MSCs include cells from bone marrow, dental tissue and adipose tissue. Somatic cells are the cells which can be reprogrammed to Induced Pluripotent Stem Cells (iPSCs) or directly to desired cell type.²

CELLS INVOLVED IN PERIODONTAL TISSUE ENGINEERING:

- a) **Bone Marrow- derived MSCs (BM-MSCs):** They were identified by Friedenstein for the first time. They have a direct role in tissue regeneration and also impacts wound healing via paracrine mechanism. They are the most potent source of cells in the field of tissue engineering.³
- b) **Pulp Stem Cells from tooth (DPSCs):** The pulpal stem cells have the potential of self-renewal and multi-potential properties. These cells can differentiate into various cell types such as osteoblasts, odontoblasts, adipocytes, chondrocytes etc.³
- c) **Periodontal Ligament Stem Cells (PDLSCs):** These are specialised connective tissue cells that help in establishing the attachment between the alveolar bone and the tooth. These can divide and develop into various cell types including neurons, chondrocytes and osteoblasts and have a potential to regenerate periodontal ligament, blood vessels and alveolar bone.³
- d) **Stem Cells from Human Exfoliated Deciduous Tissue (SHED):** These are also known as unique cell type due to their increased production rate and plasticity for multi-potent differentiation.³
- e) **Dental Follicle Stem cells (DFSCs):** The cells are collected from the dental follicle and has



an important role for development of tooth. DFSCs can differentiate into periodontal ligament fibroblasts, cementoblasts or osteoblasts. These are easy source of cells and can be taken from third molars.³

f) iPSCs: The cells are generated from somatic stem cell and have a potential for regeneration. Cell therapy will constantly remain a focus during research in periodontal regeneration with increasing evidence from 3-D printing and scaffold designing technology.³

II. Protein/Peptides based Therapies for Periodontal Regeneration

In few years, considerable improvements have been made in using various proteins (biological) for the treatment of periodontal diseases and till now a few proteins been approved by FDA for the use as a commercially available product which chiefly include recombinant human platelet derived growth factor (rhPDGF), enamel matrix derivative (EMD) and P-15 peptides.³

A) EMD

It is the first ever protein derived agent marketed as EMDOGAIN for periodontal regeneration. EMD is a mixed fraction of protein which is derived from enamel of piglet with a propylene glycol alginate carrier. The main purpose of EMD is to have an effect on the behaviour of different cell types such as cementoblasts, osteoblasts, MSCs, T-cells and acts by enhancing cell adhesion and promoting cell proliferation, osteogenesis, cementogenesis, angiogenesis and synthesis of ECM. There are evidences which proved that EMD in the field of periodontology is a single therapeutic agent which can be used for regeneration in infrabony defects, furcation defects and recession defects.⁴

B) Platelet derived growth factor (rhPDGF)

It is an important key factor released during blood coagulation and also has a potent role in angiogenesis, enhances cell recruitment and proliferation of periodontal ligament cells and bone. It is approved by FDA and is commercially available as GEM21S which is a combination of rhPDGF-BB and beta tricalcium phosphate. In periodontology, it is indicated for treatment of intrabony defects and it also supports periodontal regeneration.⁵

C) PEPGEN-15(P-15)

P-15 is a polypeptide which contains 15-AA that impersonates the cell binding domain of collagen type-1 and promotes the attachment with the cell thus enhancing osteogenesis. P-15 is approved by FDA and is now available as a mixture of P-15 with anorganic bone matrix. Clinically it is used as a bone graft material with similar or superior qualities when compared with other grafting materials. It is used for regeneration in infrabony defects, histological evaluation reflected its role in periodontal regeneration.⁶

PROTEIN BASED THERAPIES IN CLINICAL EVALUATION

i) Recombinant human fibroblast growth factor-2(rhFGF-2):

FGF-2 has a role in binding with heparin and acts in various healing and growth-related processes of the body. It acts as a potent stimulator of angiogenesis in osteoporosis. Clinically high doses of rhFGF-2 significantly improve bone fill and helps in periodontal regeneration. It is a safe protein therapy and provides good surgical outcomes.⁷

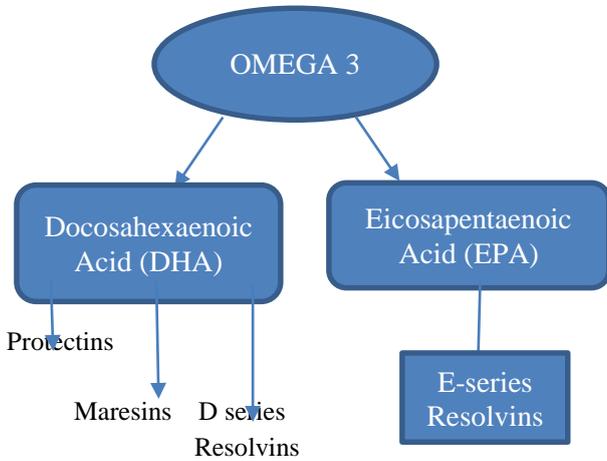
ii) Teriparatide Peptides: It is a bio-synthetic protein of parathyroid hormone which works as an anabolic agent and helps in the treatment of osteoporosis. It is used for the treatment of osteoporosis and it improves both cortical bone cancellous bone structure. Systemic administration of these peptides helps in modulating bone and periodontal wound healing.⁸

RESOLVINS

Resolvins are autocoids which are derived from OMEGA-3 (Fig.3) fatty acids and play a role in regulating the resolution phase of acute inflammatory response. In periodontal disease, resolvins helps to resolve inflammation through various processes within the lesion which chiefly involves prevention of neutrophil penetration followed by phagocytosis and clearance of the lesion thus resolving inflammation and promoting tissue regeneration.⁹

ROLE OF GENE THERAPY IN PERIODONTOLOGY

The latest establishment of already existing and current advancement of gene based applied science has permitted individuals to get a closer review of a disease. The requirement for newer gene-based



diagnostic techniques that are capable of measuring various analysis is concurrently becoming very important. The determination of particular genetic variation that can be aimed by specific drugs has become important in the present environment.

Gene therapy a reconstructive approach

A wider definition of gene therapy is the genetic alteration of cells for treatment purposes. Scaffolds made and used as carrier for proteins, gene and cell, delivery have confirmed its potential by providing biomaterials that can interact smartly with the cells, and bioactive factors. A crucial task that has been less contemplated is the modulation of the exuberant host response to microbial contamination that torments the periodontal wound microenvironment. Periodontal regeneration has for quite some time been the definitive objective in periodontal treatment. Nonetheless, treating and re-building the diseased periodontium's unique structure, properties, and capacity establish a noteworthy challenge. Various extraordinary approaches have been proposed however the quantity of regenerated tissue is regularly constrained and hard to predict. Regeneration, infers the reconstruction of the cementum, periodontal ligament, alveolar bone in a particular temporal sequence and spatial distribution is based on a number of essential factors:

- i) Protein associated approach** – factors like PDGF, b FGF, BMP-2,6,7,12, TGF- β and VEGF etc are taken in account for reforming periodontal tissues.
- ii) Cell associated approach** – Use of stromal stem cells have been useful in reconstitution of bone defect that

are too wide to resolve immediately.

- iii) Gene transport approach** - Gene therapy encodes that the growth factor is utilized to stimulate tissue regeneration and to control the short half-lives of growth factor peptides in vivo.¹⁰

Additional methods in periodontal tissue regeneration with gene therapy

Transcription factor and regulators, Wnts (the fly wingless gene), Bone sialoprotein, NTF-hydrogel therapy, periodontal vaccine.

PROTEOMICS IN PERIDONTOLOGY

Polypeptides are the functioning part of mortal somatikus. Nearly each organic particle in the body is either a protein or an out turn of protein activity. The term proteomics was coined in 1977, which is characterized research of all proteins including their relative abundance, distribution, functions in a given cell or organism within a given environment. It has given much more understanding of organisms than genomics.¹¹

Proteomics and Dentistry

Dental proteomics have prospered in two particular areas which are salivary analysis i.e. oral fluid diagnostics or oral fluid biomarkers and proteomics of bone and enamel structures, especially dental enamel. Extensive research and recognition of the protein constituents in human saliva is an imperative initiation towards the determination of saliva protein markers for human disease detection in specific for oral cancer providing a diagnostic and therapeutic significance.¹¹

Proteomics and Periodontics

Periodontal ligament fibroblast protein articulation has been deliberated using immunological methods. Certain proteins have been recognised from PDL fibroblasts which can serve as a reference map for later clinical studies as well as primary probe.¹¹

- i) Periodontal Pathogen:** Proteomics, this branch of genetics suggests a deal to understand the thorough swift taking place in oral pathogens which adapt to habitat change in their domain i.e. oral cavity. *P.gingivalis* a periodontal pathogen, undergoes changes from its commensal status in healthy individuals to an extremely intraducent intracellular pathogen in patients suffering from periodontitis. Extensive study done on this pathogen in terms of its structural variability, and the proteins responsible for their upregulation and adaptation in the epithelial cell environment which is induced by the considerable alteration in the protein complement of the organism.¹²

- **Stem Cell Research & Genetics** The proteomic and transcriptomic examination provides a radical perception of protein expression, regulation, and cellular biology of mesenchymal stem cells.¹²

The Future of Protein genetic research¹²

One of the most hopeful evolution to come from this study of human genes and proteins has been recognised as a potential new drug for curing disease. This depends on genome and proteome details to recognise proteins associated with a disease, which computer software can then use as targets for new drugs.

Development of Biomarkers¹³

The developed, of "Oral Fluid Nano Sensor Test (OFNASET) is predicted to be a hand held comfortable to use instrument that practitioners could use to quickly determine complex salivary protein and nucleic acid target.

The polymicrobial symbiosis and dysbiotic bacterial relationship¹⁴

The oral cavity is inhabited by variety of microflora which is composed of 500 species. However, this entity may become virulent leading to pathogenesis of infectious oral disease, example dental caries and periodontal disease. The human microbes and the host co-advanced to have a harmonious or reciprocal relationship. The resident microorganisms contribute to nutrition, digestion, differentiation of host mucosa, development of immunity, colonization and upregulation and take up nutritious natural surroundings around the host. Robust commensal bacterial colonization prevents the pathogenic bacterial colonization by the process known as colonization resistance.

Dysbiosis means disharmony with the symbiotic state of the organisms in the tissue. It generally happens in case of pathological changes in the cell. Periodontitis is a dysbiotic disease resulting from deviation insub- gingival gram-positive bacteria to gram negative bacteria.

The development of a periodontal dysbiosis occurs over broadened timeframe, which steadily turns symbiotic association of host and microbe to pathogenic.

THE POLYMICROBIAL SYNERGY AND DYSBIOSIS MODEL¹⁴

A recent paradigm of periodontitis progression has been postulated which challenges the traditional concept of periodontitis being induced by few particular periopathogens such as belonging to Red complex, but by a more comprehensive dysbiotic-synergistic community. These heterogenous microbiota inhabiting the periodontium or distinct gene integrations execute discrete functions that shape and stabilizes the infection eliciting pathogens Hence, the complete comprehension of the pathogenesis of periodontitis is based on the polymicrobial synergy and dysbiosis model which describes the newer and better therapeutic interventions. The causation of periodontitis by the diverse bacteria in gingival sulcus as explained by the polymicrobial synergy and dysbiosis model. Hence periodontitis to a certain extent is caused by a deflection from the harmonious symbiotic bacterial community to a dysbiotic one.

Three D Print ready Biopolymeric substances for periodontic complex reformation.¹⁵

This development and fabrication of scaffolds for tissue regeneration by material- direct printing systems are an advancement in the field of periodontology to have a newer vision of regeneration. It's uncomplicated assembly with further expected properties, synthetic polymer materials are commonly employed with diverse manufacturing systems: fused deposition modelling (FDM) and selective laser sintering (SLS). In particular, bone scaffolds are produced by FDM using PCL and mustered to spun PCL membrane for PDL cell sheets for periodontal compound neogenesis.

Three D technology for preclinical architectural periodontal regeneration¹⁵ The exposed dentinal root surface is scanned using microcomputed tomography to initiate the image data. According to figure representation defect-adaptable scaffolds are outlined. Operational restorations of PDLs are explored using periosteal mien, and 3D-printed, fiber-guiding scaffolds that could support PDL unification to the teeth with cementum-like tissues and stimulate periodontal complex formation. Based on a design for periodontal regeneration, 3D customized fiber-guiding scaffolds are lately evolved with accompanying with geographical reshaping to the one-wall defect using the canine model. A solvent casting method, PCL scaffolds are investigated for habituation to tooth-root structures using the 3D-printed models and analysed quantitatively.

Three D Scaffolding mechanism for reformative Medicine.¹⁶

Bio substances better monitored for defect adaptation and bio resorption features have much considerable claim in the clinics. The latest blueprint may permit further swift chairside. Additionally, utilization of combination or mixed therapies (cells, genes, and/or biologics) with these latest biomaterials may produce more bioactive constructs thus upgrading the regenerative outcomes. 3D bioprinting can provide inactivation of these reparative entities onto its exterior succour in the finer scheduling of cells for the advancement of new tissue formation.

CONCLUSION

So, analysts must carry on to evolve and magnify their resolution skills, evaluate parameters that affect diagnosis and prognosis, plan an extensive treatment plan, provide suitable treatment and judge the outcome when periodontal care is indicated.

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