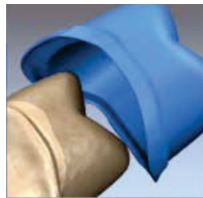


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## **Editorial**



### **The Saga Begins....**

Every new beginning embarks on its sabbatical with a jerk, shakes, tumbles, regains, rises and then slowly makes a head way, hopefully in the right direction. When the baton was passed to me to take up the task to Edit this Journal, I was euphoric to begin with. And like all euphoria, eventually reality settles and you realize what a mammoth task my predecessors have done and endured. Hats off to them, especially my mentor for this task Dr. Mohan Vakade.

While trying to keep the original dream and theme of this journal intact, we have incorporated a few changes, in tandem to the changing and daunting times. Starting with the name, we have rechristened it to "Dentimedia Journal of Dentistry" and have changed the cover page. Author's photos and abstract have been added. Every article is thoroughly checked for plagiarism and if, in spite of ample care if you come across any article in this journal which has been published elsewhere in whole; we shall disown it without delay and blacklist the authors permanently. Future issues will also feature Guest editorials. We have also introduced new concepts like heading the article as Research, Original, Review, Ethics, Biostatistics and so forth.

The Journal is also planned to be made online for all. To begin with we are hosting the current Volume issues on Google cloud. Please follow following link: <https://docs.google.com/folder/d/0B5mSc6A1p0ZAS2xiajExbktvVGs/edit> and you will be granted access after verification of your membership status and you shall receive an e mail notifying your access and carry link that you need to follow for full Access of Volume 17 issues. Should you have any trouble doing that please e mail me at [amishmehta67@gmail.com](mailto:amishmehta67@gmail.com) and we shall send you a link for full access on your e mail id. Very shortly, we shall have our own dedicated journal web site for access to articles and online Article submission. Keep watching this Editorial page for details.

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And lastly, Letters to Editor are encouraged and will be duly published in the respective issue without delay. That is a promise.

### **Dr. Amish Mehta**

Hon. Editor

### **Greetings from IDA GUJARAT STATE BRANCH**



Dear members,

We, join in unison o greet you for a very industrious here full of health, wealth & happiness. IDA Gujarat State Branch has always tried to meet up the ever increasing expectations of its illustrious members.

To that effect, we have lined up a series of CDE, CDH & humorous activities to keep this year full of activities, not to mention this fresh issue of our revered journal.

The new look of the journal prompts us to say the old economic adage, "Old wine in a new bottle". Having said that a lot of brain storming underwent to present you this new avatar of the colloquial

term "Dentimedia".

The IDC 2012 is just around the corner started to be held in Mumbai in the month of February 2012. Let us infuse our energies after our evergreen IDA head office & attend in humungous numbers to re-instilled our faith with Dr. Ashok Dhoble, Dr. Deepak Mucchala & Dr. Sanjay Joshi. Our conveners of the various committees stand pledged & committed to work intriguingly for the cause of furtherance of the dental profession.

Signing off till you hear back from us. Jai Hind. Jai IDA.

Yours in fraternity,

### **Dr. Hemant I. Patel**

President

### **Dr. Nitin Parikh**

Hon. State Secretary

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## Biometrics in Orthodontics

Prof.(Dr.) U.S.Krishna Nayak<sup>a</sup>, Dr.Crystal Runa Soans<sup>b</sup>

### Abstract :

In view of the difficulty to accommodate 3 dimensional volumes of the dental masses in restricted locations available in the jaws, orthodontists are ultimately hard pressed to resort to alternative therapies to change the perimeter of the dental arches, either reducing them through extractions and stripping, or expanding them by proclining the teeth. Although these alternatives have been uncontroversially established, decision-making can sometimes prove challenging.

The interdigitation and then interpretation of biometric data is a key factor in orthodontic diagnosis.



**Key Words :** 3 Dimensional Volumes, Biometric Data, Orthodontic Diagnosis.

### BIOMETRICS—ancient Greek: bios="life", metron="measure"



**"BIOMETRY IS THE ACTIVE PURSUIT OF BIOLOGICAL KNOWLEDGE BY QUANTITATIVE METHODS."**

Historically, the term *Biometry* is related to biological sciences and consists in the application of statistical methods applied to a wide range of measurable characteristics in biology.

### What is biometrics in orthodontics?

Humans are a source of biometric data. i.e. any measurement which is done on us or any measure of any physical parameter directly or indirectly in any form of our body is biometric data. In short all the measurements which we make during our diagnostic procedure are a collection of biometric data.

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### Applications of biometrics in orthodontics :

#### Dermatoglyphics --a marker for malocclusion ?

If seen from the breadth of science, Biometrics is the parent science of Dermatoglyphics



Dermatoglyphics is the study of dermal ridge configurations on palmar and plantar surfaces of hands and feet. Dermal ridges and craniofacial

structures are both formed during 6-7th week of intra-uterine life. It is believed that hereditary and environmental factors leading to malocclusion may also cause peculiarities in fingerprint patterns.

In a study done it was seen that statistical association between whorl patterns and classes 1 and 2 malocclusion ( $p < 0.05$ ). The dermatoglyphic findings revealed that the craniofacial Class II, div.2 pattern was associated with increased frequency of arches and ulnar loops and decreased frequency of whorls, whereas in Class III, there was an increased frequency of arches and radial loops with decreased frequency of ulnar loops.

Dermatoglyphics might be an appropriate marker for malocclusion and further studies are required to elucidate an association between fingerprint patterns and malocclusion

## Palmar dermatoglyphics and its association with malocclusion

Dermatoglyphic studies in twins showed that arch size variation, tooth displacement and cross bite showed significant genetic variance and an increased environmental component of variance in occlusion



## Biometrics used in twin studies for genetic markers of malocclusion



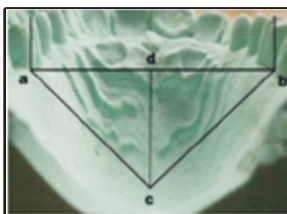
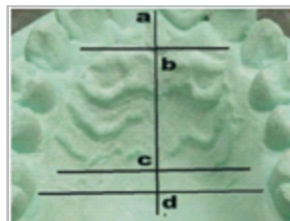
Twins are the easiest and most frequently used tool to obtain heritability estimates of diseases, malformations, and biometric traits

Twin pairs represent a unique window into the role of heredity in the determination of any human trait. Biometric studies done for the heritability of

craniofacial characteristics revealed that there is high genetic determination for the vertical and horizontal parameters, among these parameters vertical parameters showed a significantly high genetic influence especially for the lower anterior facial height among monozygous twins. Studies have also found that the cranial base is also under strong genetic influence

## Shape and biometric characteristics of the palatal rugae

Biometric measurements of palatal rugae are used to evaluate the dental movements, as they remain stable over a person's life. Palatine rugae can be used as internal dental-cast biometric reference points for quantification of tooth migration in cases of orthodontic treatment and they may serve as suitable reference



points from which the clinician can derive the reference planes

necessary for longitudinal cast analysis. Hausser observed orthodontically treated patients and concluded that the lateral edges of the rugae moved forward about one-half the distance of the migration of the adjacent teeth, while the medial rugae were not affected

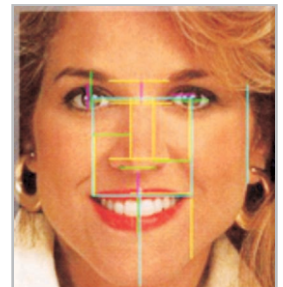
## Biometric studies of tooth size and dental crowding

Biometric studies undertaken to evaluate the influence of tooth size upon dental arch alignment shows that tooth size, along with other factors such as arch width and arch perimeter, shows great range in variability between samples of more and less crowded arches.

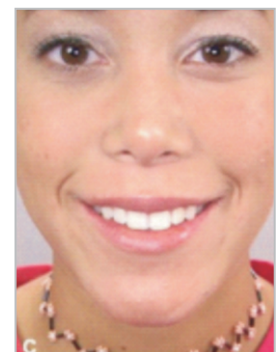
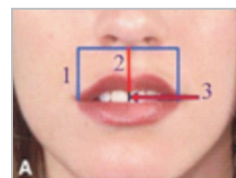
Conversely, it can be stated that one of the important factors determining whether or not a dental arch will be crowded is the absolute size of teeth in that arch.

## Biometric measurements in Smile esthetics: Perception and comparison of treated and untreated smiles

Although orthodontic treatment is based primarily on occlusal relationships, greater attention is now paid to enhancing dentofacial characteristics to produce optimal facial esthetics. Comparison of smile esthetics among patients treated with various treatment



modalities can be done to assess certain biometric dentofacial characteristics in those groups, and discuss how these features relate to smile esthetics. Dentofacial characteristics can be obtained from lateral cephalometric analyses, direct biometric measurements, and frontal photographs.

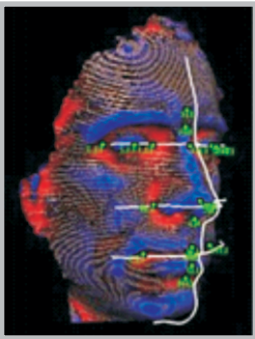


**Direct measurement as a biometric tool in smile esthetics**

The “art of the smile” lies in the clinician's ability to recognize the positive elements of beauty in each patient and to create a strategy to enhance the attributes that fall outside the parameters of the prevailing esthetic concept. Orthodontic records fall into 3 separate but interdependent categories: static records, dynamic recordings, and direct biometric measurements. Direct measurement permits the clinician to quantify resting and dynamic lip-tooth relationships and the information gathered from measuring smile characteristics can then be translated into terms meaningful to the treatment plan.

**Facial biometric measurements**

**The three-dimensional cephalogram: Theory, technique, and clinical application.**



The technique is essentially the same as that of the Broadbent-Bolton “Orientator,”

The three-dimensional method supports the usual biometrics of landmark locations, and takes advantage of a normative data base that is suited for semiautomatic analysis of syndromic data.

**Facial three-dimensional morphometry**

The internal structure of the craniofacial complex has always been evaluated with two-dimensional x-rays images, but since the study of Broadbent in 1931, attempts have been made to coordinate lateral and frontal radiographs to obtain three-dimensional data

The measurement protocol (data collection by the ELITE system mathematical reconstruction of three-dimensional facial coordinates) is suitable for the quantitative analysis of normal adults. The method individualizes the coordinates of a group of biologically significant cutaneous points, and provided direct three-dimensional measurements.



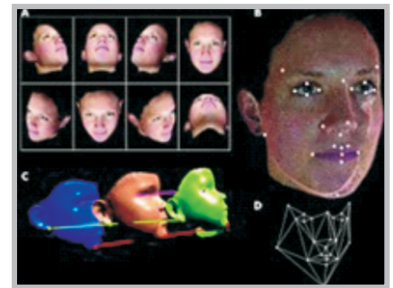
This method can be usefully applied in clinics as a supplement to the classic cephalometric analyses, especially on young subjects, to locate potential growth unbalances, and to control their spontaneous or assisted compensation

**BRACS--a method for cephalometric diagnosis and orthodontic treatment planning. Biometric radiographic analysis of the craniofacial skeleton**

The BRACS (the biometric radiographic analysis of the craniofacial skeleton) is a mathematically originated method for diagnosing malocclusion and planning orthodontic treatment. In the conventional cephalometrics, the measurements are to be made in an unstable reference frame without any definable direction or coordinate system. When using the BRACS, the natural reference structures can be replaced by an artificial stable reference system.

**Tensor biometrics---applications**

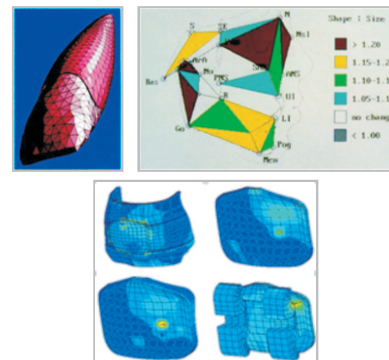
Tensor biometrics deals with size and shape variables referring to the landmark locations available for analysis. The shape changes are viewed as deformations from the basic form. The base form is constructed with study.



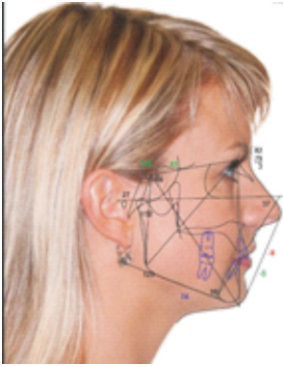
The tensor description ultimately results in a prescription of appropriate measures for characterizing an anomaly, eg: cleft lip and palate, change in cranial shape and dysmorphic syndromes

**Finite Elements and the Biometrics of Landmark Locations**

The biometric analysis of any landmark data set is essentially unique: it is the same for all complete finite-element schemes



## Biometric applications in 3D diagnosis



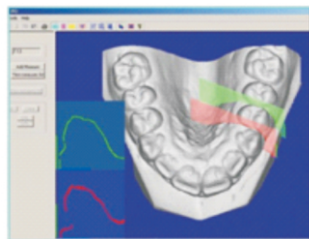
Diagnosis and treatment planning of craniofacial anomalies involve the processes of visualization and analysis. In these processes, deviations from the normal biometric landmarks, asymmetries and affected structures are realized for comprehensive treatment planning.

## Biometric measurements using 3D models



OrthoCAD™ software has been developed by CADENT, Inc. (Computer Aided DENTistry, Fairview, NJ) to enable the orthodontist to view, manipulate, measure and analyze 3D digital study models easily and quickly.

The DigiGraph™ Workstation permits the use of sonic digitization to measure lateral cephalometric values, mesiodistal tooth size and arch perimeter discrepancy as a one-stop diagnostic record taking set-up.



- TELEDENT which was developed at Technion offers a new means of space analysis, mainly the cross-section planes.

## CONCLUSION

The interdigitation and then interpretation of biometric data is a key factor in orthodontic diagnosis. The treatment outcome results in changes of this pretreatment biometric data. Thus biometric analysis is of key importance to orthodontists.

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## Comparative Evaluation of Antimicrobial Efficacy of Sodium Hypochlorite And Carbolic Acid Against Enterococcus Faecalis an In-vitro Study

Dr. Harsh Amlani<sup>a</sup>

### Abstract :

Elimination of microorganisms from infected root canals is a complicated task. Elimination or significant reduction of irritants, microorganisms and prevention of recontamination of the root canal after treatment are the essential elements for successful outcomes. Although many advances have been made in different aspects of endodontics within the last few years to preserve natural dentition, the main objective of this field remains elimination of microorganisms from the root canal systems and prevention of recontamination after treatment. *E. faecalis* can best adapt to and tolerate the ecologically demanding conditions in the root canal. Eradication of *E. faecalis* from the root canal with chemomechanical preparation and using disinfecting irrigants and antibacterial dressings is difficult. Sodium hypochloride is the most commonly used endodontic irrigant, despite limitations. None of the presently available root canal irrigants satisfy the requirements of ideal root canal irrigant. Newer root canal irrigants are studied for potential



replacement of sodium hypochloride. So far, Hydrogen peroxide, Povidone Iodine, Chlorhexidine, ethylenediaminetetraacetic acid (EDTA), ozonated water and MTAD have been used to disinfect and clean the root canals. Carbolic acid has an antiseptic, styptic, and a sedative effect. Carbolic acid, when applied to carious dentine, has an obtundant effect and arrest putrefactive changes in the devitalized structure as well as coagulate the albuminous elements in the dental tubuli. Therefore this study aims to evaluate the antibacterial efficacy of different concentrations of Carbolic acid (Phenolic compound) to eliminate *E. faecalis* from the infected root canal system as compared to sodium hypochlorite which is the most commonly used root canal irrigant.

### Key Words :

### INTRODUCTION

One of the most important objectives of endodontic therapy is the complete elimination of microorganisms from the root canal system. Failure of root canal treatment is likely caused by the inability to eliminate the bacteria responsible for refractory endodontic infections. Bacteria are the primary etiology for the development of pulpal and peri apical pathosis. Facultative bacteria such as *Enterococcus faecalis* have been isolated from infected root canals and may be related to failure of endodontic treatment.

Although chemomechanical preparation of the root canal system is able to reduce the number of bacteria, complete canal disinfection is difficult because of the internal complexity of the root canal systems. Thus irrigants are used during endodontic treatment to flush out loose debris, to lubricate the dentinal walls, to dissolve organic matter in the canal, and to have antimicrobial effects.

a.

The authors report no commercial, proprietary, or financial interest in the products or companies described in this article.

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Carbolic acid, a phenolic compound, being antiseptic, styptic, stimulant and sedative, had been used as a valuable agent in dental therapeutics. In the past, it was employed to carious dentine, to obtund sensibility and arrest putrefactive changes in the devitalized structure, and to coagulate the albuminous elements at the end of the dentinal tubuli. Therefore this study aims to determine the antimicrobial efficacy of different concentrations of carbolic acid (5%, and 10%) as an irrigant against *Enterococcus faecalis* as compared to the traditional 5.25% sodium hypochlorite irrigating solution.

### 1.0 Materials and Method :

1. 36 teeth prepared for root canal inoculation.
2. *Enterococcus faecalis* strain.
3. 5% carbolic acid solution.
4. 10% carbolic acid solution.
5. 5.25% sodium hypochlorite solution.
6. Phosphate Buffer saline.
7. Saline.

### 2.0 Procedure :

#### 2.1 Preparation of the inoculum:

1. An overnight subculture plate of *E. faecalis* was

taken.

2. A uniform bacterial suspension was made in normal saline (2ml) by picking up isolated colonies.
3. It was then adjusted to 0.5 McFarland which gives  $1.5 \times 10^8$  cfu/ml.

## 2.2 Inoculation Procedure :

1. 36 teeth prepared for root canal inoculation were taken in a sterile petridish.
2. The surface of the roots were sealed with nail polish before inoculating with bacteria.
3. Approximately 50 $\mu$ l of *E. feacalis* inoculum was injected into the canal using a tuberculin syringe.
4. These teeth were then incubated in a sterile petridish at 370c  $\pm$ 10c for 72 hours and were divided into 3 groups.

Group I : 5% carbolic acid

Group II: 10% carbolic acid

Group III: 5.25% sodium hypochlorite

## 2.3 Test Procedure :

1. Three groups of 12 teeth each were inoculated with known pathogen *E. feacalis*.
2. They were then incubated at 370 c for 72 hrs.
3. At the end of 72 hrs 36 teeth were separated into 3 groups containing 12 teeth each. Out of 12 teeth in each group,9 teeth were irrigated with 5%,10% of carbolic acid and 5.25% sodium hypochlorite solution respectively and keeping 3 teeth as positive control, which is irrigated with only saline.
4. All the teeth were kept at room temperature for 10 minutes and then washed or irrigated with saline.
5. For each group, out of the 9 teeth disinfected with carbolic acid and sodium hypochlorite, sterile paper points from 7 teeth were introduced into tubes containing Glucose Broth to look for turbidity, henceforth referred to as the turbidity subgroup. This was done to check for the efficacy of disinfectant. Paper points from the remaining 2 teeth were placed in tubes containing Phosphate Buffer saline, vortexed and plated out for calculating colonies, henceforth referred to as the colony forming unit (cfu) subgroup. This was done to get an idea of the log reduction of bacteria.

6. Of the 3 positive controls, 2 were processed for turbidity and 1 for cfu.
7. All the tubes processed for cfu were vortexed and plated out onto blood agar.
8. All the plates and tubes are kept at 370c  $\pm$ 10c for 72 hours.

The data were analysed statistically using Fisher's Exact test and Mann Whitney U test.

## 3.0 Results:

In Group 1 (5% Carbolic Acid Solution), in the turbidity subgroup both the positive control tubes showed turbidity, whereas teeth exposed to disinfectant only 1 showed turbidity.

In cfu subgroup, positive control yielded 60 colonies and those exposed to disinfectant yielded 3 and 26 colonies, thereby giving almost a 1 log reduction.

In Group 2 (10% Carbolic Acid Solution), in the turbidity subgroup both the positive control tubes showed turbidity, whereas teeth exposed to disinfectant showed no turbidity.

In cfu subgroup, positive control showed 22 colonies and those exposed to disinfectant showed 01 and 32 colonies, thereby giving almost a 0.5 log reduction.

In Group3 (5.25% Sodium hypochlorite Solution), in the turbidity subgroup both the positive control tubes showed turbidity, whereas teeth exposed to disinfectant showed no turbidity.

In cfu subgroup, positive control showed 195 colonies and those exposed to disinfectant showed 01 and 02 colonies, thereby giving almost a 2 log reduction.

## The result from the 3 subgroups is tabulated below:

Teeth	1	2	3	4	5	6	7	Positive control	Positive control
Turbidity	-	-	-	-	-	-	-	+	+

Teeth	1	2	Positive control
Colony count	03	26	60

**Table 1:****Group 1: 5% carbolic acid solution:**

Teeth	1	2	3	4	5	6	7	Positive control	Positive control
Turbidity	-	-	-	-	-	-	-	+	+

Teeth	1	2	Positive control
Colony count	00	32	32

**Group 2: 10% carbolic acid solution:****Table 2:**

Teeth	1	2	3	4	5	6	7	Positive control	Positive control
Turbidity	-	-	-	-	-	-	-	+	+

Teeth	1	2	Positive control
Colony count	00	02	195

**Table 3 :****Group 3: 5.25% Sodium hypochlorite solution**

	Group I	Group II	Group III
Turbidity (Negative)*	85.7%	100%	100%
Colony Count (Mean)*	14.5	16	1

**Statistical Analysis :****Comparison of groups**

Comparison	Turbidity*	Colony Count*
Group I vs Group II	0.878	0.747
Group I vs Group III	0.878	0.021
Group II vs Group III	0.999	0.011

\*excluding controls

**STATISTICAL COMPARISON**

- 1) P-values for Turbidity are obtained by using Fisher's Exact test
- 2) P-values for Colony count are obtained by Mann-Whitney U test (Non parametric procedure for

smaller sample size).

The results from table 1, 2 and 3 show that all disinfectants have bactericidal effect. Sodium hypochlorite solution was found to be superior to 5% carbolic acid solution and 10% carbolic acid solution.

**DISCUSSION:**

*E faecalis* is a saprophytic component of the enteric flora, a bacteria most commonly isolated in endodontic retreatment of apical periodontitis. According to Molander, *E faecalis* can survive in a quiescent phase with low metabolic activity for a period of time. This is the reason why *E faecalis* is often used in studies regarding the efficiency of irrigants in cleaning the root canal system.

Sodium hypochlorite is a proteolytic agent that dissolves necrotic tissues. For this breakdown of proteins to occur, the amount of free chlorine is required. Sodium hypochlorite forms hypochlorous acid (HOCl) when comes in contact with organic debris. HOCl exerts its antimicrobial effect by oxidation of sulphhydryl groups with in bacterial enzyme system, thereby disrupting the metabolism of the microorganisms. Sodium hypochlorite has an antimicrobial effect as long as free chlorine is available in the solution. Sodium hypochlorite may damage permanent tooth follicle, peripheral tissues and oral mucosa, if used as an irrigant in deciduous teeth. Pashley et al (1985) and Yesilsoy et al (1995) reported pain, swelling, ecchymosis, bleeding from root canal or even long term paresthesia with sodium hypochlorite. However, Sodium hypochlorite (NaOCl), with its antibacterial and dissolving effects on the necrotic tissues, remains the most popular and undisputed root canal irrigant.

Carbolic acid (phenol) is one of the oldest antimicrobial agents used in medicine. Phenol and its derivatives such as formocresol, creastin, parachlorophenol, camphorated phenol and camphorated monochlorophenol have been used in edodontics as root canal disinfectants since past many decades. Carbolic acid in the concentration of 1% to 2 % has shown optimal antimicrobial effect, however concentration as high as 30 % has also been used. Though, studies demonstrate their toxicity, some of the recent studies have shown that the risk of genotoxicity from phenol compounds in endodontics is small. Very small amount of phenol is produced endogenously as a breakdown product of protein metabolism

by the action of bacteria on normal constituents of diet in the gut. In its pure state it is escharotics; when diluted, it is rubefacient, anaesthetic and antiseptic.

The result of our study reported 5.25% Sodium hypochlorite solution to be superior to 5% and 10% carbolic acid solution.

However, this study, being an in vitro study, did not simulate the oral environment, further long term clinical studies evaluating the antimicrobial ability, may be useful in achieving predictable and successful endodontic treatment

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## Gingival Recession and Orthodontics

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### Abstract :

Orthodontic tooth movement applied is brought by prolonged application of force on periodontium. This results in cellular and extra cellular changes within attachment apparatus. Unlike bone and periodontal ligament, which regain their original structure after removal of force, the gingival tissue does not regain its pretreatment structure. This review summarizes the effect of orthodontic force on gingiva- more precisely gingival recession. It also states the various factors responsible to induce gingival recession associated with orthodontic treatment. Importance of synergism between periodontia and orthodontia is also mentioned.



### Key Words :

### INTRODUCTION

Periodontium is functional unit of tooth that includes gingiva, PDL, cementum and alveolar process. Gingiva is part of oral mucosa that covers alveolar process of the jaws and surrounds the neck of the tooth. The main function of gingiva is to protect the surrounding tissues from oral environment<sup>1</sup>.

Normally the position of gingiva is at or above the cemento-enamel junction. Gingival recession is exposure of root surface by apical shift of position of gingiva. Gingival recession can be localized or generalized. Recession is more in males than females and it increases with age<sup>2</sup>. Plaque induced gingival inflammation is the primary etiological factor with next as faulty tooth brushing. Position of tooth, presence of dehiscence and fenestrations, gingival ablation from soft tissues<sup>3</sup>, root bone angle and mesiodistal curvature of tooth surface<sup>4</sup> is the anatomical factors for gingival recession<sup>5, 6</sup>. Faulty tooth brushing, improper restoration and orthodontic labial movement leads to gingival recession<sup>1,5,7,and10</sup>.

Recession causes exposure of root surface and makes it sensitive and prone to caries. Even hyperemia of pulp occurs with excessive exposure of root surface<sup>9</sup>. Inter proximal

recession causes oral hygiene problem and there by accumulation of plaque and thus causing an eyesore appearance<sup>1</sup>.

The question orthodontic forces may have negative effect on the periodontal tissue has been evaluated through a number of clinical and experimental studies. Orthodontic tooth movement is brought about by prolonged application of force on attachment apparatus. As shown in numerous studies, tooth movement is achieved after the remodeling of alveolar bone and the response of the periodontal ligament to the mechanical force. But the gingival changes have also been found to be an important factor in an overall response<sup>10</sup>. Unlike bone and periodontal ligament, gingiva does not regain its pretreatment structure. Optimal forces can induce favorable tissue response, but whenever the balance is lost there is bad effect on the periodontal support<sup>11</sup>.

### REVIEW OF LITERATURE

It is a controversial topic whether orthodontic treatment is the only culprit for the gingival recession. There is also controversy that whether orthodontic treatment causes permanent damage to PDL or just causes marginal periodontitis.

Chronic infection, hyperplasia, gingival recession, irreversible loss of attachment and incomplete closure of extraction site are effect of orthodontic treatment. Mandibular incisors have highest risk for gingival hyperplasia. Predisposing factors or anatomic factors<sup>5, 6</sup> responsible for gingival recession are thin cortical plate, inadequate width of attached gingiva and

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amount of proclination of the incisors. Class II div 2 malocclusion having deep bite causes trauma and thereby gingival recession<sup>8</sup>. Plaque and gingivitis inhibit proliferation of cells necessary for repositioning of gingiva. Multiple factors such as amount of plaque, host resistance, presence or absence of systemic disease are responsible for the periodontal reaction along with orthodontic appliances<sup>5,7</sup>.

Inadequate arch length and severe rotation and crowding, less than 2mm of attached gingiva width, trauma from functional malocclusion like mandibular incisor cross bite and edge to edge malocclusion, aggressive tooth brushing, lip piercing; high frenum attachment contributes in recession<sup>6,12,13</sup>.

A case control study, done for the labial movement of mandibular incisors statistically does not signify that labial movement of incisors by orthodontic treatment causes the gingival recession<sup>11,14</sup>.

Study done for the post surgical effect of lefort I osteotomy on periodontal and pulpal condition of maxillary central incisors shows that 5% of the total teeth become unresponsive and 2.5 % of it undergoes root resorption, which seems to be of negligible clinical significance<sup>15</sup>.

Some authors<sup>10</sup> states that two disparate processes occur after transduction of orthodontic force on gingiva. First is injury to the connective tissue and second is the genes of collagen and elastin are activated whereas of tissue collagenase is inhibited, which helps to know the phenomena of relapse and changes in elastic and collagen fibers due to orthodontic force. Also, force compress and retracts the gingiva in contrary to bone and periodontal ligament. An excessive labial movement or lingual movement<sup>16, 17</sup> lead to irreversible change in gingiva leading to its recession.

Amount of deformation is determined by elastic properties of each tissue component. According to Baumrinds hypothesis, PDL is a continuous hydrostatic system, any force applied to it will be transmitted equally in all region of PDL<sup>18</sup>. All three structures tooth, alveolar bone and PDL are deformed.

With synergistic collaboration, orthodontic therapy can enhance periodontal health and periodontal therapy can enhance the orthodontic outcome<sup>19</sup>. In certain clinical situations, vertical bony defects may be corrected by

orthodontically repositioning teeth. Similarly, in restorative cases where, due to the extent of decay, a crown impinges on the needed biologic width of gingival attachment to tooth, and surgical crown lengthening is not practical, orthodontic extrusion of the tooth can be used to recreate biologic width.

Recession develops mostly during active orthodontic treatment and first three years after treatment in children and adolescence. No data is available for long term effect<sup>20,21</sup>. 3% recession is observed in orthodontic proclination of mandibular incisors<sup>20</sup>. Development of new recession or deterioration of existing, however, depends on amount of lower incisor proclination during Herbst treatment<sup>20</sup>. No specific sex predilection is observed.

One of the studies done to know the long term effect on PDL status after orthodontic treatment states that there is no discernible effect on PDL health of orthodontic treatment during adolescence<sup>22</sup>. Intrusion causes periodontitis because it makes supragingival plaque as subgingival. Lack of difference in loss of attachment level implies that there is no adverse effect after long term orthodontic treatment in adolescence.

Hypothesis of the study was that the height of labial alveolar bone would increase as a result of orthodontic up righting of procumbent mandibular incisors in children and adolescence<sup>23</sup>. But no significant correlation was found between changes in the alveolar bone height and amount of proclination of mandibular incisors. It states that during orthodontic treatment involving lingual positioning of procumbent incisors but no intrusion, an increase in buccal alveolar bone height takes place. While a research done by D. Cardaropoli and G. Cornette says that orthodontic intrusion shows reduced gingival recession, both in patient with thin as well as thick gingiva<sup>24</sup>.

Gingival recession in young adults is related to past orthodontic treatment and oral piercing<sup>25</sup>. Along with factors like oral hygiene habits, age and smoking habits, data suggests that gingival recession is present in 14.6% of subjects and 1.6% of all examined teeth. They mentioned that there is no relation of smoking with recession and frequency is more in males than females.

There is quite increase in adult patient in orthodontic field

since last decade. But it is challenge for the orthodontist to maintain the PDL status because usually patients have compromised PDL status. They say that new concept of non surgical and site specific treatment is better than older concepts. Patient with periodontally compromised status have to undergo periodontics treatment 4-6 months before orthodontic treatment and have to maintain at interval of 3-6 months which inturn improves the long term periodontium status in adults.

According to several authors who had done longitudinal study in adults as well as adolescence to seek the effect of orthodontic treatment in their periodontal status; states that though adults are more prone to gingival breakdown, more plaque and periodontal inflammation is observed in adolescence during treatment. In addition to this they have mentioned that tooth movement in patient with reduced but healthy periodontium does not show the significant loss of attachment while loss of tooth occur in severely compromised cases<sup>26</sup>.

Adult patient did exhibit somewhat greater bone loss during treatment, but the differences between their bone loss and that of teenagers during treatment was less than the difference start at the treatment<sup>27,28</sup>. In the absence of compromising condition adult patient are not inherently more likely than adolescent to lose dental support during their treatment.

Resistance to periodontal breakdown reduces with age<sup>29</sup>. Bone loss between restored and unrestored surface does not differ significantly. Loss of attachment depends on tooth movement and length of treatment. Preexistence of periodontal destruction is not a contraindication for orthodontic treatment. During treatment in adults there is increase risk of marginal periodontitis which increases with age without previous loss of attachment as risk factor. But it is not seen in children or adolescence who usually takes orthodontic treatment.

With reduced alveolar bone height, under same load there is increase in tooth movement. With continuation of alveolar bone resorption, the center of resistance ever approximates the alveolar crest. With increase of alveolar bone loss, the study suggested a decrease of the distance between CRes and CRot<sup>27</sup>.

Studies done on periodontal status of mandibular central incisors after orthodontic treatment states that inclination  $>95^{\circ}$  and gingival thickness  $<0.5\text{mm}$  shows more severe recession<sup>30</sup>. On contrary, Garret D, Samer Z, Catherine H<sup>14</sup> from their study done in adolescents concludes that the degree of proclination of mandibular central incisors during fixed appliance therapy was not correlated to the gingival recession. Proclination of mandibular incisors in class III patient<sup>31, 32</sup>,<sup>33</sup> prior to orthognathic surgery is associated with gingival recession, marginal bone loss and dehiscence in that area. Accelerated osteogenic orthodontics, in combination with ridge augmentation by using temporary skeletal anchorage devices<sup>33</sup>, will reduce the post treatment risk for mandibular incisors.

Some authors have evaluated the effect of force on the periodontal tissue<sup>7, 34</sup>. Due to excessive force or heavy force periodontal ligament gets crushed causes ischemia which in turn increase hyalinization and there by delay in tooth movement. Medium force causes strangulation of periodontal ligament which too delays bone resorption while light forces give continuous tooth movement. Jiggling forces will cause angular defects<sup>35,36</sup> due to improper center of resistance, which in turn creates irreversible loss of attachment of gingiva. They also states that short term orthodontic treatment have reversible effect on gingiva while long term treatment causes irreversible effect like loss of attachment and root resorption. Also there is increase in micro flora like lactobacilli and motile organisms up to 2-3 folds during and after orthodontic treatment. Moreover, there is gingival recession in maxillary premolars and molars after treatment of rapid maxillary expansion (RME). Gingival augmentation, free gingival grafts or mucogingival surgeries<sup>12, 34, 36</sup> for anterior gingival recession or ectopically erupted teeth are preferred to prevent further recession during or after treatment.

Arch expansion leads to flattening of curve of Wilson causing flaring of incisors labially through bodily or tipping movement<sup>37</sup>. Expansion may cause bony dehiscence in some individuals. Clinical evidence of phenotypic changes and labial alveolus modeling has been associated with ultra light forces with a novel alveolar development appliance.

A retrospective study<sup>38</sup> in adult patients for the development of the dehiscence<sup>31</sup> during labial movement of mandibular incisors describes the parameters like baseline recession, width of keratinized attached gingiva, gingiva biotype and visual gingival inflammation. Orthodontic treatment does not cause gingival recession significantly<sup>30, 38, 39</sup>. If orthodontic treatment is carried out under biomechanical and periodontal conditions, the risk of periodontal damage secondary to orthodontic treatment can be minimized.

Dehiscence was associated with 51.09% and fenestration with 36.51%, class I malocclusion has more prevalence of developing dehiscence than in class II malocclusion<sup>40</sup>. Alveolar defects are more seen in class I malocclusion before treatment but are not associated with facial forms. Both buccal and lingual side of the teeth is affected. Most affected are mandibular central incisors. Thicker attached gingiva plays a decisive role in preventing recession even when alveolar bone is reduced or absent. Thus, care should be taken in treating teeth with thin gingiva by applying light force.

Careful examination, optimal amount of labio lingual movement, control over tooth movement and width of attached gingiva should keep in mind before an orthodontist starts their comprehensive treatment<sup>5, 41</sup>. Proper and timely combination of orthodontics and periodontics treatment will reduce periodontal condition.

## **DISCUSSION**

Apparently, from articles reviewed there is no evident proof that orthodontic treatment causes the gingival recession. Improper application of force by the clinician, without checking the patient's parameters and criteria's there is definitely chances of worsening the periodontal status<sup>7</sup>. It seems possible that orthodontic therapy involving movement of the incisors out of the osseous envelope of the alveolar process constitutes a risk that recession of the gingiva may result<sup>17</sup>.

Few human trials<sup>11, 22, 25, 26, 30, 31, 38, 39</sup> (includes adolescence and adults) have been done to see the effect of orthodontic treatment on gingival recession. On the basis of clinical trials and follow-ups all concluded that orthodontic treatment does not signify the amount of gingival recession.

Amount of proclination will definitely affect the clinical height of the crown of incisors<sup>16, 17, 23, 31-33</sup>. Up righting the proclined or retroclined incisors and proclination of incisors prior to orthognathic surgery or in treating class III patients the gingival recession will be the adverse effect of orthodontic treatment. Treatment of severe skeletal Class III malocclusion in adults often requires decompensation, including labial inclination of the mandibular incisor teeth before orthognathic surgery. Although this procedure leads to improved facial and dental esthetic outcomes, periodontal complications can result, including bony dehiscences, fenestrations, and gingival recession<sup>42, 43</sup>. The current approach with accelerated osteogenic orthodontics, in combination with ridge augmentation by using temporary skeletal anchorage devices, potentially speaks to these shortcomings. Large-scale prospective multicenter controlled randomized clinical trials are required to definitively verify the efficacy of this technique<sup>33</sup>.

Karen F G, Elton G Z, Wellington P<sup>30</sup>, states that final inclination >95° and free gingival-margin thickness >0.5 mm showed greater and more severe recession in mandibular central incisors. Nevertheless, when comparing thickness to the final inclination, thickness had greater relevance to recession.

Presence of anatomic factors<sup>5, 6</sup> like thin cortical plate, inadequate width of attached gingiva and amount of proclination of the incisors, high frenum attachment and traumatic factors like Class II div 2 malocclusion having deep bite<sup>8</sup>, aggressive tooth brushing habit, oral piercing<sup>6, 12, 13</sup>. Also presence of plaque, systemic disease, host resistance<sup>5, 7</sup> and gingival inflammation or baseline recession, thin gingival biotype<sup>11, 31</sup> or thin symphysis<sup>31</sup> were found to preceding factors for development or increase in gingival recession.

Amount of force applied to the teeth during orthodontic movement affects the status of the periodontium<sup>7, 34</sup>. Light force is constant and beneficial for the movement of teeth; it is in control of the doctor on contrary to heavy force and jiggling force<sup>35, 36</sup>. Jiggling force are worst for the gingiva and alveolar bone as it causes loss of attachment as well as angular bone

defect thus destructing the periodontal status of the patient.

### CONCLUSION:

There is no appropriate study which states that orthodontic treatment causes gingival recession. But there are several studies have proved that excessive proclination or retroclination which requires up righting or proclination will definitely face the problem of gingival recession especially mandibular central incisors. Anatomic factors, heavy forces, bad oral hygiene, deep bite malocclusion, act as predisposing factors.

For successful orthodontic treatment one should be do careful examination of all aspect of the findings present in the patient. Take preventive measures prior to the treatment to make it successful. Synergism should be maintained between periodontia and orthodontia for comprehensive type of treatment in an individual. Proper advice for oral care is important factor to keep in mind.

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## NANODENTISTRY

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### Abstract :

Nanodentistry is the new buzz word for all the fields, its application range from manufacturing of devices, equipments, medications and what not. There is a revolution waiting to take place with further evolution and more and more application of this technology in all the areas. This nanotechnology has already influenced dental products and some new procedural techniques are being researched upon. The new era will belong to nanodentistry and this article makes an attempt to throw light on various aspects of nanodentistry.



### Key Words :

### INTRODUCTION

Dentistry is looking forward to newer dimensions to become more beneficial toward patients. With the recent developments in the field of nanotechnologies, with its wide application in all the fields, a lot is to offer for health care industry.

First we have to understand what nanotechnology is, it is the term used in 1974 by the late Norio Taniguchi (university of Tokyo) to refer to the ability to engineer materials precisely at the scale of nanometers. It is defined as design and fabrication of materials, devices and systems with control at nanometer dimensions.<sup>1</sup> The prefix “nano” derives from the Greek word for “dwarf”. One nanometer (nm) is equal to one-billionth of a meter, or about the width of 6 carbon atoms or 10 water molecules. A human hair is approximately 80,000 nm wide, and a red blood cell is approximately 7000 nm wide. Atoms are smaller than 1 nm, whereas many molecules including some proteins range between 1 nm and larger.<sup>2</sup>

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The basic idea of nanotechnology, used in the narrow sense of the world, is to employ individual atoms and molecules to construct functional structures. The late Nobel Prize winning physicist Richard P. Feynman in 1959 speculated the potential of nanosize devices as early as 1959.<sup>3</sup>

### Types of nanotechnologies

Broadly, nanotechnologies consist of three mutually overlapping and progressively more powerful molecular technologies

Nanoscale-structured materials and devices that can be fabricated for advanced diagnostics and biosensors, targeted drug delivery, and smart drugs

Molecular medicine via genomics, proteomics, artificial biobotics (microbial robots)

Molecular machine systems and medical nanorobots allow instant pathogen diagnosis and extermination, and efficient augmentation and improvement of natural physiological function<sup>11</sup>

Nanotechnology will have future medical applications in the field of nanodentistry. Nanodentistry will make it possible to maintain near-perfect oral health through the use of nanomaterials, biotechnology, and nanorobotics.<sup>4,5</sup> The contributions of these new technologies in the development of innovative materials with nanometric range particles and their daily clinic applications such as nanoparticles, nanotubes and nanocomposites amongst others. The wonderful aspects of these nanoparticles are the new antiwear, antibacterial and antifungicidal properties present in their superficial chemistry. This enables their use in treatments related to the roots of the

teeth. These properties have amazed the dental community, since they can combat *Staphylococcus aureus*, *E. coli*, *Enterococcus faecalis* and *Candida albicans*. When speaking of dentin and enamel regeneration, the combination of tissue bioengineering along with the development of genetically designed trigger nanoparticles, as well as nanoparticles which are biomimetic with mineralized tissues, have begun to bear fruit in the manufacturing of in vitro teeth.<sup>6</sup> A study done by Li et al showed that In summary, the similarity of the 20 nm HAP and the building blocks of enamel apatite result in the effective adsorption of the artificial materials to the natural tissue.<sup>7</sup>

The growing interest in the future of dental applications of nanotechnology is leading to the emergence of a new field called Nanodentistry. Nanorobots induce oral analgesia, Desensitize tooth, manipulate the tissue to re-align and straighten irregular set of teeth and to improve durability of teeth. Further it is explained that how nanorobots are used to do preventive, restorative, curative procedures.

#### *Major tooth repair*

Nanodental techniques involve many tissue engineering procedures for major tooth repair. Mainly nanorobotics manufacture and installation of a biologically autologous whole replacement tooth that includes both mineral and cellular components which leads to complete dentition replacement therapy.

#### *Tooth Durability and Appearance*

Nanodentistry has given material that is nanostructured composite material, sapphire which increases tooth durability and appearance. Upper enamel layers are replaced by covalently bonded artificial material such as sapphire. This material has 100 to 200 times the hardness and failure strength than ceramic. Like enamel, sapphire is a somewhat susceptible to acid corrosion. Sapphire has best standard whitening sealant, cosmetic alternative. New restorative nano material to increase tooth durability is Nanocomposites. This is manufactured by nanoagglomerated discrete nanoparticles that are homogeneously distributed in resins or coatings to produce nanocomposites. The nanofiller include an aluminosilicate powder having a mean particle size of about 80nm and a 1:4ratio of alumina to silica. The nanofiller has a refractive index of 1.503, it has superior hardness, modulus of elasticity, translucency, esthetic appeal, excellent

color density, high polish and 50% reduction in filling shrinkage. They are superior to conventional composites and blend with a natural tooth structure much better.

### **Nano Impression**

Impression material is available with nanotechnology application. Nanofiller are integrated in the vinylpolysiloxanes, producing a unique addition siloxane impression material. The main advantage of material is it has better flow, improved hydrophilic properties hence fewer voids at margin and better model pouring, enhanced detail precision.<sup>8</sup>

### **Regeneration**

Likewise, results obtained when using nanohydrogel in a cellular co-culture with a nanofiber net transporting in their interior particles loaded with the dental sialoprotein gene, indicate that pluripotential cells can be organized in an array of cellular layers which transform into dental and enamel tissue which are similar to tissues found in the natural tooth.<sup>9</sup>

Nanomaterials can also be grown or self-assembled into nanotubes/nanofibers which can even more accurately simulate the dimensions of natural entities, such as collagen fibers. After decreasing material size. Even though it was a field in its infancy a decade ago, currently, numerous researchers fabricate cytocompatible biomimetic nanomaterial scaffolds encapsulating cells (such as stem cells, chondrocytes and osteoblasts, etc.) for tissue engineering applications. In this review, we will focus on

Although many challenges may lie ahead, synthetic nanomaterials can mimic properties of the natural ECM and thus, show great potential for numerous tissue engineering applications. Particularly, due to their excellent cytocompatibility properties, research interest has been evoked to use nanomaterials as the next generation of tissue repair materials.<sup>10</sup>

### **Nanophase Materials**

are promising materials for various bioapplications, because human tissues are composed of nanometer components (proteins, inorganics).

## Nanophase Hydroxy Apatite

the adhesion and proliferation of osteoblasts are significantly greater on nanophase hydroxy apatite (HA) than on conventional HA. Therefore, nanophase HA clearly represents a unique and promising class of maxillofacial implant formulations with improved osseointegrative properties. Apart from nanostructured HA, both nanophase alumina and titania demonstrate the same properties. HA nanoparticles used to treat bone defects are Ostim HA (Osartis GmbH, Germany). Vitosso (Orthovita, Inc) HA + TCP (tricalcium phosphate), and NanOSSTM HA (Angstrom Medica).

## Nanophase Carbon

Carbon nanofibers have exceptional theoretical mechanical properties that, along with possessing nanoscale fiber dimensions similar to crystalline HA found in bone, suggest strong possibilities for use as a maxillofacial implant material.<sup>12</sup>

## Local Anesthesia

In the era of nanodentistry a colloidal suspension containing millions of active analgesic micron-size dental robots will be instilled on the patient's gingiva. After contacting the surface of crown or mucosa, the ambulating nanorobots reach the pulp via the gingival sulcus, lamina propria and dentinal tubules.

Once installed in the pulp, the analgesic dental robots may be commanded by the dentist to shut down all sensitivity in any particular tooth that requires treatment. After oral procedures are completed, the dentist orders the nanorobots to restore all sensation, to relinquish control of nerve traffic and to egress from the tooth by similar pathways used for ingress.<sup>5,13</sup>

## Hypersensitivity Cure

Dental nanorobots could selectively and precisely occlude selected tubules in minutes, using native biological materials, offering patients a quick and permanent cure.<sup>5,13</sup>

## Dental Durability and Cosmetics

Tooth durability and appearance can be improved by replacing upper enamel layers with pure sapphire and diamond, which

can be made more fracture resistant as nanostructured composites, possibly including embedded carbon nanotubes.<sup>5,13</sup>

## Photosensitizers and Carriers

“Quantum dot” nanocrystals are tiny particles measuring only a few nanometers across, about the same size as a protein molecule or a short sequence of DNA. Quantum dots can be used as photo sensitizers and carriers.<sup>5,13</sup>

## Orthodontics

In orthodontics, nanoparticles are being applied to control pain signaling, and increase nerve branching through the use of nanospheres filled with factors which induce nervous tissues regeneration.<sup>6</sup>

## Implantology

implantology will benefit with the development of a material named nanobone which closely imitates the structure and composition of real bone. This will turn titanium artificial implants in a matter of the past. This is due to the fact that nanobone implants possess a greater capacity to interact with live tissues, and allows for the self-repair of the body, since the body, upon recognizing it like a similar nanomaterial, tries to develop into it. Bearing this in mind, in the areas of surgery and implantology, scientists are creating intelligent» implants. These implants are able to detect which type of tissue is developing on them, to communicate this information to a hand device and liberate, drugs as needed to promote tissue development. These implants are designed as well to help avoid complications that can normally be found after a bone implant. These complication can be infections, inflammation (or scar development), loosening of the implant, and, in cases of bone cancer, recurrence of the disease. Scientists have also been studying implants which have intrinsic mechanisms to protect the body from infections or to inhibit cancer development. These implants are made of silver, zinc, zirconium selenium and chrome.<sup>6</sup>

## Challenges for nanodentistry

Basic engineering problems from the precise positioning and assembly of molecular scale parts, Biocompatibility, Cost

factor, Larger social issues of public acceptance, ethics, regulation and human safety

### Conclusion

Nanodentistry is the new pathway for the dentistry in which nanotechnology will fuel every equipment, device and material. With some limitations and challenges it might well work out wonders in terms of as biomimetically close solution possible which will be able to work for a lifetime of the patient and become a one stop solution.

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## Autonomy as a Premise of Ethics

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### Abstract :

A large component of philosophy consists of various approaches to the concept and implication of ethics. A philosophical study of moral issues of right and wrong is called ethics, and deals with the moral duties of the professional dental surgeons toward their patients, society or community and their colleagues. Ethical delivery of dental healthcare assumes greater relevance with the rapid advances in dental healthcare technologies and innovations in several areas of investigations and treatment. This article reviews the philosophy of ethics and ethical principles that the dental surgeon should follow.



**Key Words :** Ethics, Philosophy, Principles, Duties, Obligations

### INTRODUCTION

The ethics of any profession is self-inflicted and voluntarily accepted and not imposed by legislation. It is aimed at establishing and maintaining an honorable pattern of behavior recognized by members of the community.<sup>1</sup>

Since time immemorial, in the profession of dentistry, the code of ethics is outlined by the Hippocratic oath, which is a vow taken by professionals who are entitled or given an opportunity to practice. The Hippocratic Oath contains the Pythagorean duties of justice, secrecy, respect for teachers, and solidarity with peers.

The spectrum of ethical systems ranges from duty-oriented ethics to consequence-oriented ethics. The former is a static type of ethical system, which is based on religious concepts, whereas, the latter one is an evolutionary type of ethical system that is based on utilitarian thoughts. The utilitarian type of ethical system serves to be a better option for the development and advancement in the field of medical and dental science.

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It is noteworthy that before the time of Hippocrates, the branch of medicine was based only on religious aspects. Therapeutic attempts were based on religious or magical beliefs and were commonly practiced by priests, spiritual healers, and witch-doctors.<sup>2</sup>

Dental ethics is an unwritten code, but there are certain guidelines that have been laid down for the information of the members of the profession. Dentistry, being one of the healing arts, has derived its code of behavior from the Hippocratic Oath.

The word 'ethics' is derived from the Greek word 'ethos' meaning custom or character. It is the philosophy of human conduct, a way of stating and evaluating principles by which problems of behavior can be solved. It is concerned with evaluation of human conduct and standards, and judging whether the actions are right or wrong.<sup>3</sup> Ethics is that branch of the discipline of philosophy that studies morality. It is the 'science' of the moral<sup>4</sup>

The question of ethics for dental surgeons should extend beyond a listing of right or wrong actions so that the dental association defines it as their code. In the late twentieth century, obvious changes have been observed regarding what is morally or ethically acceptable to the society; the dental professionals should equip themselves with the ability to cope with the change and maintain the highest ethical values.

When it comes to decision-making for the treatment aspect also, ethics play an important role. The relationship between a dentist and a patient may be based on three ethical models:

1. **Paternalistic model:** In this type of ethical model, the dentist knows what is right for the patient and chooses the best treatment option for him without giving importance to what the patient desires. In other words, the dentist considers himself to be the father of the patient. This type of relationship totally neglects the patient's expectations, for example, if a dentist plans to close the diastema with a restoration, it might not be liked by the patient as he considers it to be a part of his identity.
2. **Engineering model:** In this type of ethical model the health scientist is as detached as an objective scientist and leaves complete decision control to the patient. This type of relationship is also not favorable as it leaves no room for the dentist's decision and also the patient's expectations can be sometimes unrealistic, which cannot be met practically.
3. **Social contract model:** This ethical model is based on genuine human interaction, on the grounds of humanism and friendship (philanthropy) in which both the dentist and the patient accept mutual obligations and rights. This is the most accepted and most favorable type of ethical model.

### What's Special About Dental Ethics?

Compassion, competence and autonomy are not exclusive to dentistry. However, the practice of

dentistry requires dentists to exemplify these values to a higher degree than in other occupations, including some other professions.

Compassion, defined as understanding and concern for another person's distress, is essential for the

practice of dentistry. In order to deal with the patient's problems, the dentist must identify the symptoms that the patient is experiencing and their underlying causes and must want to help the patient achieve relief. Patients respond better to treatment if they perceive that the dentist appreciates their concerns and is treating them rather than just their illness.

A very high degree of competence is both expected and required of dentists. A lack of competence can have serious consequences for patients. Dentists undergo a long training period to ensure

competence, but considering the rapid advance of dental knowledge, it is a continual challenge for them to maintain their competence. Moreover, it is not just their scientific knowledge and technical skills that they have to develop and maintain but their ethical knowledge, skills and attitudes as well, since new ethical issues arise with changes in dental practice and its social and political environment.

Autonomy, or self-determination, is the core value of dentistry that has evolved the most over the years. Individual dentists have traditionally enjoyed a high degree of clinical autonomy in deciding where and how to practice. Dentists collectively (the dental profession) have been free to determine the standards of dental education and dental practice. As do physicians, dentists consider that clinical and professional autonomy benefits not just themselves but patients as well, since it frees dentists from government and corporate restraints on providing optimal treatment for patients. As will be evident throughout this Manual, governments and other authorities are increasingly restricting the autonomy of dentists. Nevertheless, dentists still value their autonomy and try to preserve it as much as possible. At the same time, there has been a widespread acceptance by dentists worldwide of patient autonomy, which means that patients should be the ultimate decision makers in matters that affect themselves. This Manual will deal with examples of potential conflicts between the dentist's autonomy and respect for patient autonomy.

### Evolution and Philosophy of Ethics

The original ethical concept was based upon mysticism. Tracing the history of ethics, it has been progressing gradually into the world of mystery, which speculates on the unknown. Subsequently, people started accumulating and recording knowledge based on their facts. In the history of Egypt and Babylonia, people were interested in their destiny and belief in life hereafter. The Egyptian 'Book of the Dead', dated 3500 B.C., describes immortality of the soul and lists many behaviors that were conducive to a desirable destiny. Prior to 1000 B.C., India produced the 'Vedas'. Among the expanded versions of the Vedas, were the Upanishads, which were remarkable for their discourses on many problems such as ethics, God, death, and immortality.<sup>3,4</sup>

The founder of a philosophy with a scientific basis was the

Athenian Epicurus (341-270 BCE). Asclepiades (124-40 BCE) of Bithynia is recognized as the first physician who was proficient in both philosophy and medicine. He was influenced by the teachings of the Epicurean philosopher Zeno of Sidon (in present-day Lebanon).<sup>2</sup>

During the middle ages, philosophy and religion were united together by a common ethical interest and there was a transformation of old concepts to the new one. Individuals were recognized as Christians and scientific discoveries sparked the revival of learning.

The Nineteenth Century was generally a time of equality and plenty for all, and the scientific theory became more pronounced during these years.

The Twentieth Century brought a great variety of moral beliefs, allowing a freedom in which each person could select his own values.

Johnson, in 1946, stated that philosophical approaches were better than a dualistic approach to ethics, which may provide dental professionals with the understanding to fashion a more eclectic approach to professional personal ethics.

Brinton, in 1950, stated that ethics was only a matter of two paths to follow and it was intensified by the fact that there was no provision for absolution of sins and an afterlife to cleanse the soul of its impurities so that the minor offenders could move on to heaven.

Durant, in 1954, stated in his book, 'The story of philosophy' that the ancient Greek philosophers Plato and Aristotle viewed ethics as a value to be strived for, which was the basis of harmony in life and personal happiness.

Sabatier, in 1957, gave the either/or approach to ethics and morality remained intact.

According to B.F. Skinner, in 1971, ethics was a matter of performance discrepancy, devoid of personal values, and consisting mainly of activities that had to be learned by the management of the contingencies.

Nash, in 1984, stated that ethics was the key to expressing mutual respect among people and a normal and expected phenomenon for persons whose environment had enabled the ethical values to emerge and develop.

Bertolami, in 2004, identified three specific weaknesses in a typical ethics curriculum:<sup>5</sup>

1. Failure to recognize that more education is not the

answer to everything

2. Ethics is boring
3. Course content is qualitatively inadequate because it does not foster an introspective basis for true behavioral change.

A fourth element, an innovation, is directed to this third weakness and entails implementing a pre-curriculum very early in the dental educational experience, to address the disconnect between knowledge and action.

In an answer to this, Jenson, in 2004, did not agree to statements given by Bertolami and stated that Bertolami's article stimulated discussion on what exactly we needed to do to help students and colleagues make the right decisions, when they otherwise would not, even though they knew better.<sup>6</sup>

With this background, Johnson stated that people tend to search for external guidelines for the right conduct and spend a good deal of energy identifying to whom they should report their behavior.

### Codes of Professional Ethics

The purpose of these codes is to achieve a high level of ethical consciousness, decision-making, and practice by the members of the profession. These codes are as follows:<sup>7</sup>

- Increasing ethical and professional consciousness and the sense of ethical responsibility
- Recognition of ethical issues by the members and making a more informed ethical decision
- Establishing a standard for professional judgment and conduct
- Provide a statement of the ethical behavior that the public can expect from the members

### Ethical Principles

Moral conduct and judgment are dealt with in the philosophy of ethics. There are several principles that dental professionals must be aware of in their clinical practice. The major principles are:<sup>3</sup>

- a. To do no harm (non-maleficence)
- b. To do good (beneficence)
- c. Respect for persons
- d. Justice

- e. Veracity or truthfulness
- f. Confidentiality.

### Duties and Obligations of the Dental Surgeon

#### Toward patient/population

The first principle of medicine enunciated in the Hippocratic Oath is that the doctor's first duty is toward his or her patients. The major ethical principles that can guide in the performance of these duties are as follows:

- a. To do no harm (non-maleficence): To do no harm or non-maleficence is generally attributed to Hippocrates. It is the main foundation of social morality. The dental care professionals support this principle, but sometimes they feel guilty of transgressions that go beyond a limitation by breaking a rule or law. Iatrogenic disease is the term given for the illnesses caused by doctor to the patient whether knowingly or unknowingly.

This is the first macro-ethical principle and the investigator has the responsibility to not harm individual subjects as well as the whole population, in the population-based research studies.

- b. To do good (beneficence): To do good, or beneficence also traced to Hippocrates, is required for all dental care providers. The role of dental surgeons and dental hygienists should be to benefit patients, as also not to inflict harm. The expectation of the patient is that the care provider will initiate beneficial action and that there is an agreement between the dental surgeon and the patient that some good will result. Therefore, attempts should be made to maximize the benefits and minimize the harm.
- c. Respect for persons: Respect for persons incorporates mainly two ethical principles such as autonomy and informed consent. Autonomy dictates that healthcare professionals respect the patient's capacity for self-determination in making decisions concerning their treatment, and informed consent is an essential component of a patient's right to autonomy.
- d. Justice: The primary duty of the dental professional is to serve the patients irrespective of class, creed, and so on. Justice demands that each person be treated equally. The principle of justice calls for an obligation to protect the

weak and to ensure equity in rights and benefits, both for groups and for individuals.

- e. Truthfulness or veracity: The patient-doctor relationship is based on trust. Lying shows disrespect to the patient and threatens the relationship. The dental surgeon may feel that the patient should take some action and manipulates the information given to him. Whatever the reason, ultimately the relationship will suffer and the dental surgeon will be guilty of transgressing this principle. [7]
- f. Confidentiality: Confidentiality is a principle that can be traced to the Hippocratic Oath and exists today in the International Code of Medical Ethics, the principles of ethics of the American Dental Association (ADA), American Dental Hygienists' Association (ADHA), and the American Dental Assistants Association. Patients have the right to expect that all communications and records pertaining to their care will be treated as confidential. Dental surgeons should respect the confidentiality of client information.

#### Toward Profession/Professional Colleagues

The dental surgeon has to remember that the treatment and cure of the disease depends on the skill and prompt attention showed to the patient. The dentist has to be sober, courteous, sympathetic, helpful, modest, and punctual.

Dental surgeons should conduct professional activities and programs and should develop relationships with their colleagues honestly, respectfully, and with full responsibility. They should encourage a work environment that minimizes risk to their personal health and that of their colleagues, and promotes individual professional growth and development.<sup>7</sup>

#### Towards The Society

Dental surgeons should assume leadership in the community and should recognize and uphold the laws and regulations governing their profession. They should participate in the dental health education of the public by promoting measures that improve the dental health of both the individual and the community.

The aspects mentioned in the Hippocratic oath should always be kept in mind by the dental professionals so as to fulfill the

duties and obligations toward the patient, profession, and the society.<sup>1</sup>

- Practicing the profession with a conscience and dignity
- Patient's health should be given first priority
- Secrets have to be respected, which are confined
- Respect should be given to the teachers, with gratitude
- Colleagues should be considered as brothers or sisters
- No consideration should be given to religion, nationality, race, party politics or social standings
- Surrender life for the service of humanity
- Maintain utmost respect for human life

Research on dental profession should be encouraged and while conducting researches on human subjects, the ethical principles have to be followed with due respect. The primary purpose of dental research involving human subjects is to understand the causes, development, and effects of the diseases and to improve the preventive, diagnostic, and therapeutic interventions. Investigators should promote respect for all human subjects and their health and rights, and should consider the ethical, legal, and regulatory norms and standards for research involving human subjects in their own countries, as also the applicable international norms and standards.

### Does Dental Ethics Change?

There can be little doubt that some aspects of dental ethics have changed over the years. Until recently dentists had the right and the duty to decide how patients should be treated and there was no obligation to obtain the patient's informed consent. In contrast, the U.K. General Dental Council now advises dentists that: "It is a general legal and ethical principle that you must get valid consent before starting treatment or physical investigation, or providing personal care, for a patient. This principle reflects the right of patients to determine what happens to their own bodies, and is a fundamental part of good practice." Many individuals now consult the Internet and other sources of health information and are not prepared to accept the recommendations of dentists unless these are fully explained and justified. Although this insistence on informed decision making is far

from universal, it does seem to be spreading and is symptomatic of a more general evolution in the patient-dentist relationship that gives rise to different ethical obligations for dentists than previously.

Until recently, dentists generally considered themselves accountable only to themselves, to their colleagues in the dental profession and, for religious believers, to God. Nowadays, they have additional accountabilities – to their patients, to third parties such as managed health care organisations, to dental licensing and regulatory authorities, and often to courts of law.

Dental ethics has changed in other ways. Whereas until recently the sole responsibility of dentists was to their individual patients, nowadays it is generally agreed that dentists should also consider the needs of society, for example, in allocating scarce health care resources. Moreover, advances in dental science and technology raise new ethical issues that cannot be answered by traditional dental ethics. Health informatics and electronic patient records, changing patterns of practice and expensive new devices have great potential for benefiting patients but also potential for harm depending on how they are used. To help dentists decide whether and under what conditions they should utilise these resources, dental associations need to use different analytic methods than simply relying on existing codes of ethics.

Despite these obvious changes in dental ethics, there is widespread agreement among dentists that the fundamental values and ethical principles of dentistry do not, or at least should not, change. Since it is inevitable that human beings will always be subject to oral disease, they will continue to have need of compassionate, competent and autonomous dentists to care for them.

### Discussion

The American Dental Association has put forward the statement that constitutes the 'Principles of Ethics and Code of Professional Conduct'. The purpose is to uphold and strengthen the dental profession as a member of the learned profession.<sup>7</sup>

The National Board for Certification (NBC) believes that the guidelines stated in the ethical standards are fair and reasonable and represent the desirable code of professional conduct for dental technology.

Practicing dental surgeons assume the obligation of maintaining and enriching the profession. Each and every member shall choose to meet this obligation according to the dictates of his/her personal conscience. This is based on the needs of the general public that the professional dental surgeons have committed to serve.

There exists a need to teach professional ethics in dentistry and the appropriate goals for teaching professional ethics have been identified:<sup>8</sup>

- To sensitize student dentists to the moral dimensions of professional life and practice
- To develop in student dentists, the skills of ethical analysis
- To foster in student dentists respect for disagreement and toleration of ambiguity
- To assist student dentists in explicating the moral responsibilities incurred in becoming a member of the profession of dentistry
- To motivate the student dentists' continued learning in the field of professional ethics

'Ethical imperialism' is the term for imposing the values and priorities of rich countries on the developing world. Countries differ in the level of material progress and even within each country there may be people of different cultures, although cultural values and social mores must be respected, our aims and objectives of the studies should be to stimulate change in certain customs or constitutional behavior, so as to deal effectively with risks to health, which often require advocacy. It is possible to be an advocate and at the same time preserve sound scientific judgment and ethical values.

Individual dentists and organized dentistry alike invariably claim to be (members of) a profession. This label is cherished because it suggests a special social, moral, and political status. An occupation cannot simply claim professional status. That status must be granted by the public.<sup>9</sup>

Dentistry qualifies as a profession, but that is also exhibiting a trend toward once again becoming a business (as it was before the nineteenth century). For the sake of honesty with the public, dentistry must make a choice between these two models.<sup>10</sup>

Professional etiquette refers to the way dentists relate to one another and is governed by the ADA Code of Professional

Conduct, which expresses specific types of conduct that are either required or prohibited. Sometimes, ethics and etiquette may be in conflict. The problem of financial issues that conflict with ethical ones is discussed along with the problem of commercialism, in the practice of dentistry. Debts from dental school may adversely affect the professional behavior of young dentists, while general dentists might succumb to 'goodies' provided by specialists. These often include continuing education courses, gifts, trips, and kickbacks. Specialists may fail to inform the patients of the improper or poor quality of treatment by the referring general practitioner, fearing loss of referrals. These problems require fixing for the future of ethical dental practice.<sup>11</sup>

## Conclusion

The dental profession and the individual dental surgeons have a duty to recognize the reciprocity of the relationship that exists with society, and the duty of covenantal fidelity. The dental surgeon has a duty to conduct his or her professional life in accordance with the ethical principles rooted in the moral rules and to maintain his or her level of knowledge and skill current. These are the principles of beneficence, autonomy, and justice, in both individual and societal contexts. The dental surgeon has an obligation to participate in the professional community to help ensure distribution of society's resources and to share the burden of professional self-regulation, just to the extent that such a privilege is granted by society. The current Principles and Code are helpful expressions of dentistry's professional obligations, but are deficient in not speaking about the reciprocity of the relationship, the principle of self-determination, and not providing for societal participation in the covenant agreement.

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