

DENTAL BITES

VOLUME 1, ISSUE 2

July - September 2014

A publication of



KMCT
DENTAL COLLEGE

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Editorial

The volume 1 issue 2 of Dental Bites, our journal has molded for publication and circulation as per schedule. The contributions are highly appreciable from the view point of any aspirant in Dentistry to get accustomed with the latest in materials, techniques and technologies irrespective of being an academician or a clinician.

Our journal reflects the fact that our institution itself is going to be a platform for the professional development enriched with updated information and evidences to improve and expand the horizon of knowledge both in practice and academics with an aim and the quality beneficial to the society.

I congratulate the editorial board in selecting the articles keeping the standard of its content.

*Sd/-
Dr Kunjamma Thomas
Chief Editor*

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FROM MOBILITY TO STABILITY - A CASE REPORT

*Dr. Sanara P.P , *Dr. Shabeer Mohamed, **Dr.Sreekant P , ***Dr. Saumiya Gopal

Abstract

“From mobility to stability” is what every Periodontist aims at. For centuries dentists have been trying to stabilize loose teeth. The periodontally compromised dentition offers many opportunities to debate the efficacy of splinting. It frequently addresses the therapeutic goals of treatment, including patient comfort with mastication and retention of teeth after orthodontic intervention. When teeth are seriously loosened by acute trauma or periodontal disturbances, stabilization by splinting can become a valuable adjunct before, during and after corrective therapy. This case report highlights the management of mobile teeth with fibersplint.

Key words: mobility, splinting, fiber splints

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Introduction

In clinical practice, the treatment of mobile anterior teeth seems to be one of the most common and most challenging situations practitioners face. A splint is a device used to immobilize the teeth and it is one of the oldest forms of aids to periodontal therapy. Splinting, however, does not prevent or cure periodontal disease. By redistribution of forces on the affected teeth, the splint minimizes the effects caused by loss of support.¹

Splinting stabilizes the teeth as a unit by including healthy teeth, and redirects the forces from individual teeth to the new unit as a whole.

Including the healthier teeth results in a new increase in crown root ratio and net decrease in force to the individual tooth, especially in a horizontal direction. In early scientific literature splinting was a part of the therapy for “pyorrhea”.²

Often listed advantages to splinting include facilitation of occlusal adjunct, prevention of food impaction by stabilization of proximal contacts. It also helps in prevention of tipping, migration or supraeruption and facilitation of healing of diseased supporting tissue. It enhances the post surgical healing and improves the psychological morale of the patient.

There is little research that would indicate when a splint should be used or if it has any value at all. However, most authors attest to the theoretic and practical benefits of splinting in one form or another.³

Case report

A 38 year old male patient reported to the Department of Periodontics, Yenepoya Dental College, Mangalore with the chief complaint of loose upper front tooth since three months. Patient also gave the history of

acute trauma in relation to upper anteriors before three months. Patient noticed slight mobility which increased progressively to the current state.

On clinical examination, local factors and inflammatory signs were noticed with respect to the upper anteriors. Gingival recession, Periodontal pocket of 5mm and grade II mobility was also detected in relation to 11 including delayed response to pulp vitality test (Fig 1).

IOPA revealed horizontal bone loss in relation to 11, 21, 22. Based on clinical and radiographic examination the case was diagnosed as chronic generalized gingivitis with localized periodontitis in relation to 11, 21, and 22.

Fig 1: gingival recession on 11



The treatment plan consisted of phase I therapy which included scaling root planing followed by provisional extracoronary composite fibre splinting after acid etching and curing of bonding agent had been carried out (Fig 2& 3). Phase II therapy was not indicated as decreased mobility and periodontal pocket depth was observed during re-evaluation.

Fig 2: composite fibre splint



Fig 3: fibre splint in place



Discussion

Mobility may be caused by inflammation of periodontium, loss of periodontal attachment or functional or parafunctional forces on teeth. Splinting has long been reviewed as one component of occlusal treatment. The goals of occlusal therapy include; controlling the amount of loading that occurs at the TMJ, controlling the load that the tooth receives, so that the periodontium is not overstressed, controlling the load placed on the occluding surfaces of the teeth and producing an occlusal relationship with no pathologic symptoms for the muscles of mastication.⁴

Splinting can be applied to any of these broad goals of therapy, normally when mobile teeth are present. Tooth stabilization was indicated after trauma, as part of occlusal therapy, as a prevention of tooth drifting, as a replacement for missing teeth, and as a treatment of secondary trauma. Splinting may also be indicated to stabilize the dentition after orthodontic therapy. Although Ante's Law was not satisfied, in the absence of inflammation, periodontally compromised dentitions could be maintained for extended periods of time, in some cases more than 20 years.⁴

Rationale for tooth stabilization & splinting include rest, redistribution of forces, preservation of arch integrity, restoration of functional stability and psychologic well being.¹

When selecting reinforcement fibers for use in periodontal splinting, since all fibers provide dental composite resins with equivalent reinforcement properties, the ease of use and an assortment of width of the fibers are the primary criteria. It has been demonstrated that woven ribbon fiber reinforcement has an advantage over loose or twisted fibers because it imparts a multidirectional reinforcement to polymeric restorative resins.

Currently, five different woven and straight fiber systems for resins reinforcement are available. Lock-stitch woven Polyethylene Ribbon, Open weave polyethylene ribbon, Open weave glass fiber ribbon, Open tufts of polyethylene fibers, Tufts of kevlar individual fibers.⁵

Effective personal plaque control, professional caries risk assessment, and

periodontal maintenance are crucial to the longevity of the splint and health of the splinted teeth.⁶

Conclusion

By combining the chemical adhesive and esthetic characteristics of composite resin with the enhancement of a plasma treated, high modules, reinforcing ribbon, dentists can provide patients with restorations and splints that resist the load bearing forces of occlusion and mastication.

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BRIDGING THE GAPS- AN INTERDISCIPLINARY MANAGEMENT OF PATHOLOGICAL MIGRATION

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Abstract

Adult patients with periodontal disease demonstrate positioning of teeth that comprise their ability for proper mechanical tooth cleaning. With adequate combined periodontal-orthodontic treatment it is possible to re-establish a healthy and well-functioning dentition. This article reports an interdisciplinary (periodontic, orthodontic, restorative) approach for the treatment of a periodontally compromised patient with pathologic migration.

Key words: pathologic migration, interdisciplinary management, adult patient

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Introduction

Today many adult patients with periodontal disease exhibit problems with tooth malpositioning that comprise their ability for proper mechanical tooth cleaning. The correction of malpositioned teeth permits the patient better access for oral hygiene and can improve the morphology of marginal soft and hard tissues.

However, a different orthodontic treatment approach is required in periodontally compromised patients in terms of stabilizing anchorage system, force system, retention, as well as plaque control during treatment.

This clinical report describes an interdisciplinary (periodontic, orthodontic) approach for the treatment of a periodontally compromised patient with pathologic migration.

Case presentation

A 53-year-old, systemically healthy, nonsmoking female presented with the chief complaint of bleeding gums and increasing frontal spacing of the mandibular and maxillary anterior teeth (Fig 1). There was no history of periodontal treatment. A periodontal examination and charting were performed. Generalized pocket depths ranging from 4 to 7 mm and gingival recession ≤ 2 mm were present throughout the dentition. The occlusal examination revealed Angle Class I molar relationship bilaterally for the first molars. The upper incisors showed pathologic migration.

Radiographic examination showed generalized, moderate, horizontal bone loss in both arches. A diagnosis of moderate to advanced generalized chronic periodontitis was made.

Before starting orthodontic treatment, the patient received periodontal treatment. The treatment comprised oral hygiene instructions, supragingival scaling, and subgingival instrumentation. After periodontal treatment, the patient acquired good plaque control and clinically healthy gingiva. Probing depths were less than 4 mm with no signs of bleeding upon probing throughout the dentition 6 weeks after phase 1 therapy, and the patient was referred for further orthodontic management.

Fig 1: pre treatment photograph



The levelling and alignment were initiated with sectional wires and light forces. After 24 months of active orthodontic treatment acceptable overjet and overbite were achieved (Fig 2)

Fig 2 : post treatment photograph



The patient was seen every 4 weeks for periodontal maintenance during the orthodontic treatment and home care was emphasized. During active orthodontic treatment and retention, PDs and CALs were maintained at the levels achieved after periodontal treatment.

Discussion

Periodontal disease can lead to pathologic migration of involved teeth and cause severe functional and esthetic problems. The clinical manifestations of pathologic migration, such as rotation, elongation and spacing/crowding of the incisors have been found in 30% to 50% of patients with moderate to severe periodontal disease.^{1,2}

In the present case report pathologic migration of maxillary/mandibular incisors, and periodontal disease were significant. In this case the combined periodontal and orthodontic treatment resulted in stable periodontal health exhibiting probing depths less than 4 mm with no signs of bleeding throughout the dentition. In addition, eliminating pathologic migration helped to improve bone support and secure access for plaque control.

Although it has been demonstrated that orthodontic tooth movement is no more a contraindication in the therapy of adult patients affected by severe periodontal disease; it should be carefully performed.³ Lighter orthodontic force systems should be applied to periodontally compromised teeth because they can move easily, and greater orthodontic forces can negatively affect the periodontal membrane.⁴

It has to be emphasized that the key element in the orthodontic management of

adult patients with periodontal disease is to eliminate plaque accumulation and gingival inflammation. In contrast, the lack of oral hygiene instructions and periodical check-ups throughout orthodontic treatment results in bone resorption.⁵

The planning of retention and the stability of orthodontic treatment requires greater consideration in periodontally compromised patients. Thus, permanent retention is often part of the total treatment plan for these patients.

In conclusion, the interdisciplinary treatment approach that involved nonsurgical periodontal therapy and orthodontic tooth movement resulted in significant functional, esthetic and periodontal improvements for this patient.

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PERIODONTALLY ACCELERATED OSTEOGENIC ORTHODONTICS - A SURGICAL TECHNIQUE AND A CASE REPORT

*Dr. Shabeer Mohamed, **Dr. Anju Mary John, *Dr. Sanara P. P .

Abstract

Periodontally accelerated osteogenic orthodontics (PAOO) technique is a combination of a selective decortication-facilitated orthodontic technique and alveolar augmentation, which is an effective treatment alternative in adults with severe malocclusion that decreases the treatment time and increases the quality of treatment. The role of periodontist in assisting the orthodontists to achieve the desirable results in shorter period of time is discussed in this case report.

Key words : corticotomy, PAOO, surgery

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Introduction

Periodontally accelerated osteogenic orthodontics (PAOO) technique is a combination of a selective decortication-facilitated orthodontic technique and alveolar augmentation.¹⁻³ With this technique, teeth can be moved 2-3 times further in one third or one fourth of the time required for traditional orthodontic therapy. It can be used to treat moderate to severe malocclusions in both adolescents and adults and can also reduce the need for extractions.

Surgical intervention to affect the alveolar housing and speed tooth movement has been used in various forms for more than a hundred years. Heinrich Köle's publication in 1959⁴ was the beginning for the surgically accelerated orthodontic tooth movement. Köle believed that it was the continuity and thickness of the denser layer of cortical bone that offered the most

resistance to tooth movement. He theorized that by disrupting the continuity of this cortical layer of bone, he was actually creating and moving segments of bone in which the teeth were embedded. He believed that these outlined blocks of bone could be moved rapidly and somewhat independently of each other because they were connected by only less dense medullary bone, which would act as the nutritive pedicle and maintain the vitality of the periodontium. The blocks of bone were outlined using vertical interradicular corticotomy cuts both facially and lingually and these were joined 10 mm supra-apically with an osteotomy cut through the entire thickness of the alveolus.⁴

Over time the supra-apical connecting osteotomy cuts used by Köle were replaced with corticotomy cuts. Gantes and coworkers⁵ reported on the corticotomy-facilitated

orthodontics in adult patients in whom space closing was attempted with merely orthodontic forces. The mean treatment time for these patients was 14.8 months, with the distalization of the canines being mostly completed in 7 months. The mean treatment time for the traditional orthodontic control group was 28.3 months.

Wilcko and coworkers¹ used computed tomographic (CT) scan of selectively decorticated patients to show that the rapid tooth movement was not the result of bony block movement, but rather to a transient localized demineralization-remineralization phenomenon in the bony alveolar housing consistent with the wound healing pattern of the regional acceleratory phenomenon (RAP).

The demineralization of the alveolar housing over the root surfaces apparently leaves the collagenous soft tissue matrix of the bone, which can be carried with the root surface and then remineralizes following the completion of the orthodontic treatment. They also demonstrated that it is not the design of the selective alveolar decortication that is responsible for the rapid tooth movement⁴ but rather the degree of tissue metabolic perturbation per se.

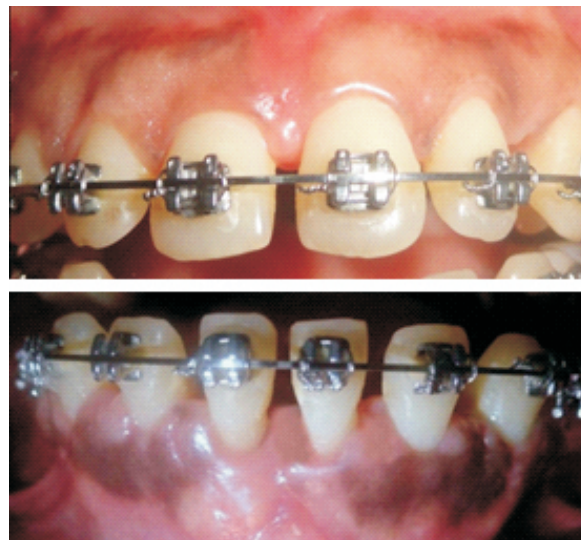
Ferguson and coworkers have further defined this to be an osteopenic process.⁵

The role of Periodontists in the PAOO is becoming increasingly important. It is important for the periodontist to know the details of the procedure to fulfill the need of the patient and thus helping the orthodontist in attaining the quicker and stable results.

Case report

A 38 year old female patient had a

Fig 1: pre operative photographs



Surgical procedure was described to the patient. Other orthodontic treatment options available were also explained to the patient including orthognathic surgery. The patient consented to the PAOO.

Prior to surgical and orthodontic treatment, periodontal health of the patient was restored by phase I periodontal therapy including plaque control measures and scaling and root planing.

The results obtained by this phase of therapy were monitored monthly during the treatment period.

Surgical procedure

The surgical procedures were performed under local anaesthesia. First, corticotomy was done for mandibular anterior teeth followed by maxillary anterior teeth. Vertical releasing incisions were placed extending from gingival margin toward level apical to the apices of mandibular anterior teeth. The vertical incisions were connected by buccal and lingual intracrevicular incisions. Mucoperiosteal flaps were reflected beyond the level of the apices of the teeth. Vertical buccal and lingual grooves were made through the cortical layer of the exposed bone with a round fissure bur mounted on a micromotor hand piece with concomitant saline irrigation, starting 1.5 mm below the interdental crest. A horizontal groove penetrating the cortical bone connected all vertical grooves 2-3 mm apical to the apices of the teeth. Adequate bio absorbable grafting material was placed over the decortication site. The surgical sites were vigorously irrigated with saline prior to flap repositioning and sutured. Analgesics and adjunctive antibiotics were prescribed for 1 week.

After a period of 1 week, procedure was performed on the maxillary arch. Full thickness mucoperiosteal flaps were reflected beyond the level of the apices of the maxillary anterior teeth. Vertical buccal and palatal grooves were made through the cortical layer of the exposed bone, starting 1.5 mm below the interdental crest. A horizontal groove penetrating the cortical bone connected all

vertical grooves 2 to 3 mm apical to the apices of the teeth.

Adequate bio absorbable grafting material was placed over the decortication site. The surgical sites were vigorously irrigated with saline prior to flap repositioning and sutured. Analgesics and adjunctive antibiotics were prescribed for 1 week. Follow up was done after 1 week. Presently patient is undergoing orthodontic treatment.

Fig 2: intra operative photographs



Conclusion

Corticotomy-facilitated orthodontics is an effective treatment alternative in adults with severe malocclusion to decrease the treatment time and increase the quality of treatment. The role of periodontist in assisting the orthodontists to achieve the desirable results in shorter period of time is increasing.

The periodontist should choose appropriate corticotomy technique, according to the alveolar topography. To avoid complications and to assist accelerated orthodontic tooth movement.

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STEM CELLS – A KEY TO INTERVENTIONAL HEALTH CARE!

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Abstract

Stem cells are undifferentiated cells that go on to develop into any of the types of cells in the adult human body. As stem cells can be grown and transformed into specialized cells their use in medical therapies has been proposed. Craniofacial stem cells, including tooth-derived stem cells, have the potential to cure a number of diseases that are relevant to medicine and dentistry. Systemic diseases that can be treated with dental mesenchymal stem cells are diabetes, muscular dystrophy, Parkinson's disease, cardiac infarcts, arthritis, soft tissue reconstruction, liver disease and many more. This article focuses on interventional aspect of stem cells in health care.

Key words: stem cells, health care, medicine, dentistry

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Introduction

Stem cells are undifferentiated cells that go on to develop into any of the types of cells in the adult human body. Stem cells found in multicellular organisms have the ability to renew them through mitotic cell division and can differentiate into a variety of specialized cell type.^{1,2}

Two broad types of mammalian stem cells are embryonic cells and adult stem cells.

In a developing embryo, stem cells can differentiate into all of specialized embryonic tissues. In adult organisms, stem cells act as a repair system for the body, replenishing specialized cells, and maintaining the normal turnover of regenerative organs, such as blood, skin, or intestinal tissues.

As stem cells can be grown and transformed into specialized cells their use in medical therapies has been proposed.

The stem cells are formed in the bone marrow.^{1,2} Each stem cell receives chemical signals that direct it to become erythrocytes, leukocytes, or a small cluster of platelets. Normally only mature cells are released into the peripheral blood stream.

In adults, stem cells are thought to reside in a specific area of each tissue where they may be constantly replicating at a controlled rate to maintain a ready pool of supply when needed. Stem cells can be seen in brain, bone marrow, peripheral blood, blood vessels, skeletal muscle, skin, adipose tissue, spleen, kidneys, and liver in an adult, but only in limited amounts when compared to embryonic stem cells.

Stem cell properties

Stem cells differentiate into progenitor cells which are more specific and developmentally committed to a cell line. Most progenitor cells are multipotent or unipotent; therefore, they are also compared to adult stem cells. Progenitor cells are usually found in adult organisms where they act as a repair system for the body. They replenish special cells and also maintain blood, skin, and intestinal tissues.³ Examples of progenitor cells include satellite cells in muscles, bone marrow stromal cells, etc. The various properties of stem cells include:

1. **Self-renewal:** They have the ability to go through numerous cycles of cell division while maintaining the undifferentiated state.
2. **Potency:** Stem cells have the capacity to differentiate into specialized cell types. Potency includes totipotency and pluripotency. Sometimes, multipotent and unipotent progenitor cells are referred to as stem cells. Different potencies of stem cells:
 - a) **Totipotent:** Stem cells are produced from the fusion of an egg and a sperm cell. Cells produced by the first few divisions of the fertilized egg are also totipotent. These cells can differentiate into embryonic and extraembryonic cell types.
 - b) **Pluripotent:** Stem cells are the descendants of totipotent cells and can differentiate into cells derived from any of the three germ layers.

- c) **Multipotent:** Stem cells can produce only cells of a closely related family of cells eg: into red blood cells, white blood cells, platelets, etc.
 - d) **Unipotent:** Cells can produce only one cell type, but have the property of self-renewal which distinguishes them from nonstem cells e.g., muscle stem cells.
3. **Homing:** It's a process by which stem cells reach to the different parts of the body.
4. **Plasticity:** It's the ability of stem cells to mix with different cells.

Identification of stem cells

Stem cells can be identified by using methods such as clonogenic assays based on a distinctive set of cell surface markers, where single cells are characterized by their ability to differentiate and self-renew.

Isolation of stem cells

The isolation of stem cells for use starts from the abortion of embryo/fetus at the age of 5–9 weeks. The primordial germ cells are isolated and cultured. The cultured embryonic stem cells (ESCs) are then selected for the specific tissue type. Embryonic stem cells can also be isolated from the blastocyst stage at the age of 6–7 days. These cells from inner mass are then cultured as ESCs and then specific cell and tissue types are isolated.

Stem cell transplant process in medical field

The process of isolation of stem cells is similar for both autologous and allogenic

stem cell transplants. However, in the case of autologous transplants, the patients undergo the stem cell collection procedure prior to receiving high-dose chemotherapy and their cells are frozen and stored until needed. In allogenic transplants, a stem cell donor typically undergoes the collection procedure just before the transplant is performed.

Autologous transplants are performed more frequently. After the stem cells are collected, or at some later date, the patient receives high-dose chemotherapy, and diseased cells are destroyed. For example, the chemotherapy drug melphalan is the most commonly used drug in cancer. Within a few days after completing the high-dose chemotherapy, the stored adult stem cells are transplanted or infused into the patient's bloodstream.

The infusion process is similar to blood transfusion. The frozen bags of adult stem cells are thawed in a warm water bath and infused into a vein over a period of 2–4 h. The infused stem cells travel through the bloodstream and settle in the target tissues, where they begin to produce new cells.

Shortcomings of stem cell therapy

Stem cell biology allows a completely new approach to the understanding and treatment of several medical conditions like cardiovascular, renal diseases. It is important to decide which system is best for modeling the role of stem cells in various diseases.

Trials on animal models for stem cells therapy have been experimented in both small and large animals. Small animal models, for example mice and rats, are useful for

molecular studies owing to the wide range of commercially available transgenic animals and antibodies, although usefulness can be hampered by a shortage of experienced technicians. Meanwhile, large animal models, for example, porcine, although technically easier to work with and in some respect closer to human biology are often restricted by lack of transgenic, money, and space.

Animal models are limited by the lack of a system that reproduces the entire disease process in man. However, in spite of this shortcoming, important information has already been obtained using these techniques. This pragmatic approach will eventually permit the transition of cell-based therapies into man. Bench-to-bedside/chair side progression can be most quickly accomplished by an open and active collaboration between cell biologists, physiologists, and clinicians.

Induced pluripotent stem cells, commonly abbreviated as iPS cells, are a type of pluripotent stem cells artificially derived from a nonpluripotent cell, typically an adult somatic cell, by inducing a “forced” expression of certain genes. Ethical issues associated with the production of ESCs do not apply to iPSCs, which offer a noncontroversial strategy to generate patient-specific stem cell lines.

Side effects of stem cell therapy in medical field

The side effects for stem cell treatments are similar to ones experienced during chemotherapy. These effects are also bound to happen because of the large amount

of strong drugs and therapy advised toward the treatment and administration of stem cell therapy. Short-term side effects often include nausea, vomiting, diarrhea, loss of appetite, hair loss, and mouth sores or ulcers.²

However, when bone marrow cells from the same patient are used, these short-term side effects are not of major concern. In some cases, skin reactions and fatigue occur due to a fall the in red blood cell count during the treatment.

Serious complications include a drastic decrease in the white blood cell count because of which an individual is more prone to infections, and bleeding.

Various organ complications are also observed in stem cell treatment, including problems developing in the organ systems, such as liver (including hepatitis and other infections), kidneys (including kidney failure), lungs (including inflammation and congestion), and most importantly heart (including reduced pumping ability), caused by chemotherapy, radiation, or medications. This condition mainly arises because of the high doses of chemotherapy involved during the therapy.

Graft versus host disease (GVHD) is a potentially serious side effect. It occurs when the body recognizes the transplanted stem cells as foreign substances and begins to attack and destroy these new stem cells.

These side effects differ from person to person. One may show all of these side effects after stem cell therapy while the other might not show all. All these side effects of stem cell therapy are at their worst in the initial

days after therapy and for a couple of weeks afterward. When the body regains its ability or blood counts start to rise, one may feel better.

Although stem cells appear to be relatively safe in the majority of recipients to date, clinical trials that use stem cells must address two concerns that accompany the delivery of these cells: (1) safety and (2) tracking the cells to their ultimate destination(s).

Stem cells in dentistry

Oral tissues are expected to be not only a source but also a therapeutic target for stem cells, as stem cell and tissue engineering therapies in dentistry continue to attract increasing clinical interest.⁴ Given their unique abilities, stem cells are particularly important for developing innovative technologies for tissue engineering strategies to regenerate or replace damaged, diseased or missing tissues and even organs.

Many basic and translational studies with stem cells and the other key elements of tissue engineering, i.e., bioactive factors and extracellular matrix scaffolds have been conducted in animal models to develop the concept of oral tissue and organ regeneration for clinical application in dentistry.

Dental stem cells display mesenchymal stem cell characteristics and have the capacity to generate dentin-producing odontoblasts, adipocytes, osteoblasts, bone, cartilage, and smooth and skeletal muscle. Studies have also shown that dental stem cells can switch lineage to form ectodermal tissues (such as neurons or epithelial-like stem cells)

and endodermal lineage (such as endothelial cells, hepatocytes, and insulin-producing cells).⁵

Dental stem cells isolated from different parts of teeth are:

1. Stem cells from exfoliated deciduous teeth (SHED)
2. Adult dental pulp stem cells (DPSC)
3. Stem cells from the apical part of the papilla (SCAP)
4. Stem cells from the dental follicle (DFSC)
5. Periodontal ligament stem cells (PDLSC)
6. Bone marrow derived mesenchymal stem cells (BMSC).

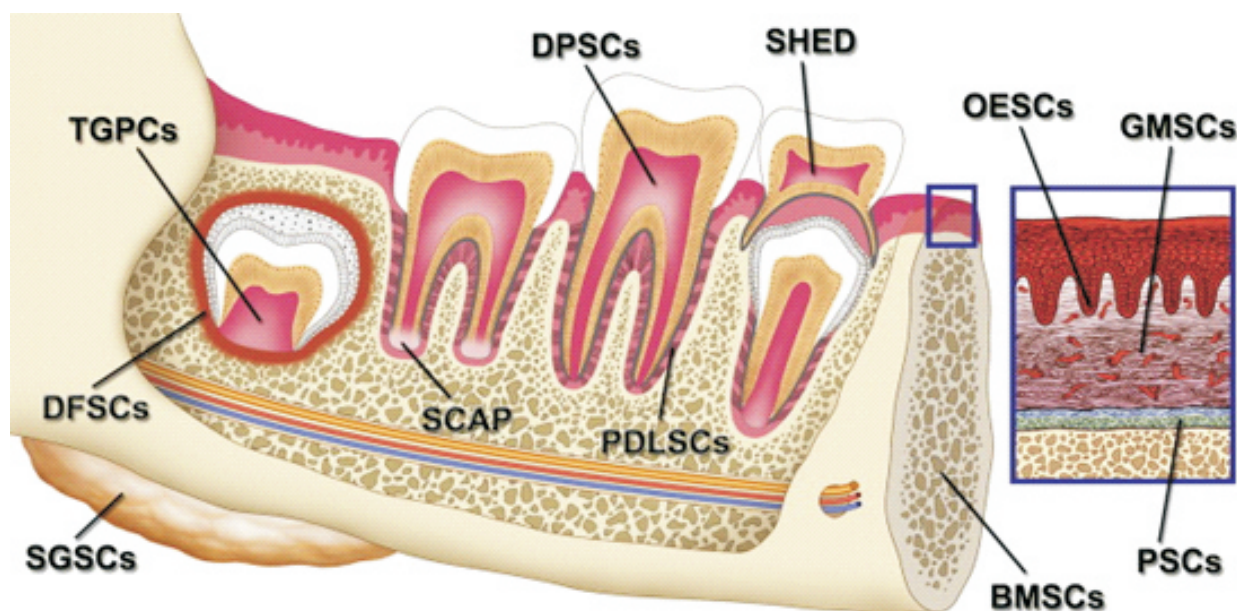
Craniofacial stem cells, including tooth-derived stem cells, have the potential to cure a number of diseases that are relevant to medicine. Systemic diseases that can be

treated with dental mesenchymal stem cells are diabetes, muscular dystrophy, Parkinson's disease, cardiac infarcts, arthritis, soft tissue reconstruction, liver disease and many more.

Currently in the field of dentistry dental stem cell research focuses on regeneration of dentine, pulp and teeth; alveolar bone; regeneration of periodontal ligament after periodontal disease; salivary gland regeneration after radiation therapy; repair of craniofacial defects; and in the treatment of lichen planus.

Future of stem cell therapy

Stem cells have great potential to cure many diseases which have been a great threat for human beings. Certain diseases which can be cured in future with the help of stem cells include Parkinson's disease, coronary artery disease, cardiomyopathy, congestive heart failure, bone marrow transplants, leukemia, and cell replacement therapy in neurological disease etc.



Of course, there are dozens of other diseases on which stem cell research is working on, including treatments of vision or ocular disease processes like retinitis pigmentosa and corneal regeneration, as well as musculoskeletal disorders like muscular dystrophy.

Growing evidence has demonstrated that the oral and maxillofacial region is a rich source of adult stem cells.⁴ Many intra-oral tissues, such as deciduous teeth, wisdom teeth and the gingiva, are not only easily accessible from the oral cavity but can also often be obtained as a discarded biological sample. Therefore, dental professionals should recognize the promise of the emerging field of regenerative dentistry and the possibility of obtaining stem cells during conventional dental treatments that can be banked for autologous therapeutic use in the future.

Stem cells promises cells cannot be denied in the 21st century, they will continue to wage an untold hope for patients around the world seeking answers and cures to formerly deadly disease processes.

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BANKING SMILES - THE STEM CELLS WAY

*Mithila Moosa, **Dr. Binu Purushothaman, ***Dr. Harish Kumar V. V.

Abstract

Stem cell technique has potential to completely revolutionize the field of medicine and dentistry. Doctors are striving to create therapies that replace the damaged cells with tissues grown from stem cells, that will offer hope to people suffering from various ailments. There are different sources of stem cells. This article highlights the current trend in stem cell therapy.

Key words: embryonic cells, pluripotent cells, stem cells, banking

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Introduction

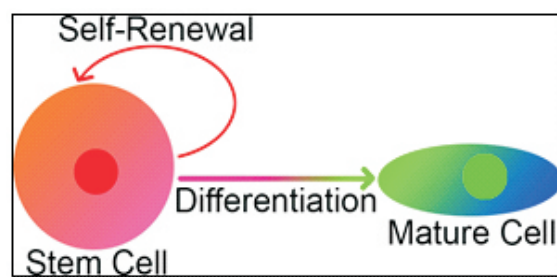
In the new millennium we are on the verge of paradigm shift exploring biological solutions to biological problems. Doctors are striving to create therapies that replace the damaged cells with tissues grown from stem cells, that will offer hope to people suffering from various ailments.

Stem cells are “unspecialized cells with ability to self-renew, capable of differentiating into one or more specialized cell types”.¹

The term “stem cell” was proposed by Russian histologist Alexander Maksimov in the year 1868.² Gronthos et al in 2003³ isolated a clonogenic, rapidly proliferative population of cells from adult human pulp.

Dental pulp is actually among the richest tissues in mesenchymal stem cells, which bear a huge application potential.

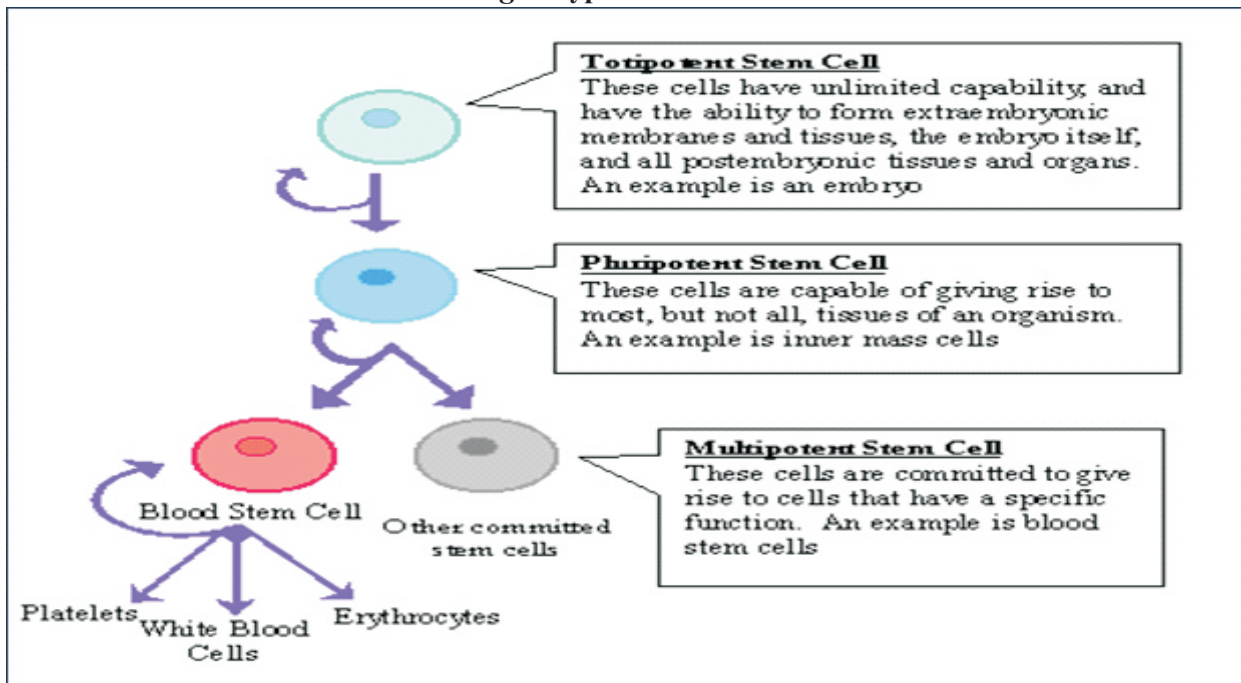
Fig 1: stem cells



Characteristics of stem cells

- Totipotent progenitor cells
- Blank cells (unspecialized cells)
- Can become cells of the blood, heart, bone, skin, muscle, brain
- Differentiation – have the potential to give rise to specialized cell types
- Proliferation and Renewal for longer periods of time.

Fig 2: types of stem cells



Sources of stem cells

1. Embryonic stem cells

Human embryonic stem cells are obtained from embryos that are 5-6 days old. They have the ability to form all the different types of cells in the body including germ cells.

Types of stem cells

2. Adult stem cells

They are undifferentiated cells, found throughout the body after development that multiply by cell division to replenish dying cells and regenerate damaged tissues. They are found in children as well as in adults. These stem cells are found in most adult tissues like teeth, umbilical cord blood, bone marrow, menstrual blood, skin, placental tissue

3. Induced pluripotent stem cells

They are regular adult cells that are not stem cells but are genetically reprogrammed to act like an embryonic stem cell.

Table 1: Comparison between embryonic and adult stem cells

Embryonic stem cells	Adult stem cells
They are pluripotent	Adult stem cells are mostly multipotent
Large numbers of cells can be relatively easily grown in culture	Adult stem cell plasticity may exist
Easy to isolate	Hard to isolate
Stem cells from a donor introduced into a patient could cause transplant rejection	The use of own adult stem cell would not be rejected by immune system

Stem cell cultivation

The embryos from which human embryonic stem cells are derived are typically four or five days old and are a hollow microscopic ball of cells called the blastocyst.

The blastocyst includes three structures: the trophoblast, which is the layer of cells that surrounds the blastocyst; the blastocoel, which is the hollow cavity inside the blastocyst; and the inner cell mass, which is a group of approximately 30 cells at one end of the blastocoels. The inner cell mass is cultured in a nutrient broth ie. culture medium.

After six months or more, the original 30 cells of the inner cell mass yield millions of embryonic stem cells. Embryonic stem cells that have proliferated in cell culture for six or more months without differentiating, are pluripotent, and appear genetically normal, are referred to as an embryonic stem cell line.

Adult stem cell location includes brain, spinal cord, cornea, retina, liver, lungs, blood vessels, skeletal muscle, pancreas, epithelia of skin, bone marrow, epithelia of digestive system etc.

Scaffolds of stem cells

Designed to create a 3D environment that promotes tissue development of cells that are placed on or within the scaffold.

Scaffold choices includes-

- Titanium
- Coraline hydroxyapatite
- Porous hydroxyapatite
- Calcium phosphates
- Bioglass

Potential applications in dentistry

- Regeneration of damaged coronal dentin and pulp
- Regeneration of resorbed root, cervical or apical dentin, and repair perforations
- Periodontal regeneration
- Repair and replacement of bone in craniofacial defects
- Whole tooth regeneration

Tooth extraction procedures in dental practice generate stem cells that could be useful for future dental and medical treatments.

In Deciduous teeth-Pulled exfoliating teeth and Teeth extracted for orthodontic reasons.

In Permanent teeth-Healthy teeth extracted for orthodontic reasons, impacted teeth can be used.

Fig 3: Harvest zone



Harvest zone is the best areas for finding deciduous teeth that are candidates for stem cell recovery, which should be slightly mobile with the root and pulp still intact.

Recovering stem cells

- From Baby teeth - age 6-12 years old: The best source are from canine to canine before the teeth fall out on their own.
- From Wisdom teeth - age 16-20 years: Third molars are a good source, although it is best when the teeth are still developing.
- From Permanent teeth over the age 20: All adult teeth with healthy pulp. As people age, dental stem cells are less useful.

Application of stem cells in regenerative dentistry

✓ Periodontal regeneration

Techniques of cell transplantation have been developed to regenerate periodontium using PDL Cells (PDL) isolated from extracted human teeth and DFSCs which could become an alternative cell source for periodontal regeneration therapy.

✓ Whole tooth regeneration

Murine stem cells when transferred in to renal capsules resulted in development of tooth structure and associated bone. Transfer of artificially created embryonic tooth primordia into adult jaw resulted in development of tooth structure. Recently some researchers have developed a bioroot in to which post and crown is placed. This developed a natural relationship with bone.

✓ Regenerative Endodontics

Regenerative Endodontics promotes a paradigm shift in treating endodontically involved immature permanent teeth from performing apexification procedures to conserving any dental stem cells that might remain in the disinfected viable tissues to allow tissue regeneration and repair to achieve apexogenesis/Maturogenesis

✓ Repair of craniofacial defects

The American Association of Orthopedic Surgeons, given the high demand for grafting procedures, the development and supply of "substitutes for conventional bone grafts" should be a priority so the embryonic stem cells have been differentiated into cartilage cells and implanted on artificially created cranial osseous defects. The group that received the implanted tissue had a significantly faster response rate.

✓ Bioroot engineering

Teeth that underwent external root resorption for orthodontic reasons, for instance, are not likely to recover the tissue loss. These findings open the possibility of Bioroot engineering which is using stem cells from apical papilla (SCAP) as well as PDL stem cells for pulp and dentin repair.

The apical papilla differs from the dental pulp for containing less cellular and vascular components. However, apical papilla stem cells have shown to have both high repair and differentiation potential.

Why stem cells from teeth???

- ✓ Most powerful cells in the body
- ✓ Stem cells from teeth replicate at faster rate.
- ✓ Less painful to extract them
- ✓ Extracted from milk teeth and wisdom teeth
- ✓ Can differentiate into nerve cell, muscle cell, insulin producing cell etc. owing to their multipotency
- ✓ Interactivity with biomaterials, making them ideal for tissue reconstruction
- ✓ They are expandable and multiplied under controlled conditions
- ✓ No ethical issues

Child's cord blood or dental pulp stem cell???

Cord blood stem cells are used today to treat blood diseases whereas dental pulp stem cells are to be used to treat hard and soft tissue diseases and injuries such as healing connective tissue, repairing dental tissues, neuronal tissue and bone tissue.

Other Applications of stem cells

- Replacing damaged tissue
- Studying human development
- Testing new drugs
- Screening toxins
- Testing gene therapy methods
- Regenerative medicine

Robot assisted stem cell therapy

Robotically assisted surgery requires only three small holes be made between the ribs. Through these holes, two robotic arms and a videoscope gain access to the heart, making surgery possible without opening the chest. Stem cells can then be directly implanted into the patient's heart using minimally invasive injection.

Stem cell banking

When the milk teeth and wisdom teeth are in a condition to fall, the dentist should be consulted for stem cell preservation. After stem cells are collected, they are x-rayed and then sent to the centers or the banks preserving these stem cells. They are preserved several degrees below freezing point (-150c) and the process is known as *cryopreservation*.

They can be preserved for more than 20 or 30 years. The person requiring the cells needs to inform the bank 24hrs in advance, and the cells are transferred within 24hrs around the world. The tooth has to be removed using a standard procedure and taken immediately to the laboratory in controlled temperature conditions for testing and storage within 48 hours of removal.

The hitch...

The stem cells taken from a child in a family cannot be used by others in the family. There is a possibility of only 25 percent in which stem cells of one person in the family can be used by others in the family.

Fig 4: dental stem cell niches

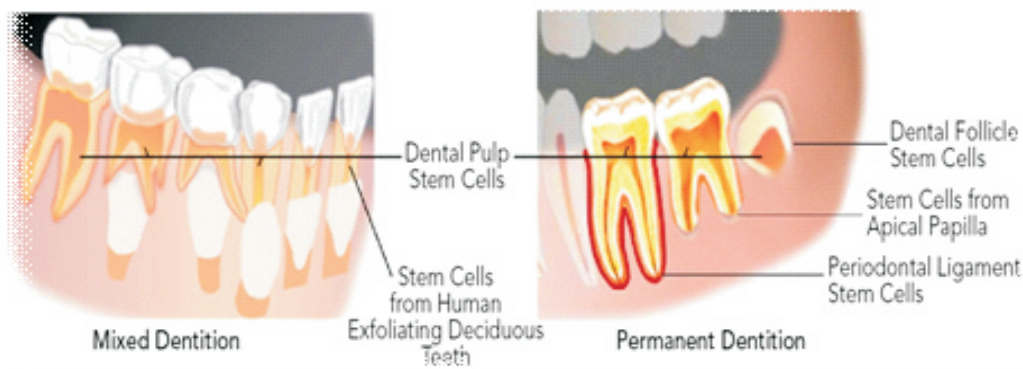
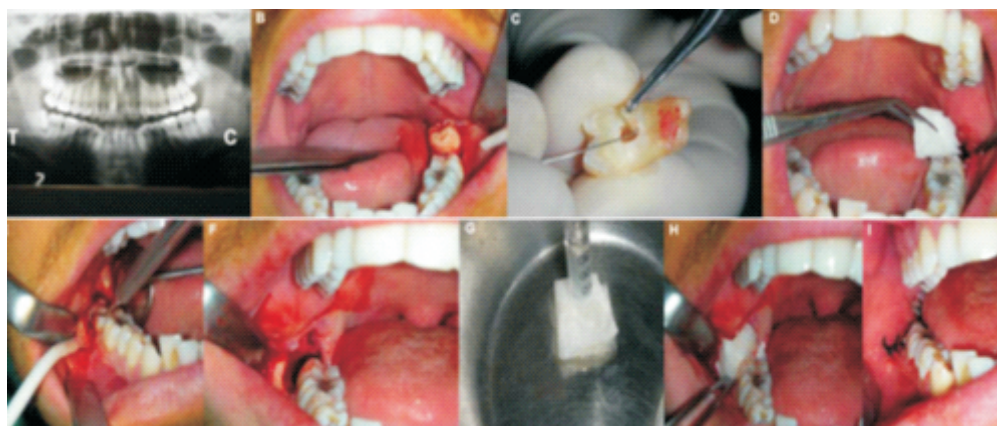


Fig 5: Human mandibular bone defect repair using stem cells from dental pulp



Conclusion

Stem cell technique has potential to completely revolutionize the field of medicine and dentistry. DPSCs presented more striking odontogenic capability than BMSCs under the induction of postnatal apical bud cells. This technique is like health insurance, in which we invest today to get the result in future, if we acquire health problems. Advances in cell isolation, expansion will lead to successful tissue engineering of tooth/ tooth-related tissues.

Stem cells could be important due to their unique property of being forever “young” and being responsive to change.

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Mithila Moosa (Intern, KMCT Dental College, Calicut) won the second best paper at the Dr. Moideen Sha Chamba Memorial State Level Scientific Paper Presentation Competition

AWARDS & ACHIEVEMENTS

Winners of KUHS North Zone Arts Fest 2014

Kerala University of Health sciences North Zone Arts Fest was conducted from 31st May to 2nd June 2014. Third year BDS student from our college, Alan Merwin Raju was chosen as “Sarga Prathibha”. He bagged first prize in English essay writing and third prize in English versification. Nabeel P.P, Intern won the second prize for Malayalam essay writing and Sharanya Babu, first year BDS student won third prize for Kerala Nadanam



Alan Merwin Raju



Nabeel P.P



Sharanya Babu

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