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TRIVANDRUM DENTAL JOURNAL

JOURNAL OF INDIAN DENTAL ASSOCIATION TRIVANDRUM BRANCH

July - December 2010

Volume-I, Issue -2

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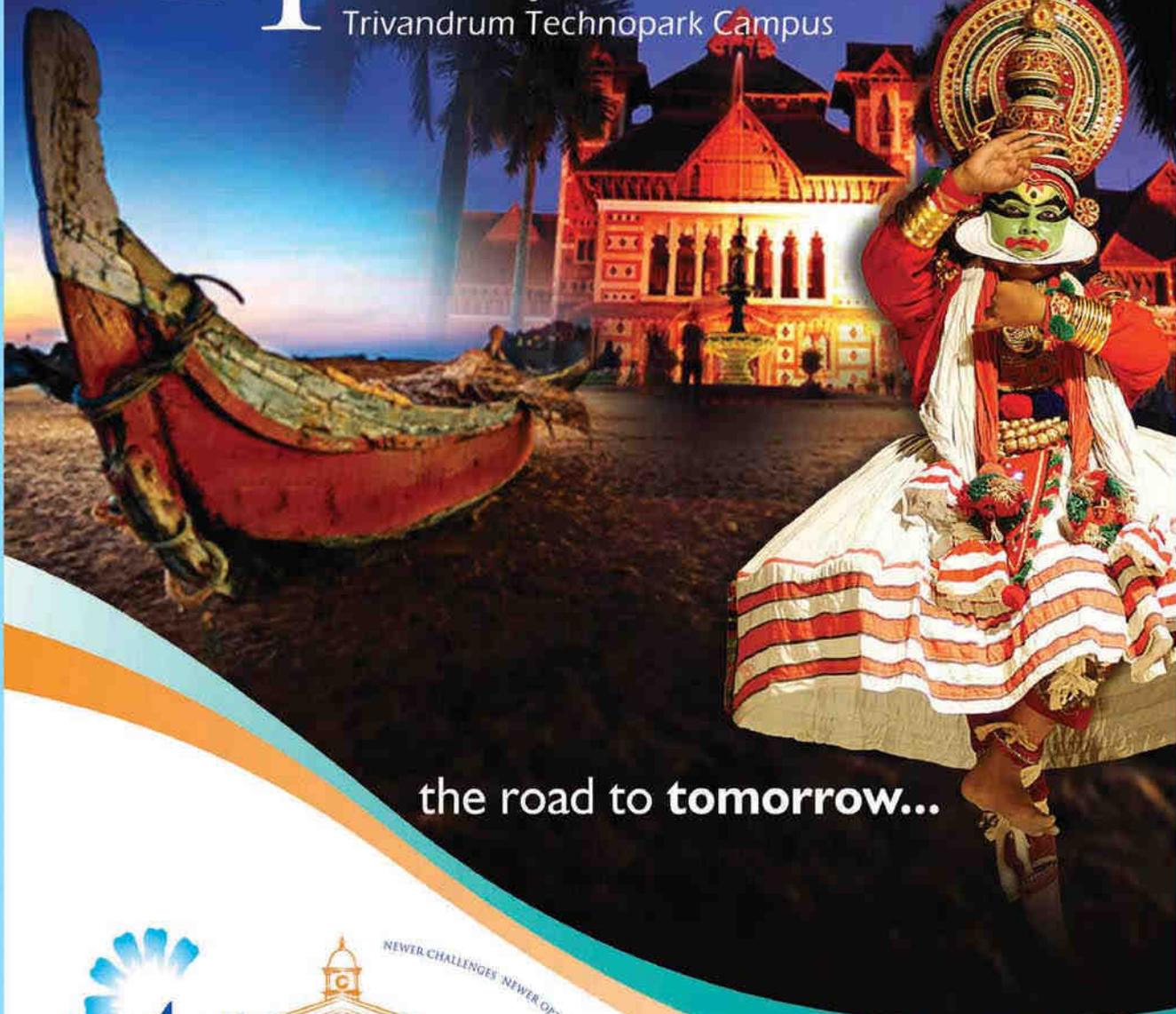
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Guest Editorial

“Following the herd is a sure way to mediocrity”.

The above dictum seems relevant in the management of oral submucous fibrosis (OSF). Controlled studies of different regimens in the management of OSF are needed. They will not be easy to organize because of the number of items in the current management protocols, but they should greatly increase our understanding of this disease. This major health problem is no longer confined to Asia, because immigrants from these high risk regions now reside in many parts of the world, carrying with them the disease burden.

Randomized controlled trials comparing surgical interventions, systemic and topical medicines or other interventions to manage the disease, were all end up in dismay, perhaps due to a conceptual pitfall inherent in the whole management strategy of the disease. The anecdotal reports of so called “cure” for the disease, seems to have originated from the failures of past and all currently available options of management. At best, they seem to be symptomatic relief and sustained cure of this condition is unlikely. This contention is based on factual evidence regarding the patho-physiology of the disease as well as the mechanism of its pathogenesis. There is compelling evidence backed by sound epidemiological data, incriminating areca nut chewing as one of the initiating causes of this disease. The infrequent, though, reports of non-habitues of areca nut contracting the disease made this assumption still complicated. A hypothesis which sound reasonable now is to assume a multifactorial origin for this disease. Whatever be this ongoing puzzle regarding the causative mechanism(s), researchers and clinicians are unanimous in conceiving that once initiated, this disease is a progressive ailment and reverting back to a stage of normalcy never exists.

Yet another facet of this disease, still intriguing, is the occurrence of carcinoma complicating the fibrotic disorder. No reports of occurrence of sarcoma noted so far, though the disease basically is a prototype of pathological fibrosis. What makes the epithelium prone to malignant transformation, sparing the stromal components, is conjecture at best. The oft cited explanations of epithelial “atrophy”, lack of perfusion etc are all met with criticisms and lack of experimental support and rely more on assumptions and customs rather than based on sound evidences.

This editorial focus on a different aspect of the disease, on the reasons of failure of different management strategies of this disease. The observation of progressive and irreversible nature of the disease subsequent to its initiation makes any current treatment approach naïve and viewed with skepticism. This aspect becomes more complicated given the nature of oral mucosa being a labile and dynamic tissue constantly undergoing remodeling. In a tissue of this nature, why the disease lingers even after cessation of the deleterious habits (areca nut) and the disease becomes irreversible. This is an area which needs retrospection and conceptual revision and perhaps explains better the reasons for its ever progressive course after initiation. One possible explanation could be an irreversible genetic damage inflicted on the progenitor

compartment of epithelial stem cell pool (adult stem cells) which makes the damage fixed. The successive generations of keratinocyte lineages carry with it these genetic alterations, being direct descendents of the damaged stem cell compartment. This made one to believe that the disease is fixed once it is initiated, and the stem cells being permanent in nature, reverting back to a stage of normalcy never exists. This concept goes well with the nature of the disease and the hitherto failures in management protocols, the number ever increases, could be understood.

Now, how could this situation be overcome and an effective treatment approach can be on the anvil. One and possibly only approach could be cell/ genome directed therapies which provide a potentially unlimited source of oral mucosal tissues, that may revolutionize the treatment of oral diseases. When fully exploited in the future, this source of cells will be able to produce functional tissues to treat a broad variety of oral diseases, which includes OSF. There are also significant opportunities to exploit this knowledge for the development of novel regenerative therapies, which seek to restore partial tissue loss. Such approaches provide potential for restoration of the oral mucosa where the new tissues become an integral part of the area, minimizing some of the problems inherent due to pathological fibrosis. David Williams, Director of the UK Centre for Tissue Engineering, recently highlighted the tremendous potential for regenerative medicine's impact on clinical treatment during a plenary lecture at the British Division meeting of the IADR. Of course, dentistry has long been a proponent of regenerative medicine. The use of calcium hydroxide for induction of reparative dentinogenesis and dentin bridge formation during vital pulp therapy has been a routine procedure for many decades. A novice, yet promising attempt in this direction came recently from Chennai (India) using autologous bone marrow stem cells for the treatment of oral submucous fibrosis (Sankaranarayanan S et al 2008). They injected autologous bone marrow mononuclear cells into the lesional tissue with an aim of increasing angiogenesis (another area of discontent!!) to reverse the pathological changes inherent to OSF. These authors claimed to have evoked relief from burning sensation, increased salivary secretion and a 4 mm increase in the mouth opening. Though naïve, research in this direction seems to be the need of the hour and hence to be promoted.

The need for high quality research in the basic sciences is paramount to ensuring that the development of novel clinical treatment modalities is underpinned by robust mechanistic data, and that such approaches are effective. This translational model epitomizes how dentistry should evolve and highlights the need for close partnerships between basic and clinical scientists.

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CASE REPORT**Prosthetic rehabilitation of a finger amputee –
A Case report**Minu. P .Mohan¹, T Sreelal², K. Harshakumar³, R. Ravichandran⁴**ABSTRACT**

Peretz defines loss as “*a state of being deprived of or being without something one has had and valued*”. Loss of a body part can be one of the most painful experiences in one’s life. The loss may manifest itself in the form of anxiety, depression or a post traumatic stress disorder. Injuries to the fingers are common in accidents at home, work, or play. Finger amputation is a surgical procedure performed to excise all or part of a digit that has been irreparably damaged by injury or illness or that has been accidentally severed (traumatic amputation) from the hand. In the case reported in this article silicone elastomer prosthesis played a significant role in prosthetic rehabilitation and helped to overcome the psychological trauma of finger loss.

KEY WORDS

Amputation, Rehabilitation, Finger Prosthesis

Introduction

Anaplastology is the art and science of restoring a malformed or absent part of the human body through artificial means ¹. For some; reconstructive surgery cannot be performed due to technical difficulties, financial and psychological issues, or due to surgical failure². A Maxillofacial Prosthodontist is the primary person involved in many facets of patient care, and is therefore the individual who is in the best position to coordinate the efforts required in this complex rehabilitative process. ³ The form of a prosthesis is thought to be created by Egyptians in the belief that whatever they took to the grave with them they brought to their after life. Ambroise Pare (1510-1590) was the first to describe fabrication of a nasal prosthesis using gold, silver, paper and linen cloth. Tycho Brahe (1546-1601) is the first documented person

that had a facial prosthesis. He had a golden plate shaped into a nose to cover his defect. Pierre Fauchard (1678-1761) made a silver mask to replace the lost portion of the mandible for a French soldier. Nicolas Dubois de Chemant (1753-1824) received a patent for perfecting porcelain denture making technique. Chemant created teeth, obturators, chin and nose prostheses. In 19th century- vulcanite rubber was used and in 1913 Gelatin-glycerin compounds. 1937 Acrylic resin was used and elastomers came into use in 1960-1970. Barnhart was the first to use silicone rubber for constructing and colouring facial prostheses by combining a silicone rubber base material with acrylic resin polymer stains. By 60’s and early 70’s, the development of medical grade silicone expanded the field and allowed new options for the creation of facial prosthetics and newer materials include silicone elastomers, visible light cure resins, ceramics, silicon block copolymers and polyphosphazenes.

The index finger is the most important digit next to thumb and is primarily used for pinch function.⁴ This article is about rehabilitation of an amputated index finger by custom silicon prosthesis.

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History

A 35 year-old man was referred to Department of Prosthodontics, Government Dental College, Trivandrum from plastic surgery department, Government Medical College for prosthetic rehabilitation of his lost left index finger. He had a history of trauma to his left index finger by a wood cutter three months back while working as an upholster.

Presentation

Examination of his hands confirmed a solitary healed wound at the base of proximal interphalangeal joint and scars on left thumb. [Fig. 1]



Figure 1- Pre operative

He was able to flex at interphalangeal joint and web spaces were intact. The patient had high hopes for appearance as well as restoration of his grasp strength. He was informed about the limitations of the prosthesis to enable acceptance.

Treatment plan

Our goal was to normalize appearance and to create a prosthesis unnoticed in public allowing the patient to lead a life without drawing attention. But being an artificial substitute for living tissue some limitations should be expected such as aging, growth, tanning and merging with the patient's surrounding tissue. It must be removed daily to allow breathing of the underlying skin and cleaning. Periodic replacements are necessary to maintain acceptable aesthetics and hygiene of the prosthesis and underlying tissue.

Prosthetic Design

The aim was to fabricate a light, small and durable prosthesis for manual tasks. The color of dorsal and ventral surfaces should also mimic the adjacent fingers and surrounding tissues. Silicone prosthesis was planned as :

Minu P. Mohan, Sreelal .T, Harshakumar .K , Ravichandran. R

- It gives life like contours, texture, realistic color match, and precise fit with a subtle blend at the margins.⁶
- Unobstructed flexion
- Stains can be removed easily with water and soap.
- The gentle, constant pressure of elastomer prosthesis *desensitizes and protects the injured tip.*⁷
- Silicon gel hydrates *stratum corneum* layer of skin.

Implant retained prosthesis was not considered due to financial constraints. Suction retention in conjunction with a medical grade adhesive was adequate since 4 cm of remaining finger was present.

Procedure for fabrication



Figure 2- Impression and model

Fabrication of the prosthesis was undertaken after three months of complete surgical healing as it allows time for swelling to subside and remaining tissues of the hand to take its final shape.

Impression

Patient's left hand was lubricated with petroleum jelly to prevent impression material from adhering to the surgical site. A suitable container was used as the custom tray and a thin mix of irreversible hydrocolloid (Jeltrate, Dentsply Caulk, USA) was poured into the container and the patient was instructed to immerse his hand in a relaxed position and gently removed after setting of the impression material (Fig. 2)

Model

The impression was then poured in Dental stone, (Kalastone, Kalabhai Dental Pvt Ltd) and cast of the finger was obtained (Fig. 2)

Wax Pattern

For wax pattern fabrication the impression of the opposing index finger was taken and was sculpted



Figure 3
Wax -up on model



Figure 4
Wax try-in

in modeling wax (Dental Products Of India Ltd) .The wax pattern was placed in warm water and then carefully shaped according to left index finger. (Fig. 3)

Nail Bed Preparation

Nail is essential for the prosthesis to be more versatile. Even though nail polish can be applied to the silicone it may not be durable. To be more natural custom acrylic nails can be casted with integral half moons, white margins and other details. Pinkish touch-up coloration can also be given.

For this patient a custom made acrylic nail was adapted into place. Color and shade were matched to nail of the natural fingers. Beneath the cuticle margin an undercut was created to retain the acrylic resin nail within the final prosthesis.

Try in

The wax pattern was tried in the patients hand and the length and fit was verified. (Fig.4).The nail was removed and later reattached to the silicone prosthesis through slits on margin.

For Tight Fit

Due to elasticity of silicone elastomer, an intimate fit to the stump was essential. By using a rectified positive model of the amputation site for the male mold, suction retention was attained.

Investment Technique

A simple stone mould was used for packing the silicone. For this a rectangular base of dental stone was made on to which the wax pattern was invested till the junction of dorsal and ventral surfaces. Index grooves were made and cold mould seal was applied. Second pour was done to stabilize stump to first pour and third pour to cover the entire wax pattern (Fig.5a).This mould facilitates an easy

packing of silicone and separate color matching for dorsal and ventral surfaces .This mould was de waxed by immersing in a boiling water bath .After the mold was carefully opened separating medium was applied between the two pours before silicone packing. (Fig. 5b)



Figure 5a - Investment



Figure 5b - After de-waxing

Color Matching And Packing



Figure 5c - Silicon packed into mold

The Silicone (MP SAI, RTV) and pigments were mixed intrinsically to match patient's skin. The base shade selected was lighter than the highest skin tone of the patient since prosthesis darkens with color. Color matching of the dorsal and ventral surface was done separately and silicone was layered into the mold and both the materials were packed simultaneously (Fig.5c) .The molds were closed, light pressure applied to remove excess material .Silicone was processed at room temperature overnight. The prosthesis was removed carefully and excess material was

removed with scissors. Polishing was done using fine sand paper

Acrylic Nail Fixation

A slit was made along the crease on the nail bead area, where nail is to be inserted.^{7, 8} The acrylic nail was larger than the nail bed by 2mm proximally (edge-to-edge), reducing on the lateral borders to matching size distally. The excess nail portion inserts into the slit.^{9, 10} After the size and position of the acrylic nail was established, the acrylic nail was unmounted and the nail bed area was cleaned and treated with primer. A cyano acrylate adhesive was applied on the undersurface of the nail for bonding with the silicone surface and placed back on the mould to achieve a stronger bond to the nail bed.

Final Prosthesis



Figure 6- Final prosthesis in place

The final prosthesis was inserted on the residual stump and the fit and color matching was evaluated. (Fig. 6)

Instructions

1. Putting on prosthesis

Apply a thin layer of the water-based lubricant (K-Y* by Johnson & Johnson) to the residual stump. Gently push or pull the prosthesis into place making sure all air has escaped. Pulling the prosthesis from one point can tear the silicone. Use only a water-based lubricant, never products such as Vaseline, or oils that may damage the silicone

2. Removing the Prosthesis

Pinch the open end, allowing air to enter, thus breaking the suction, and slowly pull it off. Not

pinching the prosthesis during removal may cause stretching and damage to the silicone. Allowing water to enter the pinched area can assist in the removal. Care while using sharp cutting tools

3. Wash prosthesis every day with warm soap and water, cleaning inside and out. Dish washing soap is recommended. A small soft nail brush may be used. Clean the prosthesis with alcohol once a week for disinfection.

4. Not to wear the prosthesis overnight. Continuous use irritates skin.

5. Avoid exposure of prosthesis to high temperatures.

6. Smoking can stain the prosthesis.

Discussion

Success of prosthesis depends on the precision in planning, making the impression, carving the model and choosing the material that best suits the circumstances. Finger prostheses are challenging due to stability required. Individuals who are most dexterous suffer the impairment more. If at least one centimeter of mobile finger remains, a retentive restoration with active grasp will be possible. Custom-made silicone finger prosthesis is esthetically acceptable and comfortable for use in patients with missing fingers. Even though silicon has some short comings like microbial growth and short durability, with proper care it may last 3-5 years^{11, 12}. This patient was an active participant in the process and was able to suggest many appropriate changes. During this time, he was able to perform a variety of tasks like manipulating his clothing and picking up small objects which proved the acceptance for this prosthesis. Vinyl polysiloxanes are ideal for fabricating prostheses for their ease of pigmentation, adjustable consistency, manageable curing rate and accuracy in recording fine details to excellent stain-resistance, elasticity and biodurability.^{13, 14}

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CASE REPORT

Mucoepidermoid Carcinoma of Minor Salivary Gland - A Rare Site

R. Asish¹, R. Heera², Anita Balan³

ABSTRACT

Mucoepidermoid carcinoma, a salivary gland neoplasm which originates from the ductal epithelium of salivary glands. Here we present a case of mucoepidermoid carcinoma which was clinically misdiagnosed as a mucocele.

KEYWORDS

Mucoepidermoid carcinoma, Mucocele, Epidermoid cells.

Introduction

Mucoepidermoid carcinoma is a distinct group of salivary gland neoplasm mainly affecting major salivary glands. These tumors rarely occur in minor salivary glands; the palatal glands; being more commonly affected. They arise from ductal tissue and are composed of three types of cells – mucous, epidermoid and intermediate. Based on the type of cell predominance, this tumor is classified into low, medium and high grade variety.

Mucoepidermoid carcinoma has a varied clinical presentation making clinical diagnosis difficult. Here we present a case of mucoepidermoid carcinoma which was clinically misdiagnosed as a mucocele. Excision of lesion done and specimen sent for histopathological examination and final report characteristic one mucoepidermoid carcinoma left retromolar area.

Case Report

A 20 year female patient, reported to the O.P section of Oral Medicine and Radiology

1. Assistant Professor, Oral Medicine and Radiology, Govt. Dental College, Kottayam
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Fig. 1: Intra oral Photograph showing the lesion.

Department, Govt. Dental College, Thiruvananthapuram, complaining of an intraoral swelling over left, lower jaw for 2 month duration. The patient gives no history of pain, bleeding or any other discharge from the site.

She was moderately built and nourished. No relevant medical history including drug therapy or family history was obtained. An intraoral swelling 1 x 0.5 cm was noticed over the left lower jaw in the retromolar region.

The lesion appeared bluish in color and mucous membrane over the swelling was normal.

The swelling was well demarcated and soft in consistency and non-tender. No expansion of buccal or lingual cortical plates noticed.

Radiographic examination revealed no bony involvement. Routine blood and urine examination results were within normal limits. A provisional diagnosis of mucocele was made and excision of growth was planned.

Under local anesthesia, the whole lesion was removed and specimen sends for histopathological analysis.

Histopathologic section consists of a connective tissue lined by ulcerated stratified squamous epithelium. The connective tissue was highly cellular with infiltrating epidermoid cells, mucous cells and intermediate cells; of these the epidermoid and intermediate cells predominate. Mucous cells are seen in between sheets of epidermoid cells. Collection of mucous acini is noted at one end of the section, duct like spaces and eosinophilic material are also noted. Connective tissue capsule is compressed and shows fat tissue in submucosa.

Final diagnosis of the case based on histopathological analysis was mucoepidermoid carcinoma – Left Retromolar area.

Discussion

The mucoepidermoid carcinoma is one of the most common type of salivary gland neoplasms. Stewart, Foote and Becker separated this tumor group from pleomorphic adenoma on the basis of clinical behaviour and histological pattern¹. They



Fig. 2: Intra oral Post operative Photograph.

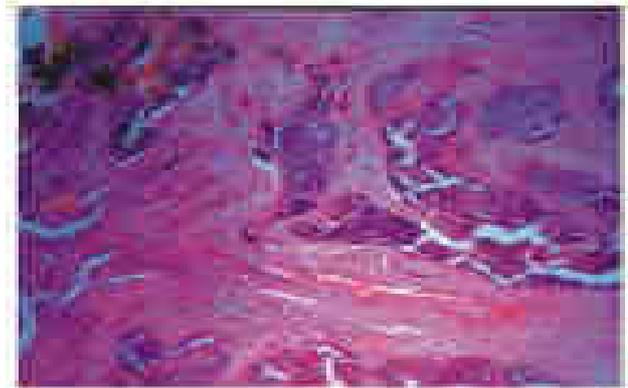


Fig. 3: Photomicrograph of the lesion.

were the first to note the malignant nature of the tumor².

Mucoepidermoid carcinoma originates in the ductal epithelium of salivary glands. It occurs over a wide range of age groups from childhood to oldage, 3rd & 4th decades are more commonly affected³. Mucoepidermoid carcinoma is the most common malignant salivary gland tumor in children. Females are more frequently affected.

Among the major salivary glands parotid gland is the common site of this neoplasm^{4,5,6}. Intraoral accessory salivary glands are also affected and mostly arises in the palatal region⁷.

Based upon clinical and histological features Stewart and his co-workers classified mucoepidermoid tumor into benign and malignant forms^{1,2}. The tumor of low grade malignancy clinically appears as a slow growing painless mass which almost simulates pleomorphic adenoma. It is not completely capsulated and often contains cysts which may be filled with a viscid, mucoid material. Individual cell keratinization may occur, keratin pearls and intracellular bridges are rare.

Tumor of high grade variety grows rapidly. It is characterized by pain and facial nerve paralysis (Parotid tumors). These types entirely lack capsule and are poorly circumscribed. Infiltration to the adjacent tissue occurs in most cases, resulting in erosion. Epithelium over the swelling is ulcerated. Mainly metastasize in to regional lymphnodes. Lung and bone metastasis are also reported. Intraoral lesions may be closely related to mucous retention phenomenon or mucocele particularly those situated in the retromolar area.

Histopathologically, as the name implies mucoepidermoid carcinoma is composed of cells

in varying proportions^{8,9}. Mucous cells predominance noticed in low grade tumour variety. Nuclear pleomorphism, hyper chromatism and epidermoid cell abundance are the characteristic findings of high grade tumors. Histological grading based on amount of cyst formation, degree of cytologic atypia, and relative numbers of mucous, epidermoid and intermediate cells. These tumors show sheets or nests of epidermoid cells that are arranged in a glandular pattern. Sometimes microcyst formation is observed which ruptures and liberating mucous.

The clinical presentation and course of mucoepidermoid carcinoma correlates with the grade of the lesion¹⁰. Low grade and intermediate grade lesions can be treated with wide-local excision with dissection of clinically positive nodes. High-grade lesions require wide-surgical excision. Neck dissection and post-operative irradiation are also recommended. Generally surgical excision is the treatment of choice and is modified by extent and biological behaviour of tumor.

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REVIEW

Proteomics : Concepts and Application in Pathology

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ABSTRACT

The term proteomics refers to large-scale characterization of the entire protein complement of a cell line, tissue or organism. The study involves protein expression, post-translational modifications, protein interactions, organization and functions. Proteomics is complementary to genomics because it focuses on the gene products, which are the active agents in cells. This technique is used for the study of diseases because, while the cause of a disease aberration may be at the genetic level, the functional consequences of such an aberration are expressed at the protein level. This article reviews the concepts and various techniques used in proteomics and also highlight the applications in pathology of the head and neck region.

KEYWORDS

Proteomics, protein characterization, protein expression.

Introduction:

The term “proteome” was first coined in 1994 by an Australian postdoctoral fellow named Marc Wilkins. In his definition, the proteome refers to the total set of proteins expressed in a given cell at a given time, the study of which is termed “proteomics.” Thus, the term proteomics refers to large-scale characterization of the entire protein complement of a cell line, tissue or organism. The aim of proteomics is not only to identify all the protein in a cell but also to create a complete three-dimensional (3-D) map of the cell, indicating where proteins are located¹.

The first protein studies began in 1975 with the introduction of two-dimensional gel by O’Farrell and Klose, who were mapping proteins from *Escherichia coli* and mouse respectively.

Though these scientists were able to separate and visualize many proteins, they could not identify any protein. A major breakthrough in protein identification has been the development of mass spectrometry (MS) technology. MS has now become the tool of choice for protein identification because of its high sensitivity and amenability to high-throughput operations².

Importance of proteomics:

With the accumulation of vast amounts of DNA sequences in databases, researchers are now realizing that merely having complete sequences of genomes is not sufficient to elucidate biological function of a cell. There is no strict linear relationship between genes and the protein complement or ‘proteome’ of a cell. Proteomics is complementary to genomics because it focuses on the gene products, which are the active agents in cells³.

In recent years, the mRNA analysis by serial analysis of gene expression (SAGE) and DNA microarray has become increasingly popular. However, the mRNA analysis is not a direct reflection of protein content in the cell. The formation of mRNA is only the first step in a long

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sequence of events resulting in the synthesis of a protein. First, mRNA is subject to post-transcriptional control in the form of alternate splicing, polyadenylation and mRNA editing. Many different protein isoforms can be generated from a single gene at this step.

Second, mRNA then can be subjected to regulation at the level of protein translation. The proteins that have been formed undergo post-translational modifications and it has been estimated that around 200 types of post-translational modifications exist. Proteins can also be regulated by proteolysis and compartmentalization. The average number protein formed per gene was predicted to be one or two in bacteria, three in yeasts and three or more in humans. Therefore, now it is clear that the tenet of "one gene, one protein" is just an over-simplification and not true any more^{4,5}.

Types of proteomics:

There are three types of proteomics namely

1. Expression proteomics:

The quantitative study of protein expression between samples that differ by some variable is known as expression proteomics. This type of proteomics is concerned with the display, measurement and analysis of global changes in protein expression. It monitors global changes arising from application of drugs, pathogens or toxins and also changes arising from developmental, environmental or disease perturbations².

2. Structural proteomics:

Proteomic studies that map out the structure of protein complexes or the proteins present in a specific cellular organelle are known as structural proteomics. Identifying the structure of a protein is important because structure is directly related to function of that protein. Structural proteomics aims at identifying all the proteins within a protein complex or organelle, determine their location and to characterize protein-protein interactions. This type of information will be helpful in understanding the overall architecture of cells and explain how expression of certain proteins gives a unique characteristic to a cell. The recent analysis of the nuclear pore complex is an excellent example of structural proteomics⁶.

3. Functional proteomics:

Functional proteomics is concerned with the identification and classification of protein functions and activities so as to understand the network of interactions that take place in a cell at a molecular level. The technique involves the isolation of protein complexes or the use of protein ligands to isolate specific types of proteins. This approach provides important information about protein signaling, disease mechanisms and protein-drug interactions. This branch of proteomics also helps in predicting the phenotypic response of a cell or organism to perturbations or mutations².

Technology of Proteomics:

A typical proteomics experiment can be divided into the following categories:

1. Separation and isolation of proteins from tissue or a cell line
2. Acquisition of protein structural information
3. Database utilization

1. Separation and isolation of proteins:

By the very definition of proteomics, it is inevitable that complex protein mixtures will be encountered. Therefore, methods must exist to resolve these protein mixtures into their individual components so that the proteins can be visualized, identified and characterized. The predominant technology for protein separation and isolation is polyacrylamide gel electrophoresis (PAGE)^{7,8}.

For many proteomics applications, one dimensional gel electrophoresis (1-DE) is the method of choice to resolve molecular protein mixtures. In 1-DE, proteins are separated on the basis of molecular masses. 1-DE is simple to perform, is reproducible, and can be used to resolve proteins with molecular masses of 10 to 300kDa. In 2-DE, proteins are separated by two distinct properties. They are resolved according to their net charge in the first dimension and according to their molecular mass in the second dimension².

2. Acquisition of protein structure information:

The information on protein structure can be obtained by mass spectrometry. It is an analytical technique that identifies the chemical composition of a compound on the basis of the mass-to-charge ratio of charged particles. The method employs

chemical fragmentation of a sample into charged particles (ions) and measurements of two properties, charge and mass of the resulting particles, the ratio of which is deduced by passing the particles through electric and magnetic fields in a mass spectrometer. The design of a mass spectrometer has three essential modules: an *ion source*, which transforms the molecules in a sample into ionized fragments; a *mass analyzer*, which sorts the ions by their masses by applying electric and magnetic fields; and a *detector*, which measures the value of some indicator quantity and thus provides data for calculating the abundances each ion fragment present².

Mass spectrometry enables us to obtain information on protein structure such as peptide masses or amino acid sequences. This information can be used to identify the protein by searching nucleotide and protein databases. The harvesting of protein information by mass spectrometry can be divided into three stages:

- A) Sample preparation
- B) Sample ionization
- C) Mass analysis

A. Sample preparation: In most of proteomics, a protein is resolved from a mixture by using a 1 or 2-D polyacrylamide gel. Further, the peptides recovered by in-gel digestion need to be purified to remove gel contaminants. The common impurities from electrophoresis such as salts, buffers and detergents can interfere with mass spectrometry. One method of peptide purification commonly used is reverse-phase chromatography. The peptides can also be purified using Zip Tips (Millipore) or by high pressure liquid chromatography^{2,8}.

B. Sample ionization: For biological samples to be analyzed by mass spectrometry, the molecules must be charged and dry. This is accomplished by converting the molecules into desolvated ions. The two common methods used for this purpose are electrospray ionization (ESI) and matrix-assisted laser desorption/ionization (MALDI). In both the methods, peptides are converted into ions by the addition or loss of one or more protons. Both ESI and MALDI are soft ionization methods which allow the formation of ions without significant loss of sample integrity⁹.

In ESI, a liquid sample flows from a microcapillary tube into the orifice of mass spectrometer, where a potential difference the capillary and the inlet to mass spectrometer results in the generation of a fine mist of charged droplets. As the solvent evaporates, the sizes of the droplets decrease, resulting in the formation of desolvated ions. In ESI, the samples are delivered by loading individual microcapillary tubes with sample.

In MALDI, the sample is incorporated into matrix molecules and then subjected to laser radiation. The laser promotes the formation of ions. The matrix is a small energy-absorbing molecule such as 2,5-dihydroxybenzoic acid or α -cyano-4-hydroxycinnamic acid. The analyte is spotted, along with the matrix on a metal plate and allowed to evaporate, resulting in the formation of crystals. The plate is then placed in the mass spectrometer and the laser is automatically targeted to specific places on the plate².

C. Mass Analysis: Mass analysis follows the conversion of peptides to molecular ions. This is accomplished by mass analyzers in mass spectrometer, which resolve the molecular ions on the basis of their mass and charge in a vacuum. The three types of mass analyzers commonly used are:

i) Quadrupole mass analyzer: The ions are transmitted through an electric field created by an array of four parallel metal rods called the quadrupole. The quadrupole act as a mass filter that allow the transmission of ions of a certain mass-to-charge (m/z) ratio.

ii) Time of flight: The time-of-flight (TOF) instrument is one of the simplest mass analyzers, which measures the m/z ratio of an ion by determining the time required for it to traverse the length of a flight tube.

iii) Ion trap: Ion trap mass analyzers function to trap molecular ions in a three dimensional electric field. The main advantage of ion trap analyzer is the ability to store the ions and then selectively eject the ions from the ion trap, thereby increasing sensitivity^{8,10}.

3. Database Utilization:

Databases allow protein structural information harvested from mass spectrometry to be used for protein identification. The main aim of database searching is to quickly and accurately identify large number of proteins. The success of database searching depends on the quality of the data obtained in the mass spectrometer and the quality of database searched².

Mascot by Matrix Sciences (www.matrixscience.com) can be freely accessed over the web (for noncommercial entities). Another algorithm that is popular is Sequest, which is not freely accessible over the web and must be purchased^{11,12}. Sonars by Proteometrics can search MS/MS spectra of peptides against protein databases. This software uses Bayesian theory to rank the protein sequences in a database by their probability of occurrence¹³.

Applications of proteomics in head & neck region:

1. Head and neck squamous cell carcinoma:

The MALDI approach holds great promise for the identification of proteomic profiles that are associated with the cancer phenotype, and this field is rapidly advancing with newly developing technology and improvements in bioinformatics data analysis^{14,15}.

MALDI analyses were performed on sera from patients with head and neck cancer (N = 99) and controls (N = 143) scanned over a full-range spectrum between 0 and 180,000 Daltons. More than 280,000 features were measured over this range, and these data were reduced by considering only one of every 100 data points (for a total of about 2800 features) in the final analysis. The protein profile that best distinguished patients with HNSCC from controls was obtained with 45 features and yielded a sensitivity of 73% and specificity of 90%¹⁶.

2. Proteome of oral pathogens:

The oral environment contains diverse communities of micro-organisms including bacteria, fungi, protozoa and viruses. Studies of oral ecology have led to an appreciation of the complexity of the interactions that oral microorganisms have with the host in both health and disease. Despite this, diseases such as dental

caries and periodontal diseases are still worldwide human ailments, resulting in a high level of morbidity and an economic burden to society.

Proteomics offers a new approach to the understanding of holistic changes occurring as oral micro-organisms adapt to environmental change within their habitats in the mouth. While the characterization of proteins observed under a range of *in vitro* growth conditions is essential for complete definition of the proteome, differential or comparative proteomics is more frequently used to establish changes in protein expression when cells are grown under different physiological conditions. Recently reported studies with oral micro-organisms invariably use this approach. In the following sections, we have summarized several of these studies¹⁷.

(a) Dental Caries: The mutans streptococci, including *Streptococcus mutans* and *Streptococcus sobrinus*, are generally associated with the initial phase of human dental caries, since their acidogenic and aciduric properties allow them to create a low-pH environment in dental plaque following the ingestion of sugars. It is not surprising, therefore, that several 2-DE proteome studies have concentrated on the physiological adaptations associated with *S. mutans* survival in the oral cavity. For example, 2-DE protein analyses of 14C-labeled cellular proteins of *S. mutans* have been used to characterize changes in protein expression following the imposition of pH, temperature, salt, and oxidative and starvation stresses. *S. mutans* responded to these adverse environmental conditions by a complex and diverse alteration in protein synthesis. For instance, the protein profile of cells shocked from pH 7.5 to pH 5.0 revealed 64 proteins that were up-regulated (25 of them acid-specific) and 49 that were down-regulated¹⁸.

In a 2-DE study, 18 proteins were up-regulated and 12 down-regulated when *S. mutans* was grown at pH 5.2 compared with cells grown at pH 7.0. These proteins were involved in energy metabolism, cell division, translation, and transport¹⁹.

The presence of fluoride in the environment represents another stress factor for many cariogenic bacteria. Fluoride not only protects tooth enamel from bacterial acids by forming fluorapatite in the outer layers of enamel, it also directly alters the

bacterial phenotype. For example, 2-DE analysis of *S. sobrinus* grown in the presence of fluoride revealed that several proteins were influenced by the presence of fluoride, including the loss of a glucan-binding lectin activity²⁰.

(b) Oral Candidiasis: *Candida* infections are the most frequently encountered fungal diseases of the oral cavity. As well as being associated with antibiotic or prolonged steroid use and with denture stomatitis, oral candidiasis presents as one of the initial manifestations of acquired immune deficiency syndrome. Virulence factors of *Candida albicans* have been widely studied and include its ability to convert from a yeast-like to a mycelial form capable of penetrating tissue. Differential 2-DE analysis of this morphological transition failed to identify any proteins uniquely associated with either morphology, though many were preferentially synthesized in germ-tube-forming cells. While these proteins may subsequently prove to be regulators of morphogenic change, none was identified, and so their biological significance could not be evaluated²¹.

Several other studies of *C. albicans* have combined 2-DE with Western blotting to identify antigens that react to antibodies present in human sera. This method has successfully identified several new antigens that may be useful in developing diagnostic strategies aimed at treating systemic candidiasis. Current treatment of *Candida* infections is impeded by the limited number of antifungal drugs and is complicated by the emergence of azole-resistant strains associated with changes in azole efflux. Azole-susceptible and -resistant isolates of *Candida glabrata* have been compared by 2-DE. Twenty-five proteins were up-regulated and 76 down-regulated in the resistant isolate. Since these proteins were not identified, further research is needed to determine their involvement in drug resistance²².

(c) Other Pathogens: Micro-organisms other than bacteria and fungi are involved in oral diseases. These include protozoans and viruses. For example, the protozoan *Entamoeba gingivalis* is found in patients with destructive periodontal disease, where it attacks and destroys both erythrocytes and leukocytes. Its presence has also been associated with human immunodeficiency virus diagnosis. Unfortunately, research on protozoan proteomes

is being hindered by the current lack of protozoan proteins in public databases. However, this situation should improve in the future as more genomes are sequenced²³.

Unlike protozoan proteomes, viral proteomes are relatively small, and many have already been predicted from their genomic sequence. Viral proteome studies tend to center on the effects of a virus on its host. For instance, a recent study based on the 2-DE differential display of HeLa cell proteins has shown that the 2A proteinase of human Rhinovirus and Coxsackie virus cleaves cytokeratin 8 in the early stages of infection²⁴. In a similar study, a combination of 2-DE and Western blotting allowed the receptors on HeLa and human lung carcinoma cells that bind Parechovirus 1 and Echovirus 1 to be identified as integrins $\alpha v \beta 3$ and $\alpha 2 \beta 1$, respectively²⁵.

Conclusion:

Proteomics provides a powerful set of tools for the large-scale study of gene function directly at the protein level. In particular, the mass spectrometric study of gel-separated proteins is leading to a renaissance in biochemical approaches to protein function. In the near future, proteomics will provide a wealth of protein-protein interaction data, which will probably be its most important and immediate impact on biological science. Because proteins are one step closer to function than are genes, these studies frequently lead directly to biological discoveries or hypotheses. The ready availability of many human genes as full-length clones is itself an extremely important extension of the genome projects that will make possible several proteomic strategies. Proteomics, when combined with other complementary technologies such as molecular biology, has enormous potential to provide new insight into biology.

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REVIEW

Orthodontic considerations for medically compromised patients”

Deepu Leander

ABSTRACT

Orthodontic Considerations for medically compromised patients. Increasingly, orthodontists are treating medically compromised patients. This phenomenon is a consequence of several factors including earlier diagnosis and better medical management of serious diseases, increased expectations for quality of life and life expectancy, greater ambulation of chronically ill patients, and increased demand for all types of dental care, regardless of underlying medical conditions. It is no longer appropriate to deny “elective” dental or medical care to patients with diagnoses that have historically been associated with poor outcomes. Orthodontists can encounter children with congenital heart defects, bleeding disorders, juvenile diabetes, chronic Asthma, renal failure, juvenile rheumatoid arthritis as well as other medical problems. Chronic diseases present major challenges to the child and family, with practical, social, and emotional implications. Orthodontists should address specific concerns while treating medically compromised patients.

KEYWORDS

Orthodontic Considerations, medically compromised

Increasingly, orthodontists are treating medically compromised patients. This phenomenon is a consequence of several factors including earlier diagnosis and better medical management of serious diseases, increased expectations for quality of life and life expectancy, greater ambulation of chronically ill patients, and increased demand for all types of dental care, regardless of underlying medical conditions. It is no longer appropriate to deny “elective” dental or medical care to patients with diagnoses that have historically been associated with poor outcomes. Orthodontists can encounter children with congenital heart defects, bleeding disorders, juvenile diabetes, chronic Asthma, renal failure, juvenile rheumatoid arthritis as well as other medical problems. Chronic diseases present major challenges to the child and family, with practical, social, and emotional implications. Orthodontists should address specific concerns while treating medically compromised patients.

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Introduction

Orthodontists can encounter children with congenital heart defects, bleeding disorders, or in remission from childhood malignancies, as well as other medical problems. Chronic diseases present major challenges to the child and family, with practical, social, and emotional implications. Although no studies have specifically investigated chronically ill children, research among those who do not have chronic illness suggests that the correction of malocclusion improves self-esteem (Shaw *et al.*, 1980)¹. It seems reasonable to assume that children with chronic medical conditions will also benefit from orthodontic treatment.

Medical conditions commonly encountered in orthodontic patients include:

- (1) Risk of infective endocarditis;
- (2) Bleeding disorders;
- (3) Leukemia;
- (4) Diabetes;
- (5) Juvenile rheumatoid arthritis;
- (6) Renal failure
- (7) Asthma

1. Children at risk of Infective endocarditis

Guidelines on the prevention of bacterial endocarditis published in the United Kingdom (Simmons *et al.* 1993)² and the United States (Dajani *et al.*1997)³ do not consider the adjustment of orthodontic appliances to be a significant risk. There is however, considerable uncertainty concerning the need for antibiotic prophylaxis when fitting and removing ortho-dontic bands. Degling(1972)⁴ speculated that of all orthodontic procedures, band fitting, and removal offer the greatest insult to the gingival margin.

The American Heart Association recommendations state that antibiotic prophylaxis should be given at the initial placement of orthodontic bands, but not orthodontic bracket. (Dajani *et.al.* 1997)³. A recent review article concluded that the likelihood of orthodontic treatment causing bacterial endocarditis was so low that the need for antibiotic prophylaxis, other than for extractions, is questionable (Roberts *et.al.*2000)⁵.

More recently, a study among 40 patients reported a lower prevalence of bacteraemia of 7.5 per cent at initial banding (Erverdi *et al.*1999)⁶. In a separate study of bacteraemia at debonding and the same authors detected bacteraemias in 6.6 per cent of the 30 patients studied (Erverdi *et al.*, 2000).

1. As an initial step the level of risk of endocarditis occurring must be established. This will involve contacting the patient's cardiologist, although the American Heart Association guidelines offer guidance on the risk categories of various heart defects (Dajani *et al*1997)³.
2. Orthodontic treatment should never be commenced until the patient has exemplary oral hygiene and excellent dental health. The prevalence and magnitude of bacteraemias of oral origin are directly proportional to the degree of oral inflammation and infection (Pallasch and Slots.1996)⁷. Guntheroth (1984)⁸ highlighted the fact that most bacteraemias occur as a result of mastication, tooth brushing, or randomly as a result of oral sepsis

3. If possible, the orthodontist should avoid using orthodontic bands and instead, use bonded attachments.
4. If banding is necessary the orthodontist must decide if antibiotic prophylaxis is required. This decision should be based on the risk of endocarditis represented by the patient's heart defect (high or moderate risk) and the patient's dental health.
5. Prior to giving antibiotic prophylaxis it is important to establish that no known penicillin allergy exists.
6. The latest American guidelines recommend the use of antibiotic prophylaxis for initial banding, but not when removing bands (Dajani *et al.*, 1997)³. It could be argued that the risk of bacteraemia might be higher at band removal when the gingival tissues adjacent to the bands are often inflamed. Erverdi *et al.* (2000)
7. During treatment the orthodontist should be particularly vigilant for any deterioration in gingival health. Regular supportive therapy from a hygienist is advisable.

2. Children with bleeding disorders

Patients with mild bleeding disorders do not usually present difficulties to the orthodontist. However, those with severe bleeding disorders can be more problematic. In addition to hemophilia A (Factor VIII deficiency), which affects about 1 in 10,000 males, a number of congenital coagulation abnormalities caused by deficiency of other clotting factors have been recognized. As the prevalence of malocclusion in these children is similar to the rest of the population and the long-term outlook is good, orthodontic treatment is often requested. Generally, orthodontic treatment is not contraindicated in children with bleeding disorders.

Special orthodontic considerations

1. It is desirable to prevent gingival bleeding before it occurs. This is best achieved by establishing and maintaining excellent oral hygiene.
2. Chronic irritation from an orthodontic appliance may cause bleeding and special efforts should be made to avoid any form of gingival or mucosal irritation.

3. Arch wires should be secured with elastomeric modules rather than wire ligatures, which carry the risk of cutting the mucosal surface. Special care is required to avoid mucosal cuts when placing and removing arch wires.
4. The duration of orthodontic treatment for any patient with a bleeding disorder should be given careful consideration. The longer the duration of treatment the greater the potential for complications (van Venrooy and Proffit, 1985)⁹.

3. Children with diabetes

There are two major forms of this condition (Little *et al.*, 1997)¹⁰: Type I, insulin-dependent diabetes mellitus (IDDM) and Type II, non-insulin-dependent diabetes mellitus (NIDDM). The orthodontist should be aware of the significance of diabetes in relation to susceptibility to periodontitis. It is recognized that diabetes is a risk factor for periodontitis. Although all diabetics are not equally at risk. IDDM, which may have an abrupt onset, is caused by the destruction of 80-90 per cent of the insulin producing pancreatic islet cells. Beta cell destruction occurs in genetically susceptible subjects as a result of an autoimmune process.

Orthodontic considerations

Orthodontic treatment should be avoided in patients with poorly controlled IDDM as these individuals are particularly susceptible to periodontal breakdown. Even in well-controlled diabetics there is more gingival inflammation, probably due to the impaired neutrophil function. During treatment, the orthodontist should monitor the periodontal condition of patients with diabetes. In addition, lengthy orthodontic appointments should be arranged in the morning, following the patient's insulin injection and a normal breakfast. Prior to commencing treatment for patients with diabetes they should be counseled about their greater propensity for gingival inflammation when wearing fixed appliances and the importance of diligently following the oral hygiene instructions given.

4. Children with juvenile rheumatoid arthritis

Juvenile Rheumatoid Arthritis (JRA) is an inflammatory arthritis occurring before the age of 16 years and now embraces Still's disease (Grundy *et al.*, 1993)¹¹. JRA is considerably more severe than the adult disease and leads to gross deformity.

Damage to the temporo-mandibular joint (TMJ) has been described, including complete bony ankylosis. It has been suggested that restricted growth of the mandible resulting in a severe Class II jaw discrepancy occurs in 10-30 per cent of subjects with JRA (Walton *et al.*, 1999)¹². Classic signs of rheumatoid destruction of the TMJ include condylar flattening and a large joint space.

Orthodontic considerations

1. If the wrist joints are affected these patients can have difficulty with tooth brushing. They may require additional support from a hygienist during their orthodontic treatment and the use of an electric toothbrush should be considered.
2. Some authors have suggested that orthodontic procedures that place stress on the TMJs, such as functional appliances and heavy Class II elastics should be avoided if there is rheumatoid involvement of the TMJs (Proffit, 1991)¹³. Instead, consideration should be given to using headgear to treat children with rheumatoid arthritis who have moderate mandibular deficiency. However, others feel that functional appliances may unload the affected condyle and act as a 'joint-protector' (Kjellberg *et al.*, 1995)¹⁵.
3. It has been suggested that in cases of severe mandibular deficiency mandibular surgery should be avoided and a more conservative approach using maxillary surgery and genioplasty should be considered (van Venrooy and Proffit, 1985)⁹.

5. Children with renal failure

Chronic renal failure may be due to a variety of causative factors, which lead to a loss of kidney function. Initially, treatment may involve dietary restriction of salt, protein and potassium depending on the degree of renal failure. In children with chronic renal failure growth can be retarded and tooth eruption delayed (Jaffe *et al.*, 1990)¹⁵.

Orthodontic considerations

Patients with chronic renal failure who are not dialysis-dependent. The orthodontist should consult with the patient's physician, and orthodontic treatment should be deferred if the renal failure is advanced and dialysis is imminent. If the patient's disease is well controlled orthodontic treatment can be considered.

Children who have received their kidney transplant. Renal transplant units use combinations of immunosuppressant drugs such as Azathioprine, Prednisolone, Cyclosporin, Tacrolimus and Mycophenolate Mofetil to prevent graft rejection. These patients may also receive calcium channel antagonists such as Amlodipine or Nifedipine. Children with renal transplants often exhibit drug-induced gingival overgrowth as a consequence of their long-term medication. There is large individual variation in the extent of gingival hyperplasia seen in these patients. Orthodontic appliances, especially fixed appliances, can produce a dramatic response in the gingival tissues even when no gingival over-growth is present before orthodontic treatment.

1. Prior to commencing orthodontic treatment all renal transplant patients should be examined to assess the extent of drug induced gingival overgrowth.
2. Orthodontic treatment should not commence until the oral hygiene is very good and the use of 0.2 per cent chlorhexidine mouthwash is advisable in these patients.
3. If gingival overgrowth is present orthodontic treatment should be delayed until the excessive gingival tissue has been surgically removed and the patient can demonstrate an adequate level of plaque control.
4. As far as possible, the treatment time with fixed appliances should be kept to a minimum consistent with a high standard of occlusal result.
5. These patients should be seen on a regular basis by a hygienist during the course of their orthodontic treatment.
6. In some patients recurrence of gingival over-growth may be a problem. Surgical removal of excessive gingival tissue is sometimes necessary during orthodontic treatment. The patient and parents should be warned of this in advance.

6. Children with Asthma

Episodic narrowing of the airways that results in breathing difficulty and wheezing characterizes asthma¹⁶. Although the symptoms are reversible; the pulmonary distress generated by

asthma can be debilitating and, without doubt, adversely affects patients' quality of life. Particularly relevant to the orthodontist is the finding that pediatric asthma is common.

There are three management considerations in providing care to asthmatic patients. The first objective is the prevention of acute asthmatic attacks. Key to this is the identification of patients at risk. The medical history should specifically query for the condition. For patients with the condition information regarding the severity of the disease (limitation in activities, emergency room visits, etc.), medications, and factors that precipitate an attack is critical. Communication with the patient's physician will assist in risk assessment. Orthodontic treatment should probably be deferred in patients who report symptomatic disease or have frequent flares despite being adequately medicated. For patients at low or moderate risk, since anxiety and stress are often associated with acute attacks, morning appointments when the patient is rested, short waiting times, and visits of limited duration are most desirable. The orthodontist should assure that the patient has taken his or her medication and, if appropriate, has his or her inhaler present if needed during the appointment. Patients with asthma may be sensitive to several specific medications including the erythromycins, aspirin, antihistamines, and local anesthesia containing epinephrine.

Chronic use of inhalers, especially those containing steroids, may result in a predilection for the development of oral candidiasis and xerostomia. Orthodontists should be aware of these possibilities in the patients with asthma. If noted candidiasis can be treated with topical antifungal agents such as nystatin. Xerostomia enhances the risk of caries. Consequently, aggressive oral hygiene, supplemental topical fluorides, and vigilance for dental disease are appropriate.

Finally, it has been suggested that orthodontic-induced external root resorption occurs with greater frequency in patients with asthma than in the non asthma population¹⁷. McNab and colleagues¹⁷ compared the incidence and severity of external root resorption following fixed orthodontic therapy between patients with asthma and a healthy population. They found that while

the incidence of external apical root resorption was elevated in the asthmatic population, the severity of resorption was the same between groups. It would seem prudent, therefore, for orthodontists to disclose the heightened risk of external root resorption to patients before initiating treatment.

Conclusion

Increasingly, orthodontists are treating medically compromised patients. This phenomenon is a consequence of several factors including earlier diagnosis and better medical management of serious diseases, increased expectations for quality of life and life expectancy, greater ambulation of chronically ill patients, and increased demand for all types of dental care, regardless of underlying medical conditions. It is no longer appropriate to deny “elective” dental or medical care to patients with diagnoses that have historically been associated with poor outcomes. Rather, the expectation and, in many cases, the law dictate that all patients have access to care. Thus, orthodontic procedures, generally perceived to be among the least invasive and physiologically benign of any in dentistry, must be evaluated for potential risks for medically compromised patients, and orthodontists must be comfortable with being able to identify patients at risk and to treat them appropriately.

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REVIEW

Contrast Radiography - An Imaging Modality

Dr. Jincy Thomas

ABSTRACT

Contrast medium is a radio opaque or radioluscent substance injected or infused to the body to facilitate radiography of internal structures that other wise is difficult to visualize on plain x-ray films. Nowadays CT scan is an important area where contrast medium is widely used. The transit and accumulation of contrast medium in different organs improve the differentiation of morphological structures and pathological tissues.

KEY WORDS: Contrast, Sialography, Arthrography, Angiography

INTRODUCTION

Certain structures in our body remain invisible on plain radiography due to lack of contrast (poor density resolution). It can be visualized only through the use of contrast medium. Some structures that contain air, such as lungs and Para nasal sinus provide high contrast with adjacent bony structures. This is an example of natural contrast medium. Artificial contrast enhancement can be achieved by introducing substance with high atomic numbers to a desired organ or system.

What is Contrast Radiography?

Contrast radiographic investigations use, radio opaque substances (contrast media) that have been developed to alter artificially the density of different parts of the patient (subject contrast). Altering subject contrast ensures a difference in the X-ray beam transmitted through different parts of the patient's tissues, making certain organs, structures and tissues, invisible in conventional radiograph, visible¹.

Contrast studies include the following:¹

- Sialography – salivary glands
- Arthrography – joints
- Angiography – blood Vessels
- Lymphography – lymph nodes and vessels

- Urography – kidneys
- Barium swallow, meal and enema – gastrointestinal tract
- Computer tomography – general enhancement
- Magnetic resonance imaging – general enhancement

A good contrast medium must ²

- A) be non toxic
- B) produce adequate contrast
- C) have suitable viscosity
- D) have suitable miscibility
- E) have suitable osmolality with good concentration.

Eventhough several contrast media are available (table-1), The ideal media is yet to be discovered.

Administration of contrast media¹

The contrast medium may be introduced by one of the several methods, it may be

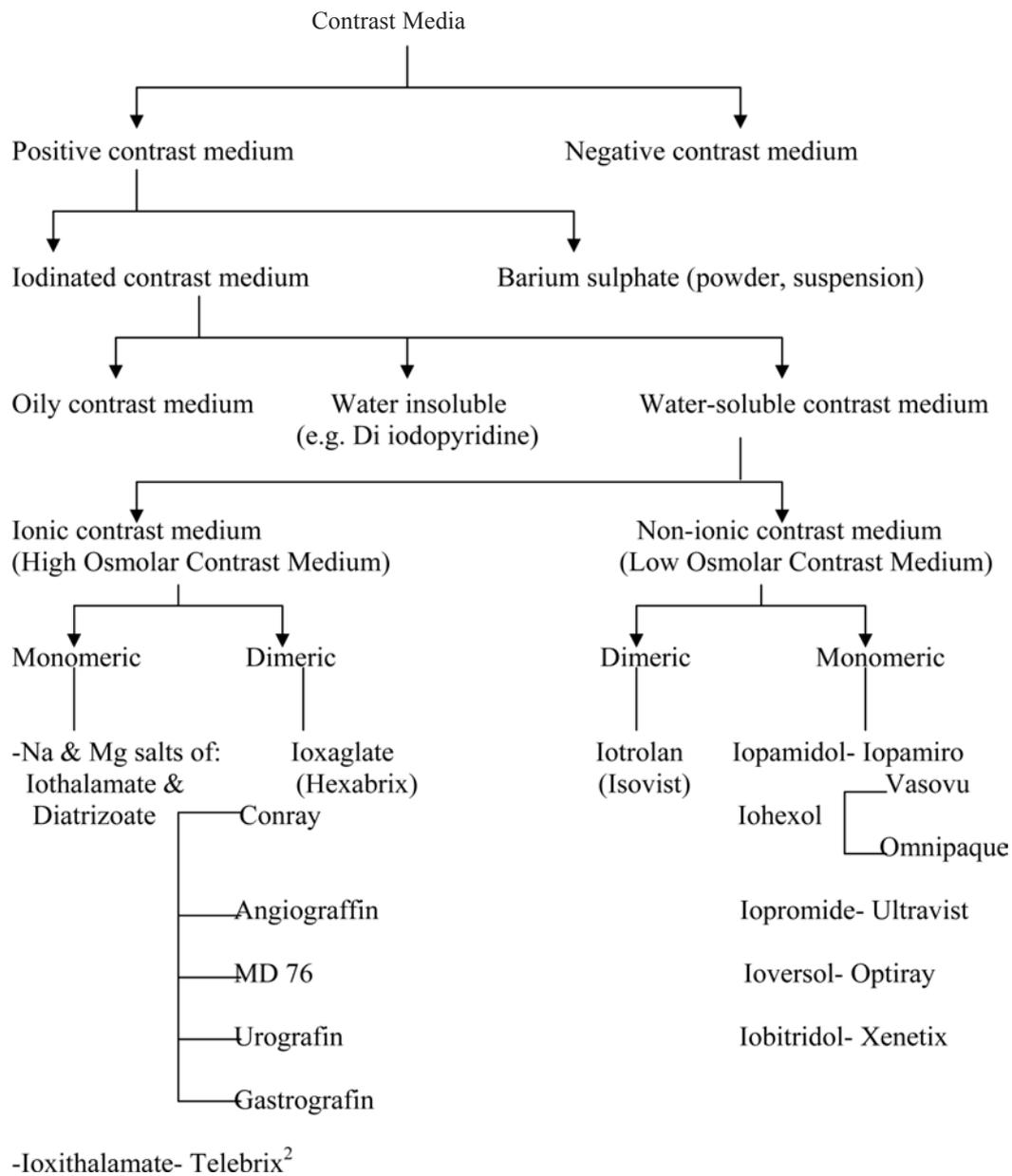
1. Injected intravascularly e.g. Angiography
2. Injected and excreted by the organ e.g. Intra venous urethrography
3. Ingested e.g. Barium meal
4. Injected directly into the site of interest e.g. Sialography
5. Injected directly into a cavity e.g. Sinusogram

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TABLE - 1 CLASSIFICATION OF CONTRAST MEDIA²



Harmful Effects of Contrast Medium

There is a small risk associated with its use, especially with the iodine based aqueous solutions (general contrast medium) when they are introduced into the blood stream. Considering that a single dose of contrast medium contains more than 2000 times as much iodine as the body's total physiological content, adverse or residual effects are remarkably rare. Ionic contrast media have been used routinely for intravenous and intra-arterial studies for over 30 years have proven to be safe and effective. The overall incidence of adverse reactions is 5-8% with a vast majority being of minor nature such as nausea, vomiting & flushing

sensation (Table-2). Uncommonly i.e., 1 in 500 to 1 in 1000, a patient develops a more serious reaction that proves life threatening.

More recently, newer contrast agents have been developed termed as lower osmolar contrast medium or non-ionic contrast medium; cause fewer adverse systemic reactions and fewer severe and potentially life-threatening reactions. The reaction rate with these newer nonionic agents is about one-fifth that of conventional standard ionic contrasts agents. But lower osmolar contrast medium cost 3-12 times more than high osmolar contrast medium.

Current criteria for use of lower osmolality contrast agents:

1. Previous reaction to contrast (except flushing, heat, nausea, vomiting)
2. History of asthma
3. History of allergy
4. Known cardiac dysfunction (including cardiac decompensation, severe arrhythmias, unstable angina, recent myocardial infarction, pulmonary hypertension)
5. Severe generalized debilitation
6. Certain medical conditions (sickle cell disease; risk of aspiration)
7. Patients manifestly anxious about contrast procedure
8. Communication problem precluding identification of above risk factors.

(Adapted from the report of the committee on drugs and contrast media of the commission on education of the American College of Radiology, October 1990)

Premedication reduces but does not totally eliminate anaphylactoid-type reactions; non-ionic contrast plus premedication reduces further the frequency of repeat reactions.³

The main complications associated with contrast media can be divided into:

Mild:- headache, nausea, warmth and/or pain, flushing, sneezing and constipation (GI investigations)

Moderate :- vomiting, bronchospasm, urticaria and hypotension

Severe:- cardiac arrhythmias, cardiac arrest, convulsions, anaphylactic shock and pulmonary edema

Fatal

Complications are mainly due to:

- i) Allergy
- ii) Chemo toxicity
- iii) Osmolality (osmotic pressure of the solution)- with ionic monomer contrast media, the osmolality is 3 times greater than that of other agents; the risk of complications arising when using these substances is therefore also greater
- iv) Anxiety¹

Table-2, Reactions to Contrast Media⁵

Effect	Symptoms	Primary treatment
1. Vasomotor effect	Warmth Nausea/ vomiting	Reassurance
2. Cutaneous	Scatteredhives Severeurticaria	H1-antihistamines H2- antihistamines
3. Bronchospastic	Wheezing	Oxygen Beta-2- agonist inhalers
4. Anaphylactoid reaction	Angioedema Urticaria Bronchospasm Hypotension	Oxygen I.V fluids Adrenergics (iv epinephrine) Inhaled beta 2 adrenergics Antihistamines (H1 &H2 blockers) Corticosteriods
5.Hypotensive	Hypotension	IV fluids
6. Vagal reaction	Hypotension Bradycardia	IV fluids IV atropine ⁵

Prophylactic measures to minimize complications

- i. Use of low osmolality contrast agents
- ii. Skin pre-testing
- iii. Prophylactic steroids
- iv. Prophylactic antihistamines
- v. Reassurance to reduce levels of anxiety
- vi. Ask specially about previous history of iodine allergy.

Contrast studies used in the head and neck

These include

1. Sialography
2. Arthrography
3. Computed tomography
4. Angiography¹
5. Magnetic resonance contrast studies

1. SIALOGRAPHY

Radiological investigation of salivary glands and ducts using water-soluble contrast medium is called sialography. Parotid and submandibular glands are usually examined to find the cause of obstruction or calculi. Sialography was first described by Arcelin in 1913. Oil based

contrast media such as lipiodol UF are commonly used. However lipiodol UF drops sometimes remain in salivary gland and in the adjacent tissues for a long time and may cause irritation.⁶

Indications: Pain, recurrent swelling, suspected calculi.

Contraindications: Acute infection or inflammation

Preliminary films : Preliminary films are necessary to demonstrate any calculus or for comparative study. Head should be immobilized. The views are different according to the gland and duct being examined.

a) Preliminary films for parotid gland

- i) Anteroposterior view: centered at the level of lower lip.
- ii) Lateral view: centered to the angle of mandible.
- iii) Lateral oblique: centered to the angle of mandible.

b) Preliminary films for Submandibular gland

- i) Infero superior, using an occlusal film: patient sits with chin raised and head tilted backwards.
- ii) Lateral: with floor of mouth depressed by a wooden spatula.
- iii) Lateral oblique: floor of mouth depressed by a wooden spatula with tube angled 20 degree cephalad, but centered at 1 cm anterior to the mandible.

Procedure

1. A lemon juice accelerates the saliva production. When the orifice of the stenson's duct or wharton's duct has been located, it is dilated with silver wire probe.
2. Cannula or polythene is inserted into the duct. The catheter can be held in place by the patient gently biting on it.
3. About 2 ml of dense low osmolar contrast medium (e.g. Iopamiro 370, Iohexol 370) is injected and is terminated immediately if any pain is experienced. Overfilling must be

avoided, so that branches of the ducts within the glands are not obscured.

4. If cannula is used, the exposure is made immediately after the injection. Catheter method has an advantage that films can be taken during the injection.

Films/Images

Immediate: same views are repeated as for preliminary films

Post Secretary: A piece lemon is given and after 5 minutes the views are repeated. This is to demonstrate Sialectasis.

Complications of Sialography:

Pain, damage and rupture to the duct and orifices, infection.^{2,7,8,9,10}

2. ARTHROGRAPHY

It is a safe technique for evaluation of intra-articular abnormalities of both native and replaced joints. Arthrography is useful in selecting those patients with severe dysfunction of the temporomandibular joint (TMJ) who would benefit from surgery. Plain films are usually unrewarding in the diagnosis of soft tissue abnormalities of the joint.¹¹

Indications

Evaluating both intra-articular and juxta-articular abnormalities, including ligamentous and tendinous tears, cartilage injuries, proliferative synovitis, masses and loose bodies and implant loosening.

Complications

- (a) Allergic reaction to the contrast
- (b) Infection
- (c) Sterile synovitis
- (d) Vasovagal reaction
- (e) Post Arthrography pain.

Temporomandibular joint Arthrography Procedure

1. A 23 gauge needle is directed vertically into the mandibular condyle. The patient is instructed to open his or her mouth partially. The examiner then gently "walks" the needle tip over the posterior margin of mandibular condyle and advances 5mm into the joint space.

2. Approximately 1-1.5ml of a mixture of contrast, xylocaine and epinephrine are injected.
3. Extravasted contrast may roughly conform to the condylar contours posteriorly but will not flow anterior to the condyle.

Films obtained are;

- i) Fluoroscopic spot films in the open and closed mouth positions
- ii) Lateral polytomography in open and close mouth positions.⁴

When evaluated the usefulness of magnetic resonance arthrography (MRAr) in imaging the pathologic temporomandibular joint, it was found that disc, the posterior attachment and the presence of perforations and adhesions were evaluated in each image. All of these anatomic and pathologic structures were clearly detected.¹²

3. CONTRAST ENHANCED COMPUTER TOMOGRAPHY

Contrast enhancement is of help in discriminating vessels from neoplastic masses, maximizes anatomic and lesion detectability. Since normal and abnormal tissue handle intravascular contrast material differently, the attenuation value difference usually increase after contrast administration.

Advantage

- (a) Routine administration of contrast material is a decrease in the time required to perform a study
- (b) Normal and anomalous vascular structures are immediately identified and a thorough search for disease has been accomplished.

Disadvantages

- (a) Routine use of contrast material includes those patients with a disease process that can be diagnosed without intravenous contrast material. They will be unnecessarily subjected to i.v. contrast material with all its attendant risk.

Phases of contrast enhancement

- (a) Vascular enlargement- shows vascular anatomy and pathology and distinguishes vessels from mass or normal structures.

- (b) General tissue enhancement- enhancement of parenchymal tissue. Helps to differentiate between solid tumors, cysts, necrotic areas and abscess.

(i) Cysts, necrotic area and abscess seen as hypo dense

(ii) Walls of cysts and abscess with rim enhancement.

- (c) Opacification of urinary tract-to identify lesions in urinary tract and bladder.

CT Myelography

Here injection of water soluble intrathecal contrast medium is used to define abnormalities of spinal cord and in patients with neuroblastoma.

Contradictions of intravenous contrast

- (a) Major reaction to contrast medium
- (b) Renal failure (creatinine over 3mg) unless predialysis
- (c) Pheochromocytoma/myasthenia gravis
- (d) Hypokalemia/hyperkalemia

Commonly used contrast media

- | | | |
|--------------|---|---------------|
| A) Ionic | - | renografin-60 |
| | - | conray-60 |
| | - | hyphaque-60 |
| B) Non-ionic | - | iopamidol-300 |
| | - | ioversol-320 |

4. CONTRAST ENHANCED MAGNETIC RESONANCE CONTRAST IMAGING

Determinants of signal and contrast in MRI include spin density, flow (diffusion and perfusion), susceptibility and relaxivity (T1 & T2).

Contrast agents used are

- gadopentelate dimeglumine (Gd-DPTA)
- gadoteridol (Gd-HP-DO3A)
- GD-DOTA

Indications in head and neck

- (a) Contrast administration has been found to improve lesion visibility, particularly with "tumors of the nasal cavity and paranasal sinuses and tumors having perineural or intracranial extension".

- (b) Use of fat suppression imaging techniques, should impact favorably on contrast use in the head and neck, permitting better discrimination of enhancement.³

5. ANGIOGRAPHY

The radiological investigation of blood vessels of the body is called Angiography. Catheters are long tube like structures introduced percutaneously into the body blood vessel to perform angiography and other procedures.

Indications in the head and neck

- (a) To show the vascular anatomy and feeder vessels associated with haemangiomas.
- (b) To show the vascular anatomy of arteriovenous malformations
- (c) Investigation of suspected subarachoid haemorrhage resulting from an aneurysm in the Circle of Willis.
- (d) Investigation of transient ischaemic attacks possibly caused by emboli from atheromatous plaques in the carotid arteries.¹

6. LYMPHOGRAPHY

The radiological investigation of lymph nodes and vessels of the body is called Lymphography. It is useful in detecting tumor metastasis and lymphnode diseases.

Factors affecting lymphangiography in tumor metastasis

- a) facilitation of metastasis from the marked alteration in lymphnode architecture.
- b) increase in blood-borne metastasis through lymphovenous shunts during or following the procedure and
- c) facilitation of metastasis within the lymphatic system from the increased intralymphatic pressure during the procedure.¹³

Conclusion

The structures invisible in plain radiography can be made visible by use of artificial contrast enhancement media, otherwise known as contrast media. Eventhough the contrast medium molecules currently in clinical use are safe, these

compounds are used in relatively massive doses that may produce toxicity. Eventhough several contrast media are available the ideal one is yet to be discovered.

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APOLOGY

The editorial board of Trivandrum dental journal appologize for the inadvertent use of the word "XEROX" instead of photostat in the section titled "Instructions to the Authors" in page - 2, of Vol. 1, Issue 1 of Trivandrum Dental Journal 2010. M/s. XEROX had communicated their displeasure vide their letter dated August 20, 2010.

The Editorial board wishes to inform M/s. XEROX that the error has been corrected in the present issue of the journal. The editorial board hereby issue an undertaking that Trivandrum Dental Journal shall not misuse the trade mark "XEROX".

For the Editorial Board

Dr. (Capt) Vivek .V
Editor in Chief
Trivandrum Dental Journal

REVIEW

Melancholia and Cancer

V. Nityasri¹, Anita Balan²

ABSTRACT:

The equilibrium of an organism with the environment is interplay of homeostasis in molecular, physiological, and behavioural levels. Psychosocial factors (e.g, stress and sleep quality) are associated with abnormal stress-hormone production among individuals with cancer. Depression and cancer commonly co-occur. Depression also affects components of immune function that may affect cancer surveillance. Immune system acts as a “sixth sense” that gives the brain valuable information about a person’s health and mental status. This article discusses the bidirectional relationship of stress and depression with cancer.

KEYWORDS:

Depression, Stress, Psychoneuroimmunology, Cancer.

Traditional medicine followed the principle of autonomy of the immune system until Hippocrates, the father of Medicine, proposed that the mind and the body should be considered as a whole. Dr.Walter Cannon was the first to study the relationship between the effects of emotion on the autonomic nervous system, giving birth to the term “homeostasis”.¹ Recent research showed that the nervous system controls the defence mechanism of the body, and that a chemical link exists between our emotions, and the regulatory systems of the endocrine and immune systems through the central nervous system.² Studies have shown that it is possible to classically condition the immune system.^{1,2} This molecular communication between the mind and the body has seen the development of a new field “Psychoneuroimmunology”(PNI).

Reber has defined PNI as “An interdisciplinary science that studies the interrelationships between the psychological, behavioural, neuro-endocrinal processes and immunology”.³ PNI is based primarily upon the neuro sciences of the central nervous system, the neuro endocrine system, the immune system and their inter-relationships.

Stress and the immune system

Every thought, emotion, idea or belief has a neurochemical consequence. Theorists propose that stressful events trigger cognitive and affective responses which, in turn, induce sympathetic nervous system and endocrine changes, which via the Hypothalamo Pituitary Adrenal (HPA) axis cause release of cortisol. This cortisol may restore the homeostasis but may ultimately impair immune function.^{5,6}

The neuroendocrine and immune systems share common signal mediators and receptors, suggesting that the brain has an immunoregulatory role and the immune system a sensory function.^{2,6} The cytokines interleukin (IL)1, tumour necrosis factor (TNF) \pm , interferon(IF) α , and IF β secreted from activated immune cells can change the

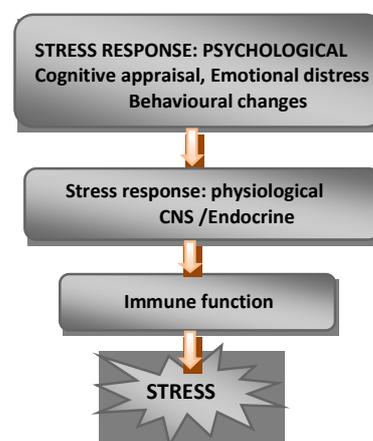


Fig: Hypothesized pathway showing how stress affects immune function and ultimately disease process.

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function of the HPA axis. Cytokines epitomize a faulty immune system. Stress increases hormones, which slow the delivery of cytokines to the site of injury or infection. Interactions between emotions and immune functions might underlie the increased clinical susceptibility to infectious diseases including cancer.

Depression as a risk factor for neoplasia

A growing body of research linking psychological and behavioral factors to the incidence and progression of cancer suggests that psychosocial factors may have an impact on some types of cancer.⁷ Stress can dysregulate Natural Killer (NK) cell function, including depressing the stimulatory response of NK cells to cytokines. This alters potentially important immune defenses to malignant diseases.⁸

Stress may also have a direct effect on the initiation and/ or production of abnormal cells independent of the immune system. In stressed individuals, the levels of methyl transferase, an important DNA repair enzyme induced in response to carcinogen damage, has been found to be significantly lower. Emotionally challenged individuals also demonstrate impaired apoptosis which lead to maladaptive consequences.^{9, 10} Psychosocial stressors could ultimately lead to progressive accumulation of errors within cell genomes as well as reducing tumor specific and innate immune responses.

Chronic stress coupled with loss of normal daily activities and interactions can cause the brain to signal the body cells to develop more rapidly than normal in order to fill that void of activity. This results in decreased lymphocyte responsiveness to chemical changes and thus cell disease begins. This theory of cell disease is called **Surveillance Theory of Cancer**.¹¹ This theory holds that:

“Cancer cells are constantly developing in the body, but that the immune system’s ability to recognize them as abnormal and destroy them is what prevents them from becoming malignant tumours. When the number of cancer cells becomes too large to be destroyed or when the lymphocytes become suppressed is when carcinogenesis occurs.”

Psychoneuroimmunology and Cancer progression

A cancer diagnosis and cancer treatments are objective, negative events. Evidence suggests that there are health behavior sequelae for individuals experiencing psychological stress from cancer. Among persons with a cancer diagnosis, depression occurs at a high rate that is approximately three to five times greater than the general population.¹²

Cancers induced by chemical carcinogens may be less affected by psychological, behavioural, and immunological factors than are those associated with a DNA tumour virus, or other viruses such as Epstein Barr virus (EBV), which are immunogenic. Thus, suppression of cellular immunity is associated with a higher incidence of some types of tumours, particularly EBV-associated lymphoproliferative diseases in organ-transplanted patients, and Kaposi’s sarcoma.⁸

A causal model in which the relation between stress, depression, and carcinoma is clarified is proposed. Most organ related carcinomas are associated with high concentrations of TNF- α , which in turn results in diminished expression of the class-I MHC antigen on the cell surface, thus permitting malignant cells to escape immune surveillance. Therefore, stress and depression can foster tumour progression by inhibition of the expression of class-I and class-II MHC molecules and by reducing NK activity.¹³

Stress hormone norepinephrine (NE) has seen to increase the production of proteins in cultures of nasopharyngeal carcinoma tumour cells that can foster the aggressive spread of the disease, a process known as metastasis.¹⁴ The NE is also instrumental to produce a compound known as VEGF — vascular endothelial growth factor — that is key to the formation of new blood vessels, which the tumour must have to grow. Thus, stress promotes progression of neoplasia. Matrix metalloproteinases — MMP-2 and MMP-9 — produced in response to excess NE play a role in breaking down the scaffolding that cells attach to in order to maintain their shape. This leads to uncontrolled cellular proliferation.¹⁵

Personality and correlation to risk of cancer

Yet another theory of cancer development and stress involves something called the Type C personality coined by Temoshok.¹⁶ The Type C personality characteristics consist of: a) The suppression of strong emotions b) Compliance with the wishes of others and a lack of assertiveness c) Avoidance of conflict or behavior that might offend others d) A calm, outwardly rational and unemotional approach to life e) Obeying conventional norms or behavior and maintaining the appearance of niceness f) Stoicism and self-sacrifice g) A tendency towards feelings of helplessness or hopelessness. It was suggested that people with Type C personality traits were more predisposed to develop cancer.

Effects of psychological intervention for cancer patients

Depression and stress remain underdiagnosed in cancer patients. Psychosocial interventions in patients with cancer are reported to increase measures of NK cell activity along with decreases in depressive symptoms. It has also increased the number and percentage of activated T cells, lowered the circulating level of TNF- α . Even in patients receiving immunosuppressive treatments (chemotherapy, surgery, radiotherapy), relaxation and imagery has been found to produce immunological changes that may have clinical relevance.¹⁷ Cancer patients with a fighting spirit were most likely to be long-term survivors, and have no relapses. Short-term survivors were more likely to show a “stoic, stiff upper lip attitude,” and to continue their lives either as if nothing were different, or with a sense of helplessness or hopelessness.

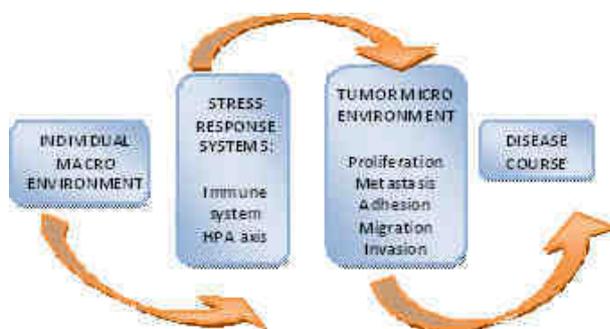


Fig: The impact of individual's emotional status on tumour growth and progression

Psychoneuroimmunology (PNI) has laid the groundwork for many complementary health care approaches; all of the modalities which utilise the science of PNI are non-invasive and return an element of control to the patient for their own health and welfare, in a world where the individual often feels a loss of that very control over their own lives. PNI has contributed to a huge paradigm shift for the present way in which the medical community functions. In conclusion it can be said that, good health depends on good communication—good communication within the internal environment of any constituency, and good communication between the component and the external environment.

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REVIEW

New technologies for clinical diagnosis of caries

Vijay Mathai

ABSTRACT

Research indicates that, while 80% of caries lesions occur in the occlusal anatomy, a significant percentage of these lesions go virtually undetected using conventional protocols such as manual probing, radiographs etc. Fortunately with the advent of new technologies such as Laser-induced fluorescence, DIFOTI, QLF, Electrical conductance as well as the use of traditional protocols, dental clinicians can now successfully detect the presence of occlusal decay and properly treat the tooth structure as necessary.

KEYWORDS:

Caries, Diagnosis, New Technologies,

Introduction

Manual probing and radiographic evaluation are often ineffective in detecting enamel defects, as they may be too small or inaccessible to the diagnostic tool. Additionally, manual probing has the potential of stimulating caries due to the iatrogenic damage caused by the explorer. Radiographs (eg. bite wing X- rays), although effective in revealing advanced stages of decay, are unsuccessful in detecting early caries, especially in the complex anatomy of fissure areas¹. Several new technologies have emerged, however that show promising results for the clinical diagnosis of caries. The technologies approved by the FDA include Laser- induced fluorescence, Digital imaging fiber optic transillumination (DIFOTI), Quantitative light- induced fluorescence (QLF) and Electrical conductance.

Laser-induced fluorescence for caries detection

The DIAGNOdent (fig.1) measures laser fluorescence within tooth structure. The DIAGNOdent is a laser-probe handpiece that uses



Fig .1. The Diagnodent (Courtesy: <http://www.kavousa.com>)

1-milliwatt, 655-nanometer wavelength red light for the detection of caries. The device, which is intended as an adjunct to the clinical and radiographic detection of caries, works by shining pulsed light of a known wavelength onto the tooth surface via specifically designed tips. After a baseline measurement of the patient's healthy tooth structure is made, the tip is placed on questionable areas of the tooth and slowly rotated or rocked with a pendulum- like motion. The unit's internal processor interprets changes in the level of fluorescence of the light emitted back by the tooth as indicative of caries. A numerical reading is displayed on the front of the DIAGNOdent and an audible signal is sounded. Kavo America claims that the device works through non- cavitated tooth structure and can be used, over time, to monitor

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changes in the degree of decalcification of a suspect area².

How it works

1. The DIAGNOdent device measures laser fluorescence within the tooth structure.
2. As the incident laser light is propagated into the site, two-way hand piece optics allows the unit to simultaneously quantify the reflected laser light energy.
3. At the specific wavelength that the device operates (655nm) clean healthy tooth structure exhibits little or no fluorescence, resulting in very low scale readings on the display.
4. Carious tooth structure exhibits fluorescence, proportionate to the degree of caries, resulting in elevated scale readings on the display. Numeric values correlate to extent of decay¹.

0-10 : Healthy tooth structure

11-20: Outer Half Enamel Caries

21-30: Inner Half Enamel Caries

30 +: Dentin Caries¹.

Benefits

With DIAGNOdent patient benefits are



Fig.2.DIFOTI (Courtesy:<http://www.dimensionsofdentalhygiene.com>)

- a) Early caries detection; Over 90% accurate in detecting lesions not detectable with X-rays or explorer.
- b) Promotes minimally invasive treatment
- c) Provides Objective data to increase confidence in treatment decision
- d) Interactively engages patient in examination process
- e) Safe, no X- ray exposure
- f) Painless¹.

Disadvantages

- a) Can't be used for recurrent caries.
- b) Difficult to distinguish between hypomineralized and carious tissues.
- c) Gives false reading in presence of plaque and debris
- d) Readings do not relate to the amount of dentinal decay³.

DIFOTI in assessment of caries

Digital Imaging Fiber-Optic transillumination (DIFOTI), (fig.2), is another new method for the reliable detection of dental caries . Images of teeth obtained through visible light fiber-Optic transillumination (FOTI) are acquired with a digital charged coupling device (CCD) camera, and sent to a computer for analysis with dedicated algorithms. The algorithms were developed to facilitate the location and diagnosis of carious lesions by the operator in real time, and provide quantitative characterization for monitoring of the lesions⁴. There is superior sensitivity of DIFOTI for detection of proximal, occlusal and smooth surface caries.

Illuminating teeth to determine the presence of demineralization or caries is a novel method of detecting and monitoring dental caries that may improve the accuracy of caries detection. The principle behind transilluminating teeth is that demineralized areas of enamel or dentin scatter light (in this case a high-intensity white light) more than do sound areas. The advantages of DIFOTI over radiography include the absence of ionizing radiation, the lack of a need for film, real-time diagnosis and higher sensitivity in detection of early lesions not apparent in conventional radiography. In the DIFOTI image, carious lesions are apparent as a black area within the tooth because of the difference in light refraction between healthy and demineralized tissues⁶. DIFOTI received FDA approval in 1999. This promising technology has potential to allow a dentist to evaluate demineralization on all tooth surface as well as inspect for tooth fractures and defective restorations⁵.

Disadvantages:-

- a) Difficult to distinguish between deep fissure, stain and dental caries
- b) Does not measure the depth of the lesion

QLF for caries detection

Quantitative laser fluorescence (QLF) uses blue light with wavelengths around 488 to 514 nm to excite yellow fluorescence at wavelengths above 520 nm. Its diagnostic capacity is based on the mechanism that the intensity of natural fluorescence of a tooth is decreased by scattering due to a caries lesion⁷. A commercially available system combines a portable arc- lamp unit with fluorescence dye, camera, and appropriate software for the detection of incipient to dentinal lesions. The method is suitable for quantitative assessment of early enamel lesion in visually accessible surfaces.

Several mechanisms may contribute to the cause of decreased fluorescence of incipient lesions.

- 1) Light is scattered and thus the absorption per unit volume is small.
- 2) Light is scattered in the lesion and it prevents the light from reaching the fluorescing dentin.
- 3) Proteinic chromophores are removed by the caries process⁷.

The operator adjusts the camera to view the region of interest on a monitor screen and the light guide is attached to the camera requiring no separate adjustment. The camera amplifier is automatically adjusted and an image can be grabbed and stored by pressing a foot pedal. There is on- screen guidance for the operator to perform image analysis.

QLF could provide information to the patient about the status of incipient lesion and might serve as a tool to give quantitative feedback and thereby increase the motivation of the patient. It further could allow short term clinical studies for evaluating caries preventive measures.

Disadvantages

- a) Detects enamel demineralization but cannot differentiate between decay and hypoplasia.
- b) Cannot detect interproximal lesions.
- c) Subject to operator bias as analysis is done on a stored tooth image³.

Electrical conductance in caries diagnosis

As a tooth demineralizes in the caries process, the loss of mineral leads to increased porosity in the tooth structure. This porosity is

filled with fluid from the oral environment which contains many ions. Increased ionic content in the pores lead to increased electrical conductivity, or, conversely, increased porosity leads to decreased electrical resistance or impedance⁹.

Electrical conductance measurements make use of the increased conductivity of carious enamel in pits and fissures. The entire occlusal surface is first covered with a conducting medium. When current is applied by placing an electrode on tooth surface, the electrical conductance is measured between this electrode and contra electrode. Several factors can influence the electrical conduction measurement readings, such as dehydration state, tooth maturation stage and the presence of stains. The electronic caries monitor can be used as a device for measuring electrical conductance. Another instrument called 'Van Guard electronic caries detector can also be used to measure electrical conductance. Here the electrical conductivity is expressed numerically on a scale from 0-9, indicating a change from sound tooth to an increased degree of demineralization³. Generally high sensitivity and specificity have been reported for electrical conductance techniques.

Advantages

- a) Detects early pit and fissure caries
- b) Can monitor progress of caries³.

Disadvantages

- a) Presence of enamel cracks gives false positive results.
- b) Separate measurements for different sites makes full mouth examination time consuming.
- c) Recognises only demineralization and not caries specifically³.

Conclusion

The development of reliable, accurate quantitative methods to diagnose and monitor early carious lesions is critical. Electrical Conductance and Light Fluorescence demonstrate significant improvements over established diagnostic methods, especially for invitro applications and particularly with regard to sensitivity and reproducibility. Because of their quantitative nature and high reproducibility, these two methods can be used to monitor the progression of a suspected carious lesion and for patient education and

motivation. However, one-time measurements made with electrical Conductance and Light Fluorescence cannot discriminate between active and inactive lesions, which is also the case with other diagnostic methods. The DIAGNOdent device, a commercial variant of Light Fluorescent technology, is non invasive and simple to use and provides quantitative measurements. However, more scientific scrutiny is required before it can be recommended for the definitive diagnosis of occlusal decay requiring operative intervention. Incorrect diagnosis results in incorrect treatment decisions. The potential risk of unnecessary restorations is greater than the risk of missing early decay. The potential risk of missing early decay is also lower in patients who return regularly for recall dental examinations. In all treatment decisions, clinicians must be aware of the limitations of the diagnostic methods that have been used. Knowledgeable clinical judgment based on the patient's case history, visual cues, review of radiographs and probability of disease is a necessity for the provision of optimum care. New technologies may provide supplemental information, but they cannot yet replace established methods for the diagnosis of occlusal caries⁸.

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REVIEW

Esthetics in Oral Implantology

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ABSTRACT

A Satisfactory esthetic outcome in implant restoration requires a clinician to be aware of multiple factors affecting esthetics. This article reviews the different factors that affect esthetics during presurgical planning, surgical, and prosthetic phase of implant placement.

KEYWORDS

Esthetics, Oral implantology

Achieving esthetics with implant restoration in the scenario of increasing patient demand for exact replica of natural dentition is a challenge for the implant treatment team due to the multiple factors that affect esthetics. The factors that have to be considered in each stage of implant restoration to achieve esthetics are detailed in this article.

Presurgical Planning : The presurgical planning for an implant restoration in the anterior region should be done with a final view of esthetic outcome of the restoration. An evaluation of soft tissue and hard tissue in the implant site, size and number of implant to be selected, type of surgical intervention, implant position, provisionalisation, and prosthetic phase of treatment should be considered to achieve a predictable esthetic result.

Soft issue Evaluation : The amount of keratinised tissue in the implant site must be assessed. A wide band of keratinised tissue around implant is preferable to ensure tissue stability and esthetics.¹ Lack of tissue stability around implant may result

in movement of tissue during functional movements leading to plaque accumulation and chronic inflammation. If soft tissue grafting is required it may be carried out before implant placement or at second stage surgery. Biotype. The patient's biotype has an influence on the esthetics of implant restoration. It is easier to achieve desirable esthetic result with thick biotype than with thin biotype. The thick biotype, characterised by thick band of keratinised tissue and less scalloping between interdental papilla responds to periodontal insult by pocket formation, whereas thin biotype characterised by minimal keratinised gingiva and pronounced soft tissue scalloping responds to an insult by recession.²

Hard tissue evaluation : The available bone in the implant site has to be assessed by bone mapping, radiographs or CT scan. Lack of adequate bone in the implant site may result in recession of gingiva, and poor implant positioning. In esthetic areas it is important to examine the interproximal bone height and thickness of facial bone. A study conducted by Tarnow et al³ revealed that when the measurement from the contact point of natural tooth to the crest of the bone was d" 5mm (Fig 1), the papilla was present almost 100% of the time, When the distance was 6mm the papilla was present 56% of the time, and when it was e" 7mm the papilla was present only 27%of the or less. If the presurgical analysis reveals that the contact to

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alveolar bone distance is greater than 5mm then vertical bone augmentation may be attempted using orthodontic extrusion, guided bone regeneration block grafting, or distraction osteogenesis. The use of Titanium papillary insert can help to reestablish interdental papilla in those cases when it is placed simultaneously with dental implant.⁴ The height and thickness of buccal bone is critical to prevent recession and exposure of implant. Spray et al examined buccal bone thickness during implant placement and found out that 1.8mm of buccal bone thickness was the critical thickness required to prevent bone loss in that area.⁵ Bone augmentation should be done if buccal bone thickness is less than 1.8mm. In partially edentulous cases if the mesiodistal width is excessive or insufficient, orthodontics could be used to create adequate space.

Implant selection : The size of the implant affects the esthetics of the restoration. Placing a wide diameter implant may result in an implant that is positioned too far facially and too close to the adjacent teeth, leading to gingival recession and loss of interdental papilla. The implant must be placed at least 1.5mm from adjacent teeth and 3mm from adjacent implants to prevent bone loss and loss of papilla⁶(Fig 1). The implant diameter should be selected based on natural tooth diameter at the level of bone to achieve an ideal emergence profile.

Number of implants : When multiple teeth have to be replaced, reducing the number of implants after analyzing the stress distribution and placing pontics between the implants improves the esthetic outcome.

Type of surgical intervention : The esthetics of the prosthesis is dependent upon whether the implant is placed immediately or delayed, or by flap or flapless method. The immediate placement of implant into extraction sockets offers several advantages including shorter treatment time, preserve the contour and dimension of alveolar ridge, fewer surgical session and easier implant positioning.⁷ In immediate implant placement bone graft is essential if the jumping distance (the space between implant and bony socket wall) is 1.25mm or greater to prevent bone loss and concomitant gingival recession. Implant placed using the delayed protocol were 7 times more at risk for having no

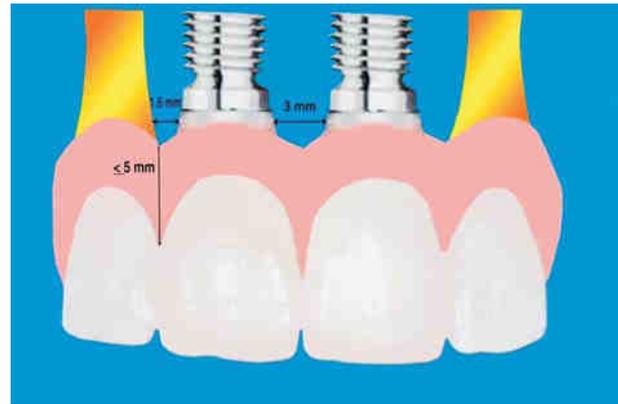


Fig 1

papilla⁸ affecting esthetics. The flapless surgical approach like “tissue punch”⁸ may provide a more esthetic result compared to flap method. If a flap design is needed minimal flap reflection and papilla sparing incisions should be considered to achieve good soft tissue architecture.

Implant positioning : Implant positioning directly influences the soft tissue profile and thereby esthetics of the final prosthesis. The more precise the implant placement, the easier it is to avoid soft tissue discrepancies and subsequent corrective surgeries. The use of surgical guide is essential to ensure their accurate placement in all the 3 dimensions (labiopalatally, Mesiodistally, Apicocoronally). Errors in any of these 3 dimensions can result in an unesthetic outcome.

Labiopalatal position : The more labially positioned implant will totally jeopardize the esthetics by having an overcontoured crown that is impossible to correct prosthetically. Moreover it will result in bone loss and gingival recession. Conversely an implant positioned too palatally requires a modified ridge lap design for the crown, which hinders the hygiene and affects the esthetic outcome. If implant has to be placed palatally dictated by the available bone, then the implant should be placed 1mm apically for every mm that is placed palatally to improve esthetics.⁹

Mesiodistal position : The implant must be placed at least 1.5mm from adjacent teeth and 3mm from adjacent implants to maintain interproximal bone and papilla (Fig 1).

Apicocoronal position : The apicocoronal position of implant depends on the bone morphology, and the size discrepancy between the tooth that is to be replaced and the diameter of the implant to be used. If a narrow diameter implant

has to be selected, then the implant must be positioned more apically to allow for the transition from the circular crosscut of the implant interface into that of natural tooth that is to be replaced.¹⁰ If there is no gingival recession, then the ideal position of implant shoulder should be approximately 2mm below the adjacent tooth cemento-enamel junction¹¹, and 3mm from free gingival margin for proper emergence profile and better esthetics.

Provisionalization : In the esthetic region, provisional restorations have important roles in soft tissue modelling. An ovate pontic will enhance the papilla formation and create an emergence profile that replicates the natural tooth appearance. If provisional restorations are not used, an alternative to maintaining the soft tissue is to use an anatomic or wide and tapered healing abutment.

Prosthetic phase : Abutment Selection. The selection of abutment is based on various requirements: visibility, accessibility, tissue architecture, angulation of the implant, interarch distance, tissue height and tissue thickness. The available abutments include cement retained, screw retained, custom made, and tooth coloured abutments. Cement retained abutments are superior in occlusion, esthetics, passivity when compared with screw retained.¹² Custom abutments have contours and finish lines that can be altered to match the tissue dimensions. Porcelain abutments may be useful in areas when metal show through is a potential concern such as in patients with thin biotype or when all ceramic crowns are used.

Conclusion :

The creation of an esthetically pleasing implant restoration requires proper diagnosis, treatment planning, precise execution of implant surgery, and appropriate selection of final restoration. Understanding the delicate relationship between hard and soft tissue morphology, implant position, emergence profile, and technical expertise can lead to an implant restoration that looks like the tooth it replaced – the ultimate achievement in dentistry today.

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A BRIEF REVIEW

Aloe Vera - A Soothing Therapy in Modern Dentistry

Niveditha Baiju¹, Srilakshmi²

ABSTRACT

Aloevera is the most impressive medicinal herb invented by nature. It is associated with wide variety of medicinal uses. In reality, aloevera is useful for both external and internal use. There is a voluminous amount of anecdotal evidence showing that authentic, properly prepared Aloe has a powerful healing property in humans and animals. This article summarizes the significance of Aloevera in oral conditions by correlating its composition with the mechanism of action and its various forms of preparation.

KEY WORDS

AloeVera, Healing property

Introduction¹

'A Miracle Plant, 'Healing Plant', 'Plant of Immortality', 'Fountain of Youth', 'Wand of Heaven', Dessert Lily' (Arab), 'ghrit- kumari' or Gheekvar' (Sanskrit) and 'Katraazhai' (Tamil) are the real names by which aloevera is honoured in the world of medicine and it rightly deserves these names by virtue of its wide variety of uses and properties that aids human kind. The word aloe derived from an Arabic word means 'Shining bitter substance'. Vera is a latin word for 'true'.

Taxonomy¹

Kingdom	;	Plantae
Order	;	Asparagales
Family	;	Asphodelacea
Genus	;	Aloe
Species	;	Aloe vera

Medically Important Species²

Aloe barbadensis miller referred to as 'TRUE ALOE' is the most consistent of all varieties and has the greatest medicinal value.

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Fig 1 - ALOE BARBADENSIS



Fig 2 - ALOE ARBORESCENS



Fig-3 ALOE FEROX

Cultivation¹

Since the water requirement is very low the crop is best suited for cultivation in arid and semi arid regions. Large scale cultivation is seen in India, Australia, Bangladesh, Cuba, China, Mexico, Jamaica, South America, etc.

In India commercially it is grown for its high demand in cosmetic industries as well as in Indian System of Medicines. It is grown in almost all parts of India, specially in Rajasthan, Gujarat, Madhya Pradesh and Maharashtra.

Composition

Aloevera contains 75 potentially active constituents. The thick succulent leaves of the plant is its economic part. The leaf when cut drips a yellow sap which has a very strong laxative effect. When the green skin of leaves are removed a clear mucilageneous substances appear that contain fibres, water and the ingredients which gives the ' ALOE GEL ' its special qualities. These are summarized in the Table – 1.

Table – 1. Constituents in Aloe Vera and their effects

CONSTITUENTS ^{3,4,5}	EFFECT ^{3,4,5}
1. Vitamins:- Vitamin A,B1,B2,B3,B6 B12 C and E	Anti Oxidant;Neutralizes free radicals;energy production
2. Enzymes a) Bradykinase b) Catalase c) Amylase, Cellulose d) Lipase e) Oxidase,Proteolytiase Phosphokinase, f) Carboxy peptidase g) Alkaline phosphatase	immune system stimulation, analgesic; anti inflammatory Prevents accumulation of water in the body Breakdown of sugars & fat; Breakdown of sugars & fat Breakdown of sugars & fat Breakdown of sugars & fat Breakdown of sugars & fat; mineralisation
3. Anthraquinones:- Aloin, Emodin, Anthranol, Barbaloin	Antiviral; Analgesic; Antibiotic[bactericidal]; Anti cancer ⁶
4. Minerals a) Calcium b) Chromium c) Iron d) Copper e) Magnesium f) Potassium	Teeth & bone formation; muscle contractions; cardiac function Balance blood sugar; protein metabolism. Essential in haemoglobin formation & oxygen transport Formation of red blood cells; pigmentation of skin & nails. Strengthen teeth & bones;maintain muscles & nervous system Regulation and maintenance of fluid balance in the body
5. Sugars a) Glucomannan b) Alprogen c) C- Glucosyl chromone d)Acemannan	Healing; immune stimulation Anti allergic Anti inflammatory activity Restores & boosts the immune system ; Anti viral.
6. Fatty acids Cholesterol, Lupeol, Sisoteral, Campesterol [Natural plant steroids]	Analgesic; Anti inflammatory; Anti septic
7. Hormones :- Auxins & Gibberellins	Helps in wound healing ; anti inflammatory.
8. Anti septic agents:- Lupeol, Salicylic acid,urea, nitrogen, Phenols & Sulphur	Inhibitory action on fungi, bacteria and virus
9.Aminoacids	Building blocks of protein ; affect brain function
10.Saponins	Anti septic property.
11.Lignins	Penetrative property.
12.Lectins	Anti cancer activity. ⁸

Mechanism of Action^{3,4,5}

1. Healing property ; Glucomannan, a mannose rich polysaccharide and Gibberellins a growth hormone interacts with growth factor receptor on the fibroblast, there by stimulating its activity and proliferation which in turn significantly increases collagen synthesis. It also changes collagen composition and increases the degree of collagen cross linking. An increased synthesis of hyaluronic acid and dermatan sulfate in the granulation tissue of healing wound is also reported. Lignins, a cellulose substance gives penetrative property allowing the healing agents to penetrate deeper into the skin. Aloe vera's powerful healing properties seem to be attributable to the highly complex and synergistic action of all its nutrients.
2. Anti inflammatory ; C- Glucosyl chromone inhibits cyclo oxygenase pathway and reduces prostaglandin E2 production from arachidonic acid. Bradykinase was shown to break down the bradykinin, an inflammatory substance that induces pain.
3. Anti allergic ; Alprogen inhibits calcium in flux into mast cells, there by inhibiting the antigen-antibody mediated release of histamine and leukotriene from mast cells.
4. Antiviral ; These actions may be due to indirect or direct effects. Indirect effect is due to stimulation of the immune system and direct effect is due to anthraquinones. The anthraquinone aloin inactivates various enveloped viruses such as herpes simplex , varicella zoster and influenza. It is also showing a real promise in the fight against AIDS.
5. Anti septic ; Lupeol, salicylic acid, urea, nitrogen, cinnamonic acid, phenols and sulphur present in aloe kill or control the growth of micro organisms like bacteria, fungus, etc. by disrupting their cell membrane and denaturing their proteins. Saponins, a soapy substance cleanse wounds of debris and kill microbes.
6. Anti cancer activity ; Acemamman stimulates the synthesis and release of interleukin- 1 and tumour necrosis factor from macrophages, which in turn initiated an attack that resulted in necrosis and regression of the cancer cells. It also increases the capacity of T- lymphocytes by 50%. Aloe – Emodin , a hydroxy

anthraquinone initiates apoptosis or cell suicides, contributing to anti cancer activity. Lectins, also naturally release immune activating anti cancer substances.

These very diverse ' benefits ' help to explain its wide range of both general and clinical application. Due to these benefits aloe vera can help with many different problems at the same time and that the body seems to be able to take from aloe vera what it needs, when it needs and where it needs.

Primary Sites of Action⁹

Epithelial tissue, it is known for penetrating capacity to reach deeper layers when applied locally.

Immune system, exerts an effect on the cytokine system resulting in immunomodulation.

Various forms of Aloe¹⁰

Aloe tooth paste

Aloe gel

Aloe propolis hand cream

Aloe activator spray

Aloe juice

Aloe tonic

Aloe in jelly form is of enormous use in dentistry.

Uses in Dentistry^{10,11}

1. Application directly to the site of periodontal surgery. Aloe gel
2. Application to the gum tissue when they have been traumatized or scratched by tooth brush, dentifrice abrasion, sharp food, dental floss and tooth pick injuries. Aloe gel
3. Chemical burns are relieved quickly from accidents with aspirin injuries. Aloe gel
4. Extraction sites respond more comfortably and dry sockets do not develop when aloe vera is applied. Aloe gel
5. Acute mouth lesions are improved by direct application on herpes simplex virus lesions, aphthous ulcer, canker sores and cracks occurring at corner of mouth.
6. Gum abscesses are soothed by aloe application . Aloe gel

7. Chronic oral lesions like lichen planus, benign pemphigus and gum problems related with AIDS patients and leukemia patients get relief. Aloe gel
8. Migratory glossitis, geographic tongue and burning mouth syndrome are reduced by aloe application. Aloe gel
9. Dental patients with sore ridges and ill fitting dentures can benefit as fungises and bacterial contamination are reduced . Aloe gel
10. Aloe can be used around dental implants to control inflammation from bacterial contamination. Aloe gel
11. Disorders such as oral candidiasis, desquamative gingivitis, vesiculobullous diseases all respond to aloe. Aloe gel
12. Aloe activator spray is excellent for throat infections and painful erupting wisdom teeth.
13. Aloe has been used in root canal treatment as a sedative, healing agent and file lubricant. Aloe juice.
14. Aloe juice is used in conjunction with planned removal of mercury amalgams as a scavenging agent. Aloe juice
15. It is applied in gum pockets where normal cleaning is difficult. Aloe gel and Aloe tooth paste.
16. Aloe propolis hand cream helps to counteract frequent hand washing and wearing of latex gloves.

Safety Measures ^{11,12}

Over dose – Diarrhoea, kidney damage

Patients on steroid pill., diuretics, digoxin, should not use aloe.

Those with intestinal disorders, pregnant and nursing mothers, children below 12years are not supposed to use aloe.

Aloe decreases the blood sugar level and thus may interact with oral hypoglycemic drugs and Insulin.

Side Effects ³

It causes redness, burning, stinging sensation and rarely dermatitis in sensitive individuals. Allergic reactions are mostly due to anthraquinones, such as aloin and barbaloin. It is best to apply it to a small area first to test for possible allergic reactions.

Discussion

The dental uses of aloe are enormous. The problem with aloe vera has always been that of maintaining its therapeutic function because it is unstable and oxidizes rapidly like any cut leaf or fruit. It has been due to relatively recent successful stabilization process that has so greatly increased the use of aloe to world wide population. It will be long time before it is thoroughly understood just how extensively does aloe work.

Conclusion

The revived interest in herbalism is focusing on over 30,000 registered plants that have medicinal and nutritional properties. AloeVera holds a top position on that list, due to its healing and nutritional capacity. As people are becoming interested in alternate therapy utilizing natural products than synthetic agents, Aloevera can have unlimited future in new dental applications. Researches and controlled human trials proves aloe vera to be reliable, safe and has minimal side effects. Thus aloevera has wide spectrum of properties and uses, some of them could be myths and some of them real magic. In future controlled studies are required to prove the effectiveness of aloevera under various conditions.

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ABOUT THE JOURNAL

The Trivandrum Dental Journal, the official publication of the Indian Dental Association, Trivandrum Branch, is intended to be a research periodical that aims to inform its readers of ideas, opinions, developments and key issues in dentistry - clinical, practical and scientific - stimulating interest, debate and discussion and an opportunity for life long learning, amongst dentists of all disciplines. All papers published in the TDJ are subject to rigorous peer review by our excellent review board. We have tried to design the journal in such a way that the readers can find the relevant information fast and easily.

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The cover page design

The shanku or the conch was considered as one of the common emblems of majority of Kerala feudal kingdoms of the past, including Travancore. The official Kerala state emblem also symbolises two elephants guarding the imperial conch and its imperial crest. The graphical representation of the conch ('shanku') is adapted to be the design on the cover page of the TRIVANDRUM DENTAL JOURNAL.



The Cover Photograph : Desquamative gingivitis is a clinical term used to describe a condition of the gingival characterized by intense redness and erosion of the surface epithelium. Earlier the condition was considered as a specific degenerative disease of the gingiva. Since 1960 it was considered that desquamative gingivitis was not a specific disease but a clinical manifestation of several diseases with several etiologies. The suggested etiologies include certain dermatoses, hormonal influences, abnormal response to irritation, chronic infections and idiopathic. Dermatoses are the most important causative factor, and dermatoses presenting oral findings that could be characterized as desquamative gingivitis are mostly Cicatricial pemphigoid, Pemphigus, and Lichen planus. Other disease processes that could present with desquamative gingivitis are epidermolysis bullosa, systemic lupus erythematosus, and Linear IgA disease. The photograph shows desquamative gingivitis in a patient suffering from Lichen Planus (*photo courtesy Dr (Capt) V.Vivek*).

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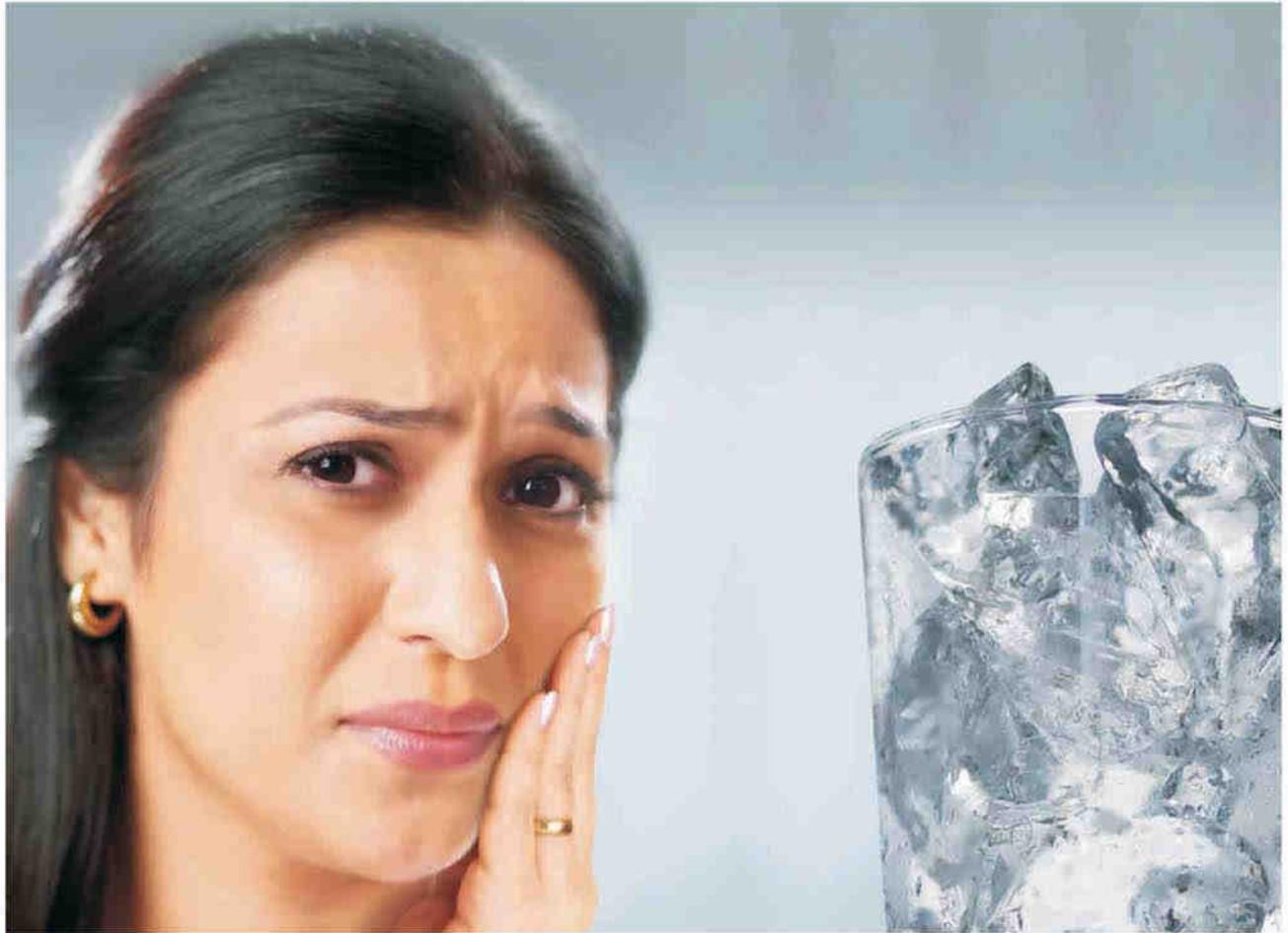


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