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## Dentistry and Otolaryngology

Antibacterial Activity

Modified Lingual Spurs

**Highlights**

Modified Cast Dowel

Assessment of Awareness

Discovering Thoughts, Inventing Future

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DENTISTRY AND OTOLARYNGOLOGY

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## Evaluation of the Antibacterial Activity in Pomegranate Peels and Arils by using Ethanolic Extract against *S. Mutans* and *L. Acidophilus*

By Fatemeh Nikfallah, Adith Venugopa, Harsh Tejani & Hemanth T. Lakshmikantha

*University of the East, Manila, Philippines*

**Abstract-** The use of antibiotics has revolutionized the treatment of various enteric bacterial infections. However, their indiscriminate use has led to an alarming increase in antibiotic resistance among microorganisms, thus necessitating the need for development of novel antimicrobials. The main objective of this study is to evaluate antibacterial activity of pomegranate fruit extract on selected bacterial culture. Antibacterial activity of pomegranate was tested on MRS agar plates by employing punch well technique. Various concentrations of the peels, arils and peels and arils mixture (1:1) prepared by dissolving in Dimethyl Sulphoxide to obtain a final concentration of 10g/ml, 5g/ml, 2.5g/ml and 1.25g/ml against the test organisms. The sensitivity of bacterial strains to aqueous and alcoholic extracts of the peels and arils of *Punica granatum* calculated by measuring the diameter of inhibition zone.

**Keywords:** pomegranate (*punica granatum*) peels, arils, *S. mutans*, *L. acidophilus*.

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# Evaluation of the Antibacterial Activity in Pomegranate Peels and Arils by using Ethanolic Extract against *S. Mutans* and *L. Acidophilus*

Fatemeh Nikfallah <sup>α</sup>, Adith Venugopal <sup>σ</sup>, Harsh Tejani <sup>ρ</sup> & Hemanth T. Lakshmikantha <sup>ω</sup>

**Abstract-** The use of antibiotics has revolutionized the treatment of various enteric bacterial infections. However, their indiscriminate use has led to an alarming increase in antibiotic resistance among microorganisms, thus necessitating the need for development of novel antimicrobials. Then main objective of this study is to evaluate antibacterial activity of pomegranate fruit extract on selected bacterial culture. Antibacterial activity of pomegranate was tested on MRS agar plates by employing punch well technique. Various concentrations of the peels, arils and peels and arils mixture (1:1) prepared by dissolving in Dimethyl Sulphoxide to obtain a final concentration of 10g.ml, 5g.ml, 2.5g.ml and 1.25g.ml against the test organisms. The sensitivity of bacterial strains to aqueous and alcoholic extracts of the peels and arils of *Punica granatum* calculated by measuring the diameter of inhibition zone. Result showed combination of peels and arils extract has greater inhibitory effect. Arils have no inhibitory effect against selected organisms. Result showed combination of peels and arils have greater antibacterial effect than pure peel extract. Also result showed combination of peels and arils have greater antibacterial effect on *L. acidophilus* in comparison with pure peel extract. Also result showed pure peel extract has greater antibacterial effect on *S. mutans* in comparison with combination of peel and arils extract.

**Keywords:** pomegranate (*punica granatum*) peels, arils, *S. mutans*, *L. acidophilus*.

## I. INTRODUCTION

*Punica granatum* is one of the oldest known edible fruits. It has been widely used in traditional medicine worldwide for the treatment of different types of diseases (Olapour et al., 2010). Also several antioxidant activities, including radical-scavenging ability, ferrous ion chelating and ferric ion reducing antioxidant power, were identified on *P. granatum*.

Research showed low concentration of *P. granatum* extract led to delay in *S.aureus* growth, while in a higher concentration of *P.granatum* extract, growth of *S.aureus* was eliminated (Braga et al., 2005). *P. granatum* also has antibacterial activity against *B. subtilis*, *E. coli*, *S. aureus* and *Klebsiella* (Fawole et al., 2012). Investigation on the chemical composition of pomegranate fruit led to identification of cyanidin-3-glucose, quercetin, gallic acid, pelargonidin-3-galactose and myricetin which has antibacterial activity

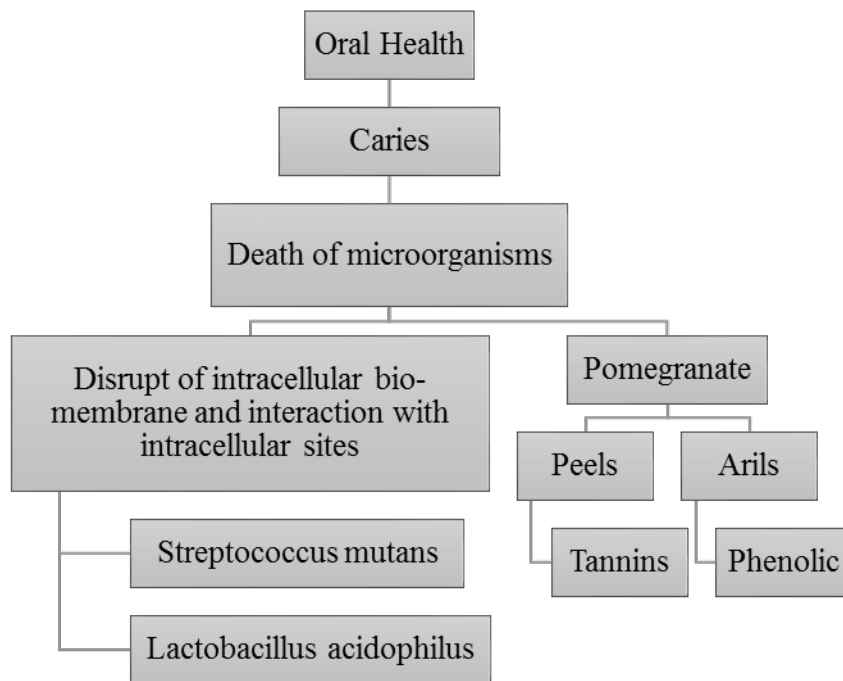
against *E. coli* and *B. subtilis*. Also research has shown that gallic acid has the highest antibacterial activity against *E. coli* and *B. subtilis* and the antibacterial activity of the compounds was due to the structural similarities of the compounds (Naz et al., 2007).

Although studies shows *Punica granatum* has antibacterial potential against few bacterial strains but there is lack of investigation on antibacterial property of *Punica granatum* against oral bacterial. Also the indiscriminate use of antibiotics led to an increase in antibiotic resistance between different microorganisms. This situation shows the need for development of novel antibiotics (Das et al., 2010).

Streptococcus mutans is the main microbial factor in dental caries and colonization of these bacteria in children is associated with dental caries (Lehl et al., 1999). Distribution of dental caries can be effectively reduced by reducing the carbohydrate in the diet and also result shown the number of oral lactobacilli has correlation with the amount of carbohydrate in the diet (Jay et al., 1938).

The aim of the study is to compare and measure antimicrobial effect of arils and peels extract of pomegranate between *S. mutans* and *L. acidophilus* which are main microbial factor in dental caries.

Conceptual or Theoretical Framework



## II. MATERIALS AND METHODS

### a) List of Materials

1. *Streptococcus mutans* and *Lactobacillus acidophilus*
2. Pomegranate
3. 95% Ethanol
4. MRS Agar
5. Dimethyl Sulphoxide (DMSO)
6. Disk paper
7. Whatman Filter paper
8. Micropipette
9. Micropipette tips
10. Incubator
11. Autoclave
12. Laminar Hood

### b) Preparation of Bacterial strain

Bacterial strains purchase from national institute of molecular biology and biotechnology (BIOTECH) University of the Philippines Los Baños, Laguna, Philippines.

### c) Methods of Extraction

Fresh pomegranate arils and peels were cleaned and separated. The peels and arils separately grounded blender. Fifty grams of blended peels or arils placed in 250ml Erlenmeyer flasks, followed by adding 100 ml of 95% ethanol. The flasks then shacked at room temperature for 18 h prior to filtration with Whatman paper. The filtrated mixtures were concentrated under reduced pressure using rotary evaporator at 40 °C. These crude extracts were kept at 4 °C until use.

### d) Measurement of Antibacterial Activity

Antibacterial activity tested on MRS agar plates by employing Punch well method. Various concentrations of the peel, arils and peel and arils mixture (1:1) prepared by dissolving in Dimethyl Sulphoxide (DMSO) to obtain a final concentration of 10g.ml, 5g.ml, 2.5g.ml and 1.25g.ml against the test organisms. The test inoculums swabbed uniformly onto the MRS agar plates and wells of diameter 8mm were punched out in each plate. 30µl of each of these extracts were pipetted out into these wells, the plates incubated upright at 37°C overnight. Dimethyl sulfate used as negative control. The sensitivity of bacterial strains to aqueous and alcoholic extracts of the different extract of *Punica granatum* calculated by measuring the diameter of inhibition zone. Bacteria showing a clear zone of inhibition >4mm considered to be sensitive. Experiments performed in triplicates for each combination of extract and the bacterial strain.

### e) Statistical Analysis

Result from experiment subjected to statistical ANOVA test. P-values < 0.05 considered as statistically significant. Graphs prepared using MS Excel 2010.

## III. RESULTS AND ANALYSIS

Result of ANOVA analysis showed there is significant difference between different concentration of different extract (P<0.01). Also result showed there is significant difference on inhibition of *S. mutans* and *L. acidophilus* in treated with different extract with different concentration (p<0.01)

Result showed combination of peels and arils extract has greater inhibitory effect. Result showed Arils

has no inhibitory effect against selected organisms. But result showed peels have inhibitory effect.

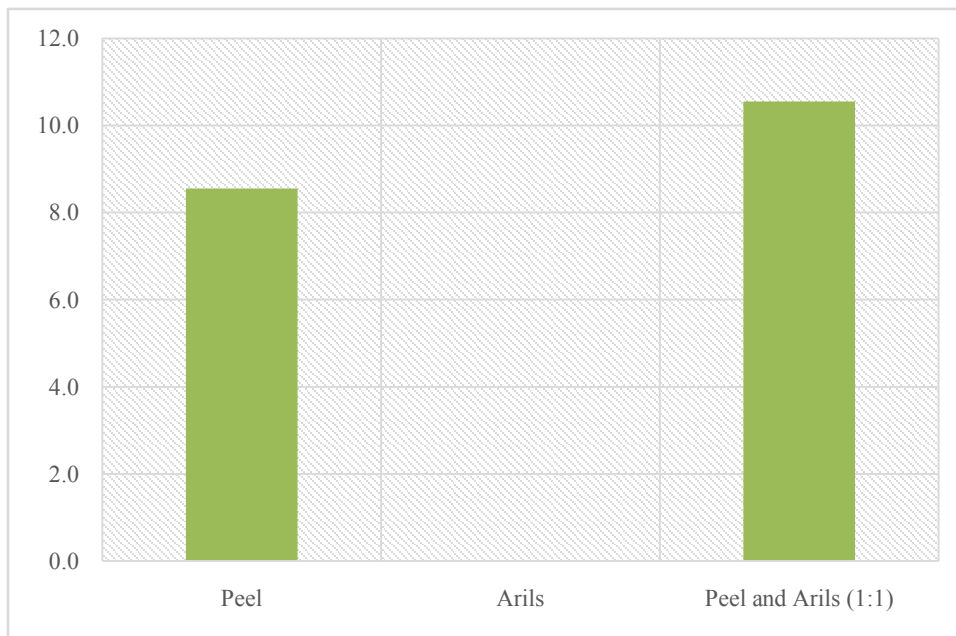


Figure 1 : Antibacterial effect of different extracts

Result showed by decrease in concentration of peel extract antibacterial effect of peel was decreased

(Figure 2) and *S. mutans* is more sensitive to peel extract than *L. acidophilus* (Figure 3).

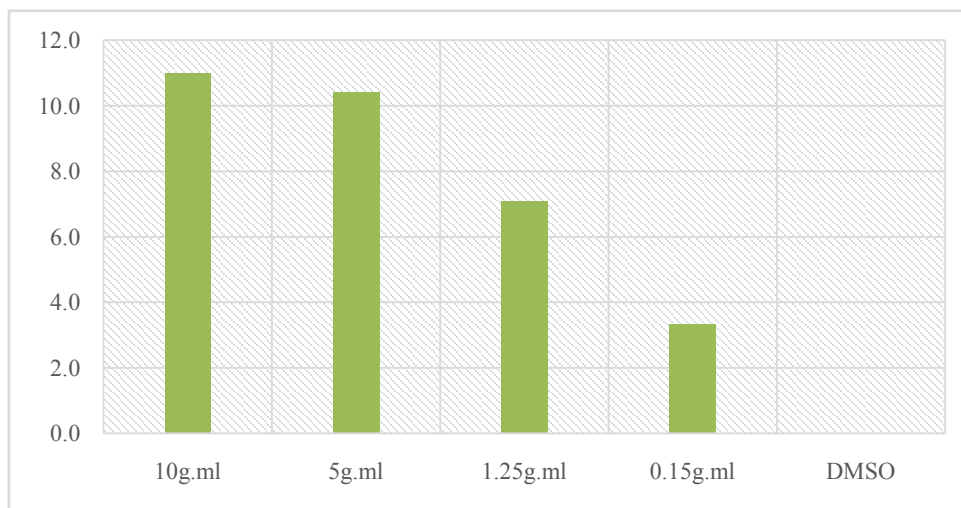


Figure 2 : Antibacterial effect of different concentration

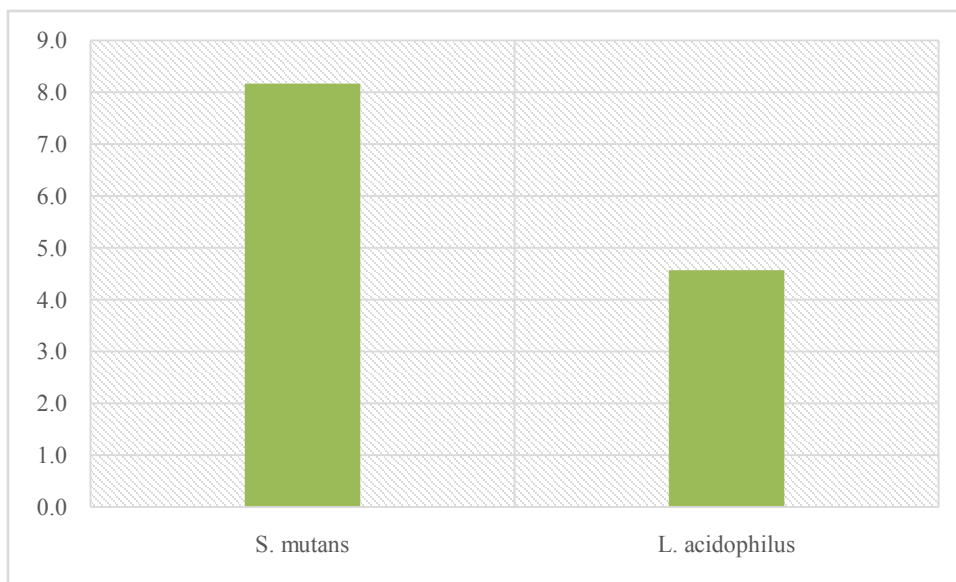


Figure 3 : Sensitivity of *S. mutans* and *L. acidophilus*

Result showed combination of peels and arils have greater antibacterial effect than pure peel extract (Figure 4). Also result showed combination of peels and arils have greater antibacterial effect on *L. acidophilus* in

comparison with pure peel extract. Also result showed pure peel extract has greater antibacterial effect on *S. mutans* in comparison with combination of peel: arils extract (Figure 5).

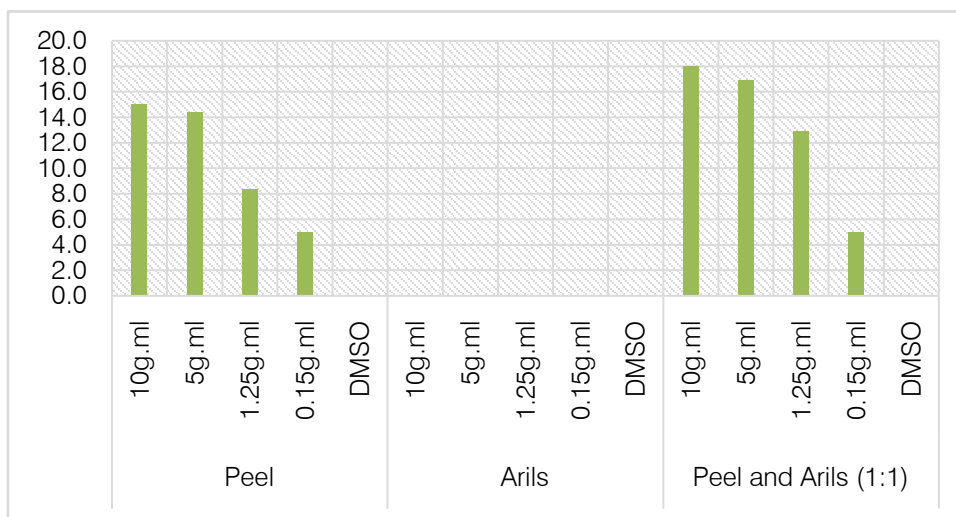


Figure 4 : Sensitivity of bacteria to peel and arils extract

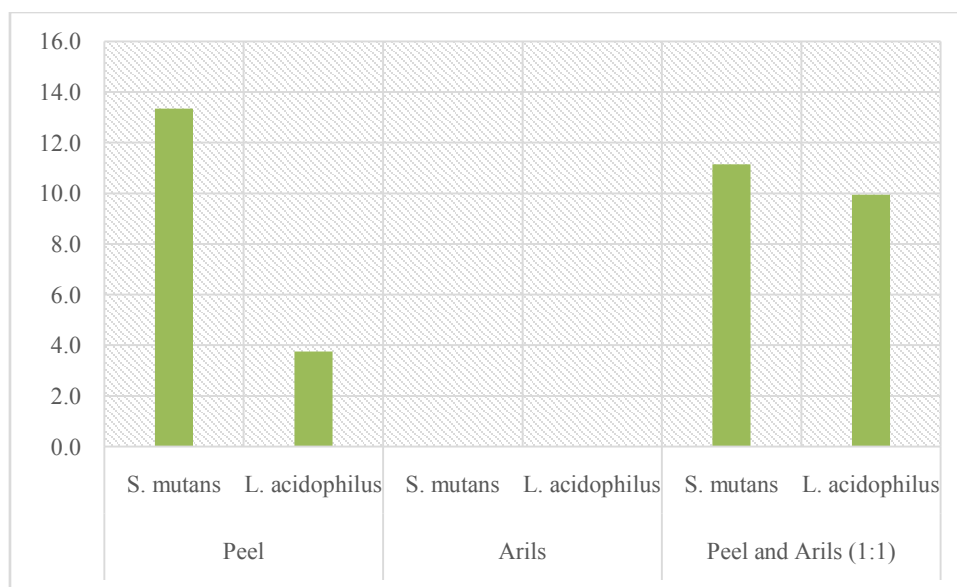


Figure 5 : Sensitivity of bacteria to peel and arils extract

#### IV. DISCUSSION

Result showed combination of peels and arils extract has greater inhibitory effect. Arils have no inhibitory effect against selected organisms. Result showed combination of peels and arils have greater antibacterial effect than pure peel extract. Also result showed combination of peels and arils have greater antibacterial effect on *L. acidophilus* in comparison with pure peel extract. Also result showed pure peel extract has greater antibacterial effect on *S. mutans* in comparison with combination of peel: arils extract.

Arils of pomegranate, contains 85% water, 10% total sugars, mainly fructose and glucose, and 1.5% pectin. Also arils contain organic acid such as ascorbic acid, citric acid, and malic acid. Arils contain bioactive compounds such as phenolics, flavonoids and principally anthocyanins. The seeds are a rich source of total lipids. (Aviram et al., 2000; Tezcan et al., 2009). The arils contain less chemical substances in comparison with pomegranate peel.

Pomegranate peel is rich in hydrolyzable tannins like punicalin, pedunculagin, and punicalagin (Seeram et al., 2005). Peel is rich in esters of hexahydroxydiphenic acid and glucose or quinic acid (Clifford et al., 2000). Also pomegranate peel contains hydroxybenzoic acids such as gallagic, glycosides (Amakura et al., 2000). Pomegranate peel contains anthocyanidins which are principally cyanidin, pelargonidin, and delphinidin (Noda et al., 2002). Pomegranate peel contains flavonoids such as kaempferol, luteolin, and quercetin (Van Elswijk et al., 2004).

#### V. CONCLUSION

Combination of (Peel: arils) extract has greater antibacterial effect than the pure extract of the arils and

the peels. Also result confirmed arils were not effective in the inhibition of *S. mutans* and *L. acidophilus*.

#### VI. RECOMMENDATIONS

Further study on antibacterial effect of seed extract in combination with juice and peels is recommended. Also further study on antibacterial effect against wider range of oral bacteria is recommended.

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## Low-Level Laser for Prevention of Chemotherapy-Induced Oral Mucositis in Pediatric Patients with Acute Leukemia, HC/UFMG 2012-2013

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**Abstract-** Oral mucositis (OM) is the non-hematological toxicity with the highest prevalence and morbidity in anticancer treatment. This study evaluated the use of low-level laser for the prevention of chemotherapy-induced OM by comparing 101 cycles with prophylactic irradiation using a gallium aluminum arsenide (GaAlAs) laser diode ( $\lambda=660$  nm;  $P=40$  mW, dose of 4 J/cm<sup>2</sup>) and 121 cycles with no irradiation. The conditions associated with oral health, chemotherapy cycles, neutropenia patterns, infectious complications and nutritional status were evaluated. OM occurred in 41.9% of the cycles. The probability of developing OM in the final cycles (7 to 10) was 7.34 times higher than in the initial cycles (1 to 6); 4.19 times higher in febrile neutropenia than in physiological neutropenia; 2.08 times higher when a therapeutic antimicrobial drug was used; and 2.12 times higher when gingivitis was present.

*GJMR-J Classification: NLMC Code: WB 350*



LOW-LEVEL LASER FOR PREVENTION OF CHEMOTHERAPY-INDUCED ORAL MUCOSITIS IN PEDIATRIC PATIENTS WITH ACUTE LEUKEMIA HC/UFMG 2012-2013

*Strictly as per the compliance and regulations of:*



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# Low-Level Laser for Prevention of Chemotherapy-Induced Oral Mucositis in Pediatric Patients with Acute Leukemia, HC/UFMG 2012-2013

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**Abstract-** Oral mucositis (OM) is the non-hematological toxicity with the highest prevalence and morbidity in anticancer treatment. This study evaluated the use of low-level laser for the prevention of chemotherapy-induced OM by comparing 101 cycles with prophylactic irradiation using a gallium aluminum arsenide (GaAlAs) laser diode ( $\lambda=660$  nm; P=40 mW, dose of 4 J/cm<sup>2</sup>) and 121 cycles with no irradiation. The conditions associated with oral health, chemotherapy cycles, neutropenia patterns, infectious complications and nutritional status were evaluated. OM occurred in 41.9% of the cycles. The probability of developing OM in the final cycles (7 to 10) was 7.34 times higher than in the initial cycles (1 to 6); 4.19 times higher in febrile neutropenia than in physiological neutropenia; 2.08 times higher when a therapeutic antimicrobial drug was used; and 2.12 times higher when gingivitis was present. After finding similarity between the groups with respect to the variables studied, it was concluded that the application of prophylactic laser did not reduce the frequency of chemotherapy-induced OM but was effective in preventing severe forms of the disease, reducing the occurrence of OM grades III and IV from 22% to 7% with no adverse effects, which justifies its routine use.

## I. INTRODUCTION

Chemotherapy- or radiation-induced oral mucositis (OM) is an inflammatory reaction resulting from complex interactions among several factors and the main cause of which is the direct and indirect stomatotoxicity of anticancer agents. The condition primarily affects tissues with a high cell turnover rate, such as the oral mucosa, and develops in approximately 40% of patients subjected to chemotherapy (CT) (Epstein & Schubert, 2004; Rubenstein *et al.*, 2004).

OM is a common complication with relevant morbidity in which sequelae cause disturbances in the integrity and function of the oral cavity, causing moderate to severe pain; an increased risk of local and

systemic infections; functional, nutritional, and sleep disorders; and difficulty in oral hygiene (Maiya *et al.*, 2006; Lalla *et al.*, 2008; Mañas *et al.*, 2009). These changes may trigger severe systemic repercussions, such as sepsis and respiratory failure, and require the reduction and/or interruption of the antineoplastic therapy, with implications for the survival of the patient. In addition to their negative effect on the quality of life, the harmful effects of OM increase hospitalization time and treatment costs (Cheng *et al.*, 2012; Carlotto *et al.*, 2013).

Currently, the approach to OM focuses on palliative measures, such as pain management, nutritional support, and the maintenance of good oral hygiene. Low-level laser (LLL) has proven effective as a method for the prophylaxis and/or treatment of OM, producing clinical and functional improvement. LLL accelerates the healing of wounds and has anti-inflammatory, analgesic, and biomodulator effects (Cowen *et al.*, 1997; Bensadoun *et al.*, 1999; Arora *et al.*, 2008; Genot *et al.*, 2008; Guatam *et al.*, 2013).

Mastering interventions that prevent this condition is becoming increasingly relevant. This study evaluated the effects of LLL on the prevention of chemotherapy-induced OM in pediatric patients with acute leukemia.

## II. PATIENTS AND METHOD

This study was approved by the Ethics and Research Committee of the Federal University of Minas Gerais (Comitê de Ética em Pesquisa da Universidade Federal de Minas Gerais - COEP-UFMG) process no. 01155712600005149. The study was conducted from January 2012 to December 2013, and patients were randomly allocated by doctors of the Teaching Hospital of UFMG (Hospital das Clínicas da UFMG – HC/UFMG). Patients with acute leukemia, from both genders and aged up to 17 years, were included in the study. The CT cycles were divided into two groups: **group I:** cycles of patients whose oral cavity was prophylactically irradiated with low-intensity laser; **group II:** cycles of patients not irradiated. Patients with infectious diseases and with other cancers were excluded.

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The sample size ( $n \geq 101$  cycles/group) was defined considering the 35% prevalence of chemotherapy-induced OM and a decrease of 18% in response to the prophylactic application of LLL, to obtain a statistical power of 80% and a significance level of 5%.

The OM classification recommended by the World Health Organization (WHO) was categorized into three groups: no mucositis (Grade 0), mild/moderate mucositis (Grade I and II), and severe mucositis (Grade III and IV).

Irradiation was performed daily in the whole oral cavity with 4 J/cm<sup>2</sup> red laser energy density (maximum power 40 mW;  $\lambda=660$  nm), 10 s per point, in the first three days of each CT cycle, prioritizing the most susceptible intraoral regions. If OM occurred, irradiation was maintained until the complete regression of signs/symptoms.

The following variables potentially associated with the risk of OM were selected for study: oral health indicators (carious lesions, tooth exfoliation, tooth eruption, gingivitis, supra-gingival plaque, and/or tartar); nutritional status (unchanged, mild nutritional risk, severe nutritional risk, malnutrition, and obesity); CT cycle phase (induction, reinduction, consolidation, intensification, interphase, and maintenance); neutropenia pattern (physiological neutropenia, febrile neutropenia or neutropenia with no defined focus, and severe neutropenia); and infectious complications (presence of infection, therapeutic use of antimicrobial drugs, and infection group).

The data were analyzed using SPSS 14.0 for Windows.

### III. RESULTS AND DISCUSSION

In total, 233 CT cycles were included. There were 11 losses, five due to absence of dental evaluation and six due to interruption of the CT and/or irradiation cycles. Ultimately, 222 cycles were analyzed: 101 cycles with preventive LLL irradiation and 121 cycles with no irradiation. Laser application was well tolerated, and there were no records of undesirable effects attributable to its use.

The studied variables showed a homologous distribution between the groups. Among these variables, the following showed evidence of risk for OM development: presence of gingivitis ( $p=0.016$ ), neutropenia ( $p=0.001$ ), nutritional status ( $p=0.028$ ) number of the CT cycle ( $p=0.016$ ), presence of infection ( $p=0.002$ ), therapeutic use of antimicrobial drug ( $p=0.002$ ), and infection group ( $p = 0.013$ ).

The frequency of mucositis was similar between the groups ( $p=0.851$ ): 42.6% (43/101) in irradiated cycles with prophylactic LLL and 41.3% (50/121) in cycles with no irradiation.

Table 1 shows the distribution of OM severity among the groups, and Table 2 shows independent risk factors associated with the development of the condition.

**Table 1 :** Severity of chemotherapy-induced oral mucositis in pediatric patients with acute leukemia, according to group (irradiated with prophylactic LLL and not irradiated), HC/UFGM, 2012-2013

Mucositis Severity	Prophylactic Irradiation With LLL		No Prophylactic Irradiation		P
	n	%	n	%	
Grade 1 or 2	40	93.0	39	78.0	0.043
Grade 3 or 4	3	7.0	11	22.0	
Total	43	100	50	100	

Note: The significance probability refers to the Chi-square test. n=number of chemotherapy cycles.

**Table 2 :** Factors associated with the development of chemotherapy-induced oral mucositis in pediatric patients with acute leukemia, HC/UFGM, 2012-2013

Variable	Coefficient	Wald's $\chi^2$	p	OR (odds ratio)
Intercept	-2.007	32.359	< 0.001	
Cycle number	1.994	15.337	< 0.001	7.34
Neutropenia	1.432	11.005	0.001	4.19
Indication for antibiotics	0.734	3.471	0.062	2.08
Gingivitis	0.749	4.107	0.043	2.12

The probability of developing OM in the final cycles (7 to 10) was 7.34 times higher than in the initial cycles (1 to 6); 4.19 times higher in febrile neutropenia than in physiological neutropenia; 2.08 times higher when a therapeutic antimicrobial drug was used; and 2.12 times higher when gingivitis was present (Table 2).

The use of LLL at the beginning of each chemotherapy cycle did not reduce the risk of occurrence of OM but did reduce the severity of the condition.

Randomized clinical trials confirmed the potential of LLL in reducing the need for opioid analgesics and parenteral nutrition and also confirmed its remedial action, especially in the last stages of the pathogenesis of OM, but recorded little evidence of prophylactic benefits (Genot *et al.*, 2005; Cruz *et al.*, 2007; Abramoff *et al.*, 2008; Cauwels *et al.*, 2011; Arbabi-Kalati *et al.*, 2013; Guatam *et al.*, 2013).

Two recent meta-analyses showed evidence of the effect of LLL. When analyzing 11 randomized studies

involving 415 patients, in which LLL was applied at doses higher than 1 J/cm<sup>2</sup>, Bjordal (2011) observed a reduction of 2.72 (95% CI: 1.98-3.74) in the relative risk (RR) of developing OM and a reduction in the severity and duration of the ulcer with therapeutic use. The study by Cruz and colleagues, included in this meta-analysis, concluded that LLL did not show prophylactic benefits regarding OM. However, these authors did not evaluate the effect of the laser on mucositis grading.

In a meta-analysis covering 33 studies, other authors (Bensadoun *et al.*, 2012) found a decrease of 2.45 (95% CI: 1.85-3.18) in the RR of developing OM when LLL was applied in doses between 2 and 3 J/cm<sup>2</sup>. This study, whose prophylactic protocol adopted a dose of 4 J/cm<sup>2</sup>, observed a reduction in the severity of the lesions with the use of prophylactic LLL. Severe OM (grade III and IV) occurred in 22% of cycles of patients who did not receive prophylactic LLL and in only 7% of patients who did.

The identification of OM risk factors is often not an easy task. The complex interaction among several factors that define the pathogenesis and intensity of OM results in wide individual variation, in which patients of the same age treated with identical CT protocols and similar oral hygiene patterns progress with different clinical presentations (Who *et al.*, 1993; Cheng *et al.*, 2011). The screening of patients prophylactically subjected to LLL, performed randomly by physicians of the service, could have selected patients with a higher risk of OM occurrence. However, the data analysis did not show differences between the groups, which allowed for assessment of the risk of OM occurrence and its severity.

The risk of OM occurrence may vary between cycles, and the anxiety level and previous history of mucositis are risk factors associated with a higher probability of occurrence (Cheng *et al.*, 2011). Our results showed a tendency of association between the occurrence of mucositis and the cumulative effect of CT, with an increased risk of mucositis in cycles subsequent to the sixth.

The literature describes OM as an important signal of severity and, at the same time, a consequence of the immune status and cytotoxic response of the individual. Souza *et al.* (2008) showed that the presence of a mucositis grade higher than two (WHO) is predictive of severity in cancer patients with febrile neutropenia. The oral microbiota of neutropenic patients is different from the oral microbiota of healthy people. The ulcerations found in neutropenic patients are clinically visible when the first evidence of neutropenia appears, and they represent a four times higher risk factor for sepsis (Sonis, 1998). Our results show neutropenia as a significant independent risk factor for the development of mucositis.

It is widely known that inadequate oral hygiene, teeth with carious activity, and chronic and acute infections of the periodontal system are predictors of the

incidence and severity of OM (Coracin *et al.*, 2013). The emphasis on oral care results from proven microbial diversity at cancer diagnosis, which favors the pronounced modification of Gram-negative microbiota and worsening of mucositis

(Ye *et al.*, 2013). In addition, when the structural integrity is compromised, new glycoconjugate structures become available in the mucosal surface, which, when associated with pseudomembranes, add selective advantages to the oral microbiota, favoring the fixation of opportunistic pathogens and the entry of microorganisms into the submucosa, which may result in systemic spread. (Ducan *et al.*, 2003). Among the studied variables that indicate oral health, only gingivitis was associated with OM risk.

Nutritional status is believed to be among the main factors that modulate the stomatotoxicity of antineoplastic therapy. Children undergoing chemotherapy may have reduced food intake due to poor appetite or stomatotoxic involvement, which puts them at risk of malnutrition and intolerance to treatment, and also due to increased local and systemic infections, which expand the already extensive factors that negatively affect the quality of life of cancer patients (Andrassy *et al.*, 1998; Lobato-Mendizábal *et al.*, 1989; Hafiz *et al.*, 2008). In this study, nutritional status did not influence the development of OM.

#### IV. CONCLUSION

There was a higher risk of mucositis under the following conditions: from the 6<sup>th</sup> CT cycle on; in the presence of fever, the therapeutic use of an antimicrobial drug, or severe neutropenia; and in the presence of gingivitis. The similarity between groups reinforces the data presented regarding the beneficial effects of LLL in reducing OM severity. OM grades III and IV decreased from 22% in cycles not irradiated to 7% in prophylactically irradiated cycles.

The adjustment of the laser therapy protocol remains a challenge, especially regarding the daily doses, the frequency of radiation, and the identification of independent risk factors, which could signal adjustments in irradiation flows.

#### V. CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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## Parents' Dental Knowledge and Oral Hygiene Habits in Saudi Children with Autism Spectrum Disorder

By Ebtissam Z. Murshid

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**Abstract- Background:** In Saudi Arabia, too few studies are published regarding the dental health habits of children with Autistic Spectrum Disorders (ASD).

**Aim:** The aim of this study was to evaluate their parents' dental knowledge; and the oral hygiene practices of a group of autistic children.

**Subjects and Methods:** This is a cross-sectional study targeting parents of autistic children enrolled in three different rehabilitation centers in Riyadh. A total of 450 self-administered questionnaires formulated in simple Arabic were distributed to parents of children diagnosed with autism or any form of ASD. The questionnaires consisted of demographic questions and dental-related questions, such as the sources of dental knowledge, causes of dental problems, and opinion about the proper time of first dental visits.

**Results:** The majority of the participating parents didn't receive any dental knowledge from dental personnel. More than 60% of the parents reported that their children were unable to brush their teeth by themselves.

**Keywords:** *autism, parents' dental knowledge, oral hygiene practices.*

**GJMR-J Classification:** *NLMC Code: WU 113*



*Strictly as per the compliance and regulations of:*



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**Results:** The majority of the participating parents didn't receive any dental knowledge from dental personnel. More than 60% of the parents reported that their children were unable to brush their teeth by themselves. In addition, the results showed that 90% of the children used toothbrushes and pastes, and only 34% of them brushed their teeth once per day. Furthermore, more than half of the mothers reported that they helped their children during tooth brushing. The parents did not have proper knowledge about the timing of children's first dental visit.

**Conclusions:** Based on the results, it can be concluded that there is lack in dental knowledge within the participating group of parents in this study. Dental professionals should increase their efforts to educate their patients about dental knowledge.

**Keywords:** autism, parents' dental knowledge, oral hygiene practices.

## 1. INTRODUCTION

Autism, or Autistic Spectrum Disorder (ASD), is a neuro-developmental disorder. It is characterized by impairments in behavioral and social interaction; language, communication, imaginative play, and a range of interests and activities *Friedlander AH. 2003, Muhle R, 2004 Cassel TD, 2007*. ASD is not a disease, but a syndrome with multiple interacting causes; both genetic. *Folstein S, Rosen 2001, Bayou N, 2008, Landrigan PJ. W 2010 & Boyd et al. 2010* and non-genetic *Hamilton 2006*. By the definition of ASD, the child must be of an age where his or her social skills

would be expected to be developed enough that such impairments can be noted; typically this is around pre-school age of 3 or 4 years old (*APA 2000*). Recently, it was reported that other social indicators such as shared smiles and direct vocalizations can be used to distinguish children as young as 12 months of age, that are at risk of developing ASD (*Ozonoff et al. 2010*). Due to the difficulty of diagnosing ASD cases, the prevalence of ASD is hard to establish, but is surely increasing rapidly all over the world. *APA 2000*. In Saudi Arabia, an extensive review of the literature revealed no specific numbers regarding diagnosed cases of autistic children reported. A rough estimate was reported in 2009 as 18 per 10,000 (*Al-Salehi, Al-Hifthy, & Ghaziuddin 2009*).

While several prominent researches have been conducted from a medical point of view, the oral health and dental needs of children with ASD "specifically caries incidence studies" have been evaluated by few investigators. Previous studies conducted on this matter reported no statistical significant differences in the prevalence of fillings and caries rates in comparison to those of non-autistic individuals (*Lowe O and Lindemann R. 1985, Backman, Pilebro. 1999, Fahlvik-Planefeldt C, Herrstrom P 2001*). Others reported a lower incidence of caries (*Kopel HM: 1977, Karmen S, Skier I. 1985, Namal et al 2007, Loo et al 2008, and A. Jaber 2011*). Furthermore, previous studies showed that children with ASD showed visible plaque and different degrees of gingivitis (*Lindemann and Lowe 1985, Shapira et al 1989, Murshid 2005, DeMattei et al. 2007, Kopycka-Kedzierawski and-Auinger, 2008*). This might be due to the children lacking the manual dexterity needed for proper OH practices, or as a side effect of the medication used to treat their disorder. Many of the medications used to control the behavior of children with ASD or to increase their concentration and social interactions may have adverse oro-facial side effects due to their anti-cholinergic properties, including xerostomia, sialorrhea, dysphagia, sialadenitis, dysgeusia, stomatitis, gingivitis, gingival enlargement, glossitis, bruxism, edema and discoloration of the tongue (*Loo et al., 2008*).

Several studies reported a significant association between the parents' dental knowledge, routine oral hygiene practices, dietary habits, and children's oral health (*Barker JC and Horton SB 2008 &*

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*Bilal Mirza et al 2011*). The standard of the children's oral hygiene correlated directly to that of their parents. Parents with better oral hygiene tended to have children with similar high standards of hygiene, and vice versa *Al-Shalan, 2003, Wyne AH, 2004, Saied-Moallemi et al 2007, Kopycka-Kedzierawski and Auinger 2008*. Most of the published studies targeted either parents of healthy children or parents of children with dissimilar medical conditions, but only few published studies were conducted to evaluate the parents' dental knowledge and oral hygiene practices of children with ASD *Stein et al., 2012*. Children with Autism Spectrum Disorders present a unique behavioral challenge to pediatric dentists due in part to the intrinsic communicative disability and altered sensitivities to various stimuli. Given the reported rise in the prevalence of ASD over the last 20 years, pediatric dentists can expect to be faced with the challenge of providing oral care for an increasing number of children with ASD. Increasing the parents' dental knowledge and the focus on the preventive programmes designed particularly to parents of children with ASD becomes highly significant. This can be achieved by investigating the dental knowledge of parents with ASD children. Therefore, the aim of this study was to investigate the dental knowledge of ASD children's parents and the oral hygiene practiced by ASD children.

## II. SUBJECTS AND METHODS

### a) Questionnaire

This cross-sectional survey was approved by the Ethical Committee of Human Studies at the College of Dentistry Research Center (CDRC). A self-administered questionnaire was formulated in simple Arabic language. To assess the questionnaire's readability, a group of 30 parents with autistic children attending the dental college at King Saud University were asked to answer the questionnaire and write their comments. Taking into consideration the comments of the pilot group of parents, a modified version of the questionnaire was distributed to parents of children diagnosed with any form of Autism or ASD. The questionnaire consisted of questions regarding the child's age, gender, and if the child was professionally diagnosed with any kind of Autistic Spectrum Disorder (ASD). In addition, it included dental questions like the sources of parents' dental knowledge, causes of dental problems, and their opinion about time of first dental visits.

### b) Subjects

The subjects of this study were recruited from three of the major autistic rehabilitation centers in Riyadh (The capital of Saudi Arabia). The centers were registered with the Saudi Autistic Society (SAS). The authorities of each center were contacted and ethical approval was obtained before distributing the

questionnaires to the parents of the autistic children. The staff members in each center distributed the questionnaires to all the parents who initially agreed to answer the survey while dropping their children off at the centers and collected them back later.

### c) Methods

A cover letter of invitation to participate in the study was sent with the questionnaires. The letter included an explanation of the purpose, the importance of the study, and a short introduction of the investigator. The questionnaires requested information like the child's age, gender, and if the child was professionally diagnosed with autism, semi-autism, or any kind of Autistic Spectrum Disorder (ASD). In addition, dental questions like sources of parents' dental knowledge, causes of dental problems, and their opinion about time of first dental visits. Parents were asked to answer questions in regard to the frequencies of brushing, methods and tools of oral hygiene practiced by the autistic children or their caregivers. It was thought that the distribution of the questionnaire by a 3rd person and not by the investigators would be advantageous, as the bias would be reduced if the parents answered the questionnaire away from the dentist.

The total number of questionnaires distributed was 450. The copies were distributed taking into consideration the number of children enrolled in each center and the parents' initial agreement to participate in the survey. Every family was assured of the confidentiality of the collected data and that the resultant information would be used only for research purposes. The questionnaires were distributed to all the families with the help of the staff members working in the three selected centers during the month of May in 2012. All the answered questionnaires were collected by the author. Only children who were professionally diagnosed with ASD and the completed questionnaires were included in the study. The collected data was entered in the computer using Statistical Package for Social Sciences (SPSS) software for frequencies distribution of all variables in number and percentage.

## III. RESULTS

Out of 450 questionnaires distributed, 344 were returned and with an overall response rate of 76.4%. The children's ages ranged from 3 to 14 years old (mean age  $\pm 6.4$ ) with 75.9% males and 24.1% females.

Table 1 shows the distribution of parents' response to the source(s) of their dental knowledge. The majority of the parents (57.3%) reported that they did not receive any information about dental knowledge. Other sources were from dentists and dental personnel, and from the media (14.2% and 9.6% respectively). Regarding the parents' knowledge about etiology of dental caries, a large number of the parents (48.8%) choose irregular cleaning of the teeth as the main cause



of dental caries. Hereditariness or genetic causes was given by 12.5% of the parents as the main reason of dental caries. Only 11.6% thought bacteria was the main cause. The parents were asked what age the child should have their first dental visit at. The results show

that 28.2% of the parents thought dental visits were necessary only at signs of pain or dental problems. Only 2 parents thought it should be during the first year since the child's birth. Twenty-seven percent of the parents didn't know the answer.

Table 1 : ASD parents' response to the dental knowledge questions (N=344)

Question	Parents' Response	NO (%)
Parents' sources of dental knowledge	No information was received	197 (57.3)
	Information received from Dentist/dental personal	49 (14.2)
	Information received from media	33 (9.6)
	Information received from folds and brochures	19 (5.5)
	Information received from friends, relatives	10 (2.9)
	Multiple resources	36 (10.5)
Reason for teeth decay	Irregular cleaning	168 (48.8)
	Multiple reasons	59 (17.15)
	Hereditary/ Genetics	43 (12.5)
	Don't know	44 (12.8)
	Bacteria	40 (11.6)
	Consuming food high in sugar	35 (10.1)
Time of first dental visit	Only in case of pain or dental problems	97 (28.2)
	Don't know	94 (27.3)
	From 3-6 years	65 (18.9)
	After 6 years	46 (13.4)
	From 1-3 years	40 (11.6)
	During the first year	2 (0.6)

Table 2 shows the distribution of the parents' responses regarding the oral hygiene practices of their children. The data shows that 38.7% of the children were able to brush their teeth by themselves, while 61.3% needed help during tooth brushing. More than half (52.3%) of the mothers were helping their children during tooth brushing. Only a few fathers (10.2%) were involved in the brushing practices. Receiving help during brushing from home nurses, helpers and maids represented 13.4%. Only 5.8% of the parents reported irregular or no brushing of their children's teeth. The

parents reported that 32.6% of their children either did not practice tooth brushing (3.8%) or brushed on an irregular basis (28.8%). The rest of the children reported brushing once or twice a day, 34.0% and 29.1% respectively. Only 4.4% of the children brushed 3 times or more. An enormous number of the parents (90.7%) reported that toothbrushes and toothpaste were the main tools used to clean their children's teeth. A few parents (8.5%) used Miswak only and only 0.9% relied solely on water rinses or swabbing the teeth with water and cotton.

Table 2 : ASD parents' response to the oral hygiene practices questions (N=344)

Question	Parents' Response	NO (%)
ASD child's ability to brush his/her teeth by his/her-self	Yes	133 (38.7)
	No	211 (61.3)
Children's help during tooth brushing	Mother	180 (52.3)
	Children are able to brush by themselves	133 (38.7)
	Father	35 (10.2)
	Maid, helper, home nurse	46 (13.4)
	More than one person	55 (16.0)
	Siblings	9 (2.6)
	No or irregular brushing	19 (5.8)
Frequencies of tooth brushing practiced by The Children	Never brushing	13 (3.8)
	Irregular brushing	99 (28.8)
	Brushing once per day	117 (34.0)

	Brushing twice per day	100 (29.1)
	Brushing more than twice per day	15 (4.4)
<b>Methods and tools used during brushing</b>	Tooth brush & paste	312 (90.7)
	Miswak only	25 (7.3)
	Tooth paste+ miswak	4 (1.2)
	Water rinse /water swab only	3(0.9)

#### IV. DISCUSSION

In Saudi Arabia, the amount of consequent research on Autism Spectrum Disorders (ASD) is sorely lacking, at least from the dental aspect. While several prominent researches have been conducted from a medical point of view, far too few studies have focused on the dental, which drew forth the inspiration behind this research. The cooperation and enthusiasm of the staff in the three selected centers had a great effect on the response rate of the parents.

In this study, the insufficiency in the distribution of oral hygiene instructions and dental awareness by dentists or dental personnel and dental institutions was reflected in the parents' responses. Only small number of parents received direct oral hygiene instructions from dentists, and even fewer parents received information from other sources like professional dental brochures and the media. Similar findings of shortages in the distribution of oral hygiene instructions was reported by parents of healthy children, or parents of children with different disabilities from the same city. (*Al-Shalan 2002, Al-Bader et al 2006, Wyne 2007, )* Conversely, in other studies conducted with parents of children with Cerebral Palsy (CP) (*Wyne 2007*) and Down syndrome (DS) (*Al\_Hussyeen 2006*) the parents reported that they had received dental instructions directly from dentists at an early age. An explanation of this discrepancy could be the differences in the nature of the children's conditions. CP and DS are two conditions that are easily diagnosed at or about the time of birth, so parents usually are educated about their children's condition and the importance of an early intervention in regards to different health aspects before they leave the maternity and delivery ward. However, in the case of autistic children, the child looks absolutely normal at birth. "ASD cases usually diagnosed by the age of 2 years or older" (*APA 2000, WHO 1992, Stone W et al 1999, Moore. V, Goodson S 2003, Amendah, D. et al 2011*) In addition, Autism is considered to be a relatively new condition when compared to CP or DS, so parents with autistic children might be more occupied with the urgency of the medical, behavioral and training condition of their children than the dental condition.

Dental literature define caries as the most common multi-factorial disease of the human race. Parents in this study showed substantial deficiencies in their dental knowledge, which was clearly reflected in their responses regarding the cause of dental caries. A large number of parents attributed the cause of dental

caries to improper tooth brushing only. The role of bacteria was chosen by a very small number of parents in this study, and similar studies conducted with parents of healthy children *Almas K et al 2003* and parents of children with different disabilities (*Al-Bader 2006, Wyne 2007*) (*Al-Bader 2006, Wyne 2007*) Some parents chose genetics and hereditariness as the main cause of caries. This could be due to autism being considered a genetic and/or hereditary disorder, making parents believe that the two are correlated. Some studies point out that autism is a genetic disorder and many characteristics of the disease are still inexplicable, parents may believe that genetics may cause victim-blaming or victim-shaming. These responses merely highlight the necessity of raising awareness about these controversial topics. Parents should be better educated by medical personnel on the procedures that follow the successful diagnosis of autism, or any signs of ASDs in children, so that they may seek dental advice from professionals well-acquainted with these disorders and sufficiently equipped to handle these children (e.g. pediatric dentists).

While the American Academy of Pediatric Dentistry (*American Academy of Pediatric Dentistry: www.aapd.org*), calls for the first dental visit to be by one year of age, a large number of the participating parents believed dental visits should be an option only in the case of pain or dental problems. Similar responses were reported by mothers of children with Down's syndrome (*Al-Hussyeen 2006*). Unfortunately, only two parents in this study thought their children should visit a dental clinic during their first year of age and many others chose the ages 3-6 to do so. Similar findings of delaying first dental visits were reported by other studies conducted in the same area (*AlShalan et al. 2002, Al-Bader 2006, Al-Hussyeen A 2006, Wyne 2007*). The delay in performing dental visits could be due to many reasons such as; the difficulty in managing the behavior of ASD children, or the unavailability of specialist clinics to treat children with Autism. Parents were likely unaware that dentists specializing in pediatric dentistry are trained in and capable of managing patients with different medical conditions and special needs. The lack of simple language brochures explaining the wide selection of behavioral management techniques that can be used in dentistry can be linked to this response. Cooperation between the different dental service providers in designing and distributing brochures customized for children with special needs is essential. Furthermore, a list of pediatric dentists and clinics

should be sent to the SAS website and different rehabilitation centers to convey this information to the parents and increase their dental awareness.

Most of the children in the present study needed help during tooth brushing, which given the nature of disorder (wherein physical impairments or poor manual dexterity skills are counted amongst the characteristics of autism) was to be expected. (AAP 2000, Vivian Nordan, Ch Gillberg 1996, NIH 2008, Amendah, D. et al .2011) Another expectation was the large number of mothers helping during brushing. The mothers' role and enthusiasm in regards to their disabled children's oral health was acknowledged in many studies (Petersen PE 1995, Al-Tamimi S. 1998, Al-Hussyeen 2006, Hulya Bilgin, Leyla Kucuk 2010, ) It is also worth noting that most Saudi families are in the habit of hiring live-in help, usually nannies or maids, to help care for their children and perform household chores. Therefore it makes sense that some of the participant children were helped by their caretakers as well. It is important to highlight that the number of fathers assisting during tooth brushing was not particularly high. This could be due to the fact that most of the fathers in Saudi society are the main source of their families' income, and mothers usually are the ones caring for the children and homes.

Even though a large number of the parents in this study didn't receive any dental information or oral hygiene instructions, most of them brushed their children's teeth once or twice a day. This could be considered largely adequate on their part, especially if we take into consideration the territorial outlook most ASD children have when it comes to their privacy. (Friedlander 2003, Klein and Nowak 1999, Marshall et al 2007, Loo et al. 2008, , Hulya Bilgin, Leyla Kucuk 2010, Murshid 2011. Fortunately, only a fractional percentage of the parents never brushed for their children. Similar regular oral hygiene practices were reported by different authors, who collected their data from parents of children with different disabilities living in the same area. (Al-Bader et al 2006, Al-Hussyeen, 2006, Wyne 2007 )

The use of toothbrushes and toothpaste was reported with the majority of the parents of this study and many other similar studies conducted in the same area (Al-Bader et al 2006, Wyne 2007). Luckily, only a few of the parents in this study used water rinsing and cotton swabs only. Fewer parents still reported the use of the traditional and cultural tool known as Miswak to brush their children's teeth. Miswak is a natural tree branch taken from the *Salvadora persica* tree (a wooden stick) commonly used for brushing teeth in Arabian Countries and other parts of the world. The benefits of Miswak to the gums and teeth were touched upon by the World Health Organization. (T. al-Khateeb, D. O'Mullane, H. Whelton, M. Sulaiman 1991, WHO 2000, Ezoddini-Ardakani 2010) A small percentage of the parents in this study were using Miswak with their

children. Similar findings were reported by parents of children with cerebral palsy in Riyadh. (Wyne 2007) This could be due to the difficulties in controlling the stick during brushing especially in cleaning the back teeth.

In general, the data collected in this study shows that most of the parents seemed to understand the importance of oral hygiene practices. A positive attitude in brushing the children's teeth was shown by the mothers participating in the study. The lack of circulation of dental information by professional dental personnel and dental institutions was clearly reflected in the parents knowledge of the causes of dental caries and the time of first dental visits and regular checkups. It is noteworthy to mention that a child with ASD may not be able to overlook and accept changes in his or her expected environment; most of them may become particularly defensive and obsessive about the variation. (Bogdashina, 2003). The difficulties in controlling and dentally treating children with ASD have been mentioned in a variety of studies. (Klein and Nowak 1999, Friedlander 2003, Loo et al. 2008, Marshall et al 2010, Murshid 2011) Therefore, obviously preventing dental problems in this group of children is more convenient than treating them. Parents should be informed that preventing plaque formation is the key to reducing dental caries and gingival diseases. This can be achieved by mechanical removing of plaque materials, reducing the refined carbohydrate diet intake, fluoride applications and regular dental check-ups.

## V. LIMITATIONS

The questionnaire and data collection methods in this study may have certain limitations. For example, the educational level and socioeconomic status of the participants were not included though this could affect the results. To overcome these shortcomings, future studies are recommended. With the limitation of this study, it can be concluded that:

## VI. CONCLUSIONS

- There is lack of dental knowledge amongst the participating parents of children with ASD in this study, especially in regards to causes of dental caries, and the appropriate time of a child's first dental visit.
- Parents of children with ASD showed satisfactory oral hygiene practices.

## VII. RECOMMENDATIONS

- The need for professional dental health awareness lectures, brochures, educational television and radio advertisements, and programs designed especially for children with different disabilities becomes obvious.
- A list of dentists specializing in treating and managing children with autism should be available

for parents either through the Saudi Autistic Societies or other rehabilitation centers, major hospitals and schools.

- Health care professionals other than dentists need to provide information and promote for early dental visits especially for children with disabilities.

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## Modified Lingual Spurs with Begg Brackets and Lock Pins – A Clinical Pearl

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*Abstract- Introduction:* Tongue thrusts wallow is one of the major etiologic factor of the malocclusions like anterior open bite, proclination and spacing etc. Currently a number of appliances available to correct the tongue thrust habit which requires an elaborate laboratory procedures, long chair side time for its fixation and difficulty for normal functions of the oral cavity.

*Methods:* As a new method of tongue thrust habit correction, patient's lingual surface of lower anterior teeth were bonded with begg brackets followed by insertion of lock pins to act as a remainder appliance.

*Keywords:* tongue thrust, modified lingual spurs.

*GJMR-J Classification:* NLMC Code: WU 158, WU 600



*Strictly as per the compliance and regulations of:*



# Modified Lingual Spurs with Begg Brackets and Lock Pins – A Clinical Pearl

Dr. Ali Jabir <sup>α</sup>, Dr. Nandish Shetty <sup>σ</sup> & Dr. Akhter Husain <sup>ρ</sup>

**Abstract- Introduction:** Tongue thrusts wallow is one of the major etiologic factor of the malocclusions like anterior open bite, proclination and spacing etc. Currently a number of appliances available to correct the tongue thrust habit which requires an elaborate laboratory procedures, long chair side time for its fixation and difficulty for normal functions of the oral cavity. **Methods:** As a new method of tongue thrust habit correction, patient's lingual surface of lower anterior teeth were bonded with begg brackets followed by insertion of lock pins to act as a remainder appliance.

**Keywords:** tongue thrust, modified lingual spurs.

## I. INTRODUCTION

“Tongue thrust swallowing” is the placement of the tongue tip forward between the incisors during swallowing. Sustained pressure by the tongue against the teeth have significant effects in causing malocclusion, though the Pressure by tongue against the teeth during a typical swallow last for approximately only one second. Since a typical individual swallows about 800 times per day while awake and a few swallows per hour while asleep, the total instances per day therefore is usually around 1000<sup>1</sup>.

Various mechanical methods have been used like fixed or removable cribs<sup>2, 3</sup>, spurs<sup>4</sup> and myofunctional appliances<sup>5</sup> etc. to treat this habit.

We have devised a new method of fabrication of modified lingual spurs with begg brackets and lock pins as a remainder method to treat tongue thrust habit.

## II. PROCEDURE

- A. Begg brackets were bonded on etched lingual surface of the lower incisors (figure-1).
- B. Two, one point safety lock pins were inserted from gingival to incisal direction and the excess was bended 90°lingually with 'V' shaped fashion by using Weingart plier (figure-2).
- C. Modified lingual spur with begg brackets and lock pins (figure-3).

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## III. DISCUSSION

To correct tongue thrust habit we used begg brackets and lock pins to fabricate “spurs”, which are inexpensive, easy to apply and do not need any technician's assistance and procedure is not technique sensitive. Since the attachment is fixed on the lingual surface of anteriors, the possibility of mesial movement of the anchor molars by the thrusting force of tongue as seen in the other appliances is eliminated and the maintenance of oral hygiene is easy.

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**Figure 1 :** Begg brackets were bonded on etched lingual surface of the lower incisors





*Figure 2* : Two, one point safety lock pins were inserted from gingival to incisal direction and the excess was bended 90°lingually with 'V' shaped fashion by using Weingart plier.



*Figure 3* : Modified lingual spur with begg brackets and lock pins



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## Assessment of Awareness Regarding Prevention of Infective Endocarditis among Graduating Medical & Dental Students at Qassim University, KSA

By Ahmed Ali Al Fawzan, Abdullah A. Al Saeed & Dr. Alaa E. Abd Elmoniem  
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**Abstract-** Infective endocarditis (IE) is an infection of the endothelial surface of the heart and heart valves with serious, even fatal complications and that often requires long-term treatment. Many dental procedures may lead to IE in high-risk patients. The aim of the present study was to assess the awareness and knowledge of graduating medical and dental students at Qassim University, KSA regarding prevention of infective endocarditis. A questionnaire was administered to the last year medical and dental students. An acceptable level of success in the test was defined as at least 7 correct answers out of 13 (53%). Out of 118 students participating in this study, 65 (47.4%) passed the test successfully. Although the pass-rate of medical students (45/93 or 48.4%) was comparatively higher than that of dental students (11/25 or 44%) the difference between the two groups was not statistically significant. This study showed that the knowledge concerning prevention of IE among the dental and medical students was moderate and highlighted the necessity of more education in this field.

**Keywords:** *infective endocarditis; knowledge, dental students, medical students.*

**GJMR-J Classification:** *NLMC Code: WU 18.5*



ASSESSMENT OF AWARENESS REGARDING PREVENTION OF INFECTIVE ENDOCARDITIS AMONG GRADUATING MEDICAL DENTAL STUDENTS AT QASSIM UNIVERSITY KSA

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# Assessment of Awareness Regarding Prevention of Infective Endocarditis among Graduating Medical & Dental Students at Qassim University, KSA

Ahmed Ali Al Fawzan <sup>α</sup>, Abdullah A. Al Saeed <sup>σ</sup> & Dr. Alaa E. Abd Elmoniem <sup>ρ</sup>

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## I. INTRODUCTION

Infective endocarditis (IE) is an uncommon but life-threatening infection. Despite advances in diagnosis, antimicrobial therapy, surgical techniques and management of complications, patients with IE still have high morbidity and mortality rates related to this condition (1). Endocarditis occurs when bacteria enter the bloodstream (bacteremia) and attach to a damaged portion of the inner lining of the heart or abnormal heart valves (2).

Viridans streptococci causes approximately 60% of cases of native valve endocarditis and dental manipulation have been repeatedly considered as a source of bacteremia that leads to IE (3). One study reported that 10% to 20% of patients with IE caused by oral flora underwent a preceding dental procedure (4). The evidence linking bacteremia associated with a dental procedure with IE is largely circumstantial, and the

number of cases related to a dental procedure is overestimated for a number of reasons (1). The American Heart Association (AHA) published regularly updated guidelines that emphasized the association between dental procedures and IE and recommended antibiotic prophylaxis (1).

The AHA has been recommending for the prevention of IE for more than 55 years. The first AHA document on the subject been published in 1955 (5).

Infective endocarditis is taught to all dental and medical students as a part of their curriculum and they must be familiar with the latest AHA recommendations on the prevention of IE. However, several studies have showed low compliance with AHA guidelines for prevention of IE, lack of knowledge at a reasonable level in this field among dental and medical students and practitioners, and the need for improved education regarding AHA guidelines (6) (7) (8) (9).

Study about dentists' and dental students' knowledge of the newest guidelines for antibiotic prophylaxis for high-risk patients in dentistry and the correct application of these guidelines in different regions is very important (10).

Considering this, it is critical that all dental and medical students have an up-to-date and reasonable knowledge about cardiac lesions and invasive procedures that predispose patients to the development of IE and prophylaxis regimens recommended by AHA for prevention of this disease.

The aim of the present study was to assess of awareness and knowledge of graduating medical and dental students at Qassim university, KSA regarding prevention of infective endocarditis.

## II. MATERIALS AND METHODS

This survey was conducted using a structured questionnaire having multiple-choice questions based on the last AHA recommendations (2007) about the prevention of IE. The questionnaire validated by previous studies (6) (10). The questionnaire consisted the following:

- Part I: personal data which including gender and college.

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- Part II: three multiple - choice questions about the causative bacteria and underlying cardiac conditions that predispose patients to IE.
- Part III: three multiple-choice questions about commonly performed dental procedures, oral cavity as a possible source of bacteremia and the safety of electric powered toothbrushes in susceptible patients.
- Part IV: seven multiple-choice questions about the type of antimicrobial prophylaxis to be prescribed for “at risk” patients before invasive dental procedures.

The questionnaire was distributed to 137 Graduating medical and Dental Students at Qassim

University, KSA from 5<sup>th</sup> to 12<sup>th</sup> January 2013. 118 filled questionnaires were returned giving a response rate of 86.1%. The data was analyzed using SPSS 16 program for descriptive statistics. Chi-square was used to compare the medical and dental student with regard to there knowledge. The  $\alpha$  level for the statistically significant result was  $p > 0.05$ .

### III. RESULTS

44.1% or respondents were male medical students, 34.7% were female medical students and 21.2% were male dental students (Table 1).

**Table 1 :** No. and Percentage of Distributed & Returned Questionnaire in each College

College	Sex	NO. of distributed Q.	NO. of returned Q.	Perc. of returned Q.
Medicine	Male	65	52	44.1%
	Female	44	41	34.7%
Dentistry	Male	28	25	21.2%
<b>Total</b>		<b>137</b>	<b>118</b>	<b>100%</b>

An acceptable level of success for the test was defined as at least 7 correct answers out of 13 (53%). Of 118 students participating in this study, 65 (47.4%) of them passed the test successfully. The pass-rate of medical students (45/93 or 48.4%) was higher than that of dental students (11/25 or 44%).

Regarding the question, about cardiac condition in which the risk of occurrence of infective

endocarditis is higher than others, 51.6% of medical students and 32% of dental students were able to recognize that Prosthetic heart vale is the correct answer. The chi-square test showed no significant difference between the knowledge of the medical and dental students  $p = 0.132$  (Table 2).

**Table 2 :** Cardiac Condition in which the Risk of Occurrence of Infective Endocarditis is Higher than others

College	Prosthetic heart vale *	Previous infective endocarditis	Tetralogy of Fallot	Mitral stenosis	N	P
Medicine	51.6%	19.4%	14%	15%	93	0.132
Dentistry	32%	16%	32%	20%	25	
<b>* the correct answer of the Question</b>						

35.5% of medical students and 30% of dental students correctly chose Mitral valve prolapse without regurgitation as the cardiac condition in which there is a

lower or negligible risk for developing infective endocarditis. The difference was not statistically significant  $p = 0.575$  (Table 3).

**Table 3 :** Cardiac Condition in which there is a Lower or Negligible Risk for Developing Infective Endocarditis

College	Mitral valve prolapse without regurgitation *	Surgically constructed systemic-pulmonary shunts	Ventricular septal defect	Coarctation of aorta	N	P
Medicine	35.5%	12.9%	26.9%	24.7%	93	0.575
Dentistry	30%	14%	32%	24%	25	
<b>* the correct answer of the Question</b>						

Streptococcus Viridans was chosen by 60.2% of medical students and 40% of dental students as the

most causative pathogen of Infective endocarditis ( $p = 0.343$ ) (Table 4).

**Table 4 :** The Most Common Causative Pathogen of Infective Endocarditis

College	Staphylococcus Aureous	Streptococcus Viridans *	Candida Albicans	Actinobacillus actinomycetemcomitans	N	P
Medicine	9.7%	60.2%	17.2%	12.9%	93	0.343
Dentistry	16%	40%	24%	20%	25	
<b>* the correct answer of the Question</b>						

Only 33.3% medical students and 40% of dental students agreed that the bacteremia resulted from invasive dental procedures usually lasts for about

10 to 15 minutes and the difference between the knowledge of both groups was not significant  $p= 0.502$  (Table 5).

**Table 5 :** The Bacteremia Resulted from Invasive Dental Procedures Usually Lasts for about

College	10 to 15 minutes*	1 to 2 hours	3 to 4 hours	5 to 6 hours	N	P
Medicine	33.3%	24.7%	25.8%	16.2%	93	0.502
Dentistry	44%	28%	12%	16 %	25	
* the correct answer of the Question						

Concerning dental procedures in which antibiotic prophylaxis is not indicated the percentage of correct answers 43% among the medical students and

68% among the dental students. The difference between the knowledge of the two groups was statistically significant  $p= 0.002$  (Table 6).

**Table 6 :** According to American Heart Association, in Which of The Following Dental Procedures Antibiotic Prophylaxis is not Indicated

College	Dental extraction	Initial placement of orthodontic bands	Scaling and root planning	Restoration of occlusal class 1 cavity on the first upper molar*	N	P
Medicine	0%	21.5%	35.5%	43 %	93	0.002
Dentistry	0%	32.0%	0%	68.0%	25	
* the correct answer of the Question						

51.6% , 52% of medical and dental student respectively, truly answered that AHA lists electric toothbrushes as recommended dental aids for patients

who are susceptible to infective endocarditis,  $p= 0.576$  (Table 7).

**Table 7 :** AHA Lists Electric Toothbrushes as Recommended Dental Aids for Patients who are Susceptible to Infective Endocarditis

College	True*	False	N	P
Medicine	51.6%	48.4%	93	0.576
Dentistry	52.0%	48.0%	25	
* the correct answer of the Question				

Amoxicillin was chosen by 57 % of medical students and 68% of dental students as the first-line antibiotic for prevention of infective endocarditis in dental practice according to AHA guideline. The

difference between the knowledge of the medical and dental students was statistically significant  $p= 0.019$  (Table 8).

**Table 8 :** According to AHA Guideline, the First-Line Antibiotic for Prevention of Infective Endocarditis in Dental Practice is

College	Clindamycin	Amoxicillin*	Azithromycin	Cephalexin	N	P
Medicine	20.4%	57%	0%	22.6%	93	0.019
Dentistry	8%	68%	8%	16%	25	
* the correct answer of the Question						

Concerning the antibiotics that is no longer recommended by the AHA for prevention of infective endocarditis, 43% medical students and 32% of dental

students correctly chose Erythromycin. The difference was not statistically significant  $p= 0.575$  (Table 9).

**Table 9 :** Which of the Following Antibiotics is No Longer Recommended by the AHA for Prevention of Infective Endocarditis

College	Erythromycin*	Parenteral ampicillin	Parenteral cefazolin (Ancef)	Cephalexin (Keflex)	N	P
Medicine	43 %	30.1%	18.3%	8.6%	93	0.575
Dentistry	32%	32%	16%	20%	25	
* the correct answer of the Question						

50.5% of medical students and 34.0% of dental students correctly selected Cephalexin, 2 g PO, 1 hour before treatment that is the regimens recommended by AHA for antibiotic prophylaxis in susceptible patients

among the other options. The difference between the knowledge of the two groups was statistically significant  $p= 0.036$  (Table 10).

**Table 10 :** Which of the Following Regimens is Recommended by AHA for Antibiotic Prophylaxis in Susceptible Patients

College	Azithromycin, 1 g PO, 1 hour before treatment	Clarithromycin, 500 mg PO, 2 hours before treatment	Cephalexin, 2 g PO, 1 hour before treatment*	Penicillin V, 3 g PO, 1 hour before treatment	N	P
Medicine	8.6%	24.7%	50.5%	16.1%	93	0.036
Dentistry	24.0%	14.0%	34.0%	28.0%	25	
* the correct answer of the Question						

600 mg of clindamycin in the most recent set of recommendation for prevention of infective endocarditis

was correctly chosen by 44.1% of medical students and 48.0% of dental students,  $p= 0.898$  (Table 11).

**Table 11 :** What is the Clindamycin dose in the most Recent Set of Recommendation for Prevention of Infective Endocarditis

College	150 mg	300 mg	600 mg	1200 mg	N	P
Medicine	16.1%	18.3%	44.1%	21.5%	93	0.898
Dentistry	20%	16%	48%	16%	25	
* the correct answer of the Question						

45.2% of medical students and 48.0% of dental students were able to recognize the correct dose of amoxicillin for prevention of IE which is 2 g of amoxicillin

PO 1 hour before the appointment. The difference between the knowledge of the medical and dental students was statistically significant  $p=0.015$  (Table 12).

**Table 12 :** The Recommended Regimen for Antibiotic Prophylaxis using Amoxicillin is

College	1 g of amoxicillin PO 2 hours before the appointment	2 g of amoxicillin PO 1 hour before the appointment*	3 g of amoxicillin PO 1 hour before the appointment	4 g of amoxicillin PO 2 hour before the appointment	N	P
Medicine	38.7%	45.2%	10.8%	5.3%	93	0.015
Dentistry	16.0%	48.0%	12.0%	24.0%	25	
* the correct answer of the Question						

Only 38.6% of medical students and 32.0% of dental students were able to recognize that the second dose of amoxicillin is no longer recommended for

second (follow-up) based on the latest AHA guideline.  $p= 0.047$  (Table 13).

**Table 13:** The Second (Follow-Up) dose of Amoxicillin According to the Latest AHA Guideline is

College	500 mg of amoxicillin PO 6 hours after the initial dose	1 g of amoxicillin PO 8 hours after the initial dose	1.5 g of amoxicillin PO 6 hours after the initial dose	The second dose is no longer recommended*	N	P
Medicine	15.1%	19.4%	26.9%	38.6%	93	0.047
Dentistry	36.0%	24.0%	8.0%	32.0%	25	
* the correct answer of the Question						

If the patient has forgotten to take his/her premedication , the effective prophylaxis is possible if the patient is medicated anytime up to 2 hours from the

time of induced bacteremia was the correct answer that 45.2% of medical students and 24.0% of dental students were able to recognize ,  $p= 0.083$  (Table 14).

**Table 14 :** Your Patient has Forgotten to take his/her Premedication. in Such a Case, Effective Prophylaxis is Possible if the Patient is Medicated Anytime up to .....from the Time of Induced Bacteremia

College	1 hour	2 hours*	4 hours	There is no prophylactic benefit	N	P
Medicine	12.9%	45.2%	19.4%	22.6%	93	0.083
Dentistry	32.0%	24.0%	24.0%	20.0%	25	
* the correct answer of the Question						

## IV. DISCUSSION

IE is a severe, life-threatening disease of the heart with poor prognosis. It is difficult to treat and has a high mortality rate. Bacteremia-inducing dental procedures are considered to be one of the major factors<sup>(12)(13)</sup>. An understanding of the various preventive and prophylactic measures is very important in this disease<sup>(14)</sup>.

Some cases of IE occur after invasive procedures such as dental extraction that are associated with bacteremia. On the other hand, underlying cardiac conditions such as valvular abnormalities that render the patient susceptible to IE are common. Considering these facts, AHA has started publishing recommendations for antibiotic prophylaxis and prevention of IE since 1955. This guideline is recently revised and updated and has been accepted as the standard of care in many countries around the world (1).

In the present study, we assessed awareness and knowledge of graduating medical & dental students at Qassim university, KSA, regarding the latest recommendations for prevention of IE published by AHA in 1997.

The mean marks of medical students in all three sets of questions were higher than that of dental students and the differences were not statistically significant. These findings are in disagreement with the results that have been reported by M. R. Zarei<sup>1</sup>, et al (10).

No significant difference in success rates or mean marks found according to sex in the present study. These findings are in agreement with the results that have been reported by M. R. Zarei<sup>1</sup>, et al (10).

Most dental procedures that cause tissue injury and bleeding which need antibiotic prophylaxis are tooth extraction, Scaling and root planning and initial placement of orthodontic bands, both of which (1).

Dental procedures that do not need antibiotic prophylaxis are dental radiographs, prosthetic impression and routine anesthetic injections through noninfected tissue (1). The most critical thing in the present study that some of dental and medical students did not know that initial placement of orthodontic bands requiring preventive antibiotic in susceptible patients.

In this study, 70% of the participants selected amoxicillin as the antibiotic of choice, 54 % selected a single 2-g dose 1 hour before treatment and only 44 (37%) knew that the second (follow-up) dose was no longer recommended by the AHA. This study also showed that only 48 (40.7%) of the medical and dental students knew that erythromycin had been eliminated from the latest guideline for antibiotic prophylaxis.

Nelson and Van Blaricum in a study on 1131 dentists and physicians in the United States found out that only 39.2% of them adhered to the latest AHA

guideline when prescribing antibiotic for IE prophylaxis (15). Nelson and Van Blaricum also demonstrated that physicians might not be as familiar with the latest AHA recommendations as dentists (15). In a study amongst clinicians in a teaching hospital, Solomon and colleagues showed that 62% of the participants had an acceptable level of knowledge about antibiotic prophylaxis and prevention of IE (6).

In another survey on the method of antibiotic prophylaxis against IE by dentists, Bennis and colleagues found out that only 21% of the dentists used the recommended dose of amoxicillin (16).

There is no doubt that lack of knowledge concerning AHA guidelines would lead to noncompliance. Considering the implication of invasive dental procedures in the development of IE, the severity of this disease, and the ease and efficiency of AHA recommendations, all dental and medical students should be qualified in prevention of IE (11). IE should be presented to the students using various methods of teaching in order to improve learning.

In summary, this study showed that the knowledge concerning prevention of IE among the dental and medical students was moderate and necessity of more education in this field. Dental student after graduation will provide dental care that could lead to development of IE in susceptible patients. Medical student after graduation will deal with IE susceptible patients and may receive medical consultation from the dentists.

## V. CONCLUSIONS

The study highlighted the lack of knowledge regarding prevention of infective endocarditis among the medical and the dental students and the need of improvement of their knowledge and compliance with AHA guidelines for prevention of infective endocarditis.

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## A Comparative Study between IHC in Frozen Sections and Formalin Fixed Sections and their Clinical Significance- A Retrospective Study

By Dr. Minal Chaudhary, Dr. Deepali Jain, Dr. Madhuri Gawande & Dr. Swati Patil

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**Abstract- Aim and Objective:** Comparison of IHC expression of P53 protein in frozen section versus routine paraffin embedded section in OSCC.

**Materials and Methods:** Patients diagnosed with OSCC were selected from the Department Of Oral and Maxillofacial Surgery of Sharad Pawar Dental College, Sawangi, During curative surgery tissue sections were obtained for frozen IHC and paraffin embedded sections were obtained from routinely processed resected tissue which were sent for histopathological diagnosis were also subjected to IHC for the purpose of the study. The tissue when then assessed to determine the expression of p53 protein.

**Results:** Sharper and more extensive p53 protein expression was observed in frozen section as compared to formalin fixed paraffin embedded sections. This is thought to be due to the blockage of antigen sites by formalin.

**Conclusion:** This study is of great significance to the pathologist who routinely assess IHC and reports on frozen section as diagnostic tools to guide the surgeon in order to determine the extent to which the resection should be carried out.

**GJMR-J Classification:** NLMC Code: WU 158



A COMPARATIVE STUDY BETWEEN IHC IN FROZEN SECTIONS AND FORMALIN FIXED SECTIONS AND THEIR CLINICAL SIGNIFICANCE - A RETROSPECTIVE STUDY

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# A Comparative Study between IHC in Frozen Sections and Formalin Fixed Sections and their Clinical Significance- A Retrospective Study

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**Conclusion:** This study is of great significance to the pathologist who routinely assess IHC and reports on frozen section as diagnostic tools to guide the surgeon in order to determine the extent to which the resection should be carried out. Hence, we can conclude that frozen section is more derivative in accordance with time as compared to formalin fixed tissue for determining the expression and as an important investigation to modify resection by using various tumor markers. In our study, we also considered conduction of IHC for margins during surgical procedure in order to guide the surgeon whether the margins are positive or negative and if the resection has to be extended or not. IHC here was conducted in a time period of 2 hours by polymer technique. Hence, an important and more definitive diagnostic tool for immediate results.

## I. INTRODUCTION

Frozen sections are immediately obtained during surgical procedure. Whereas, the formalin fixed sections are obtained during incisional biopsy which is taken in order to attain a definitive diagnosis and resected specimens which are obtained as post-surgical procedure. These tissues are fixed in neutral buffered formalin for 24 hours and then embedded in paraffin wax for the preparation of blocks from which sections are prepared for routine hematoxylin and eosin staining and also for IHC.

Immunohistochemistry is an indispensable tool for diagnostic as well as research purpose in human

disease, and is widely employed in establishing diagnosis. It can be conducted on frozen section and formalin fixed section. It is a method for demonstrating the presence and location of proteins in tissue sections.

Though the procedure is less sensitive quantitatively than others, it enables the observation of processes in the context of intact tissue. This is especially useful for assessing the progression and treatment of diseases such as cancer.

In general, the information gained from IHC combined with microscopy literally provides a “big picture” that can help make sense of data obtained using other methods. Immunohistochemical staining is accomplished with antibodies that recognize the target protein.

Since antibodies are highly specific, the antibody will bind only to the protein of interest in the tissue section. The antibody-antigen interaction is then visualized using either chromogenic detection, in which an enzyme conjugated to the antibody cleaves a substrate to produce a colored precipitate at the location of the protein.

Mutation of the p53 tumor suppressor gene is the most frequent abnormality in various human tumors. More than 95% of these alterations are missense mutations which are scattered in the central part of the gene. Although all these mutations lead to the inactivation of the biological properties of the p53 protein, they also have dramatic consequences in term of p53 stability. Mutant p53 protein, which takes on an abnormal conformation, is more stable than the wild-type (half-life of several hours compared to 20 minutes for the wild type p53), accumulates in the nucleus of neoplastic cells and thus becomes immunologically detectable. An important consequence of this phenomenon is that positive immunostaining is indicative of abnormalities of the p53 gene and its product.

## II. MATERIAL AND METHODS

The study was carried out at Sharad Pawar Dental College, Sawangi, Wardha in the Department of Oral and Maxillofacial Pathology. 30 samples were selected who had been diagnosed clinically and histologically with OSCC. Patients consent was taken

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prior to the conduction of the study. The IHC procedure which was carried out for the purpose of this study was Universal immuno enzyme technique

These samples had been procured during the curative surgical procedure for frozen section and later from resected specimen for paraffin embedded sections. These samples were then subjected to IHC staining for p53 antibody.

For frozen sections the tissue sample obtained during the surgical procedure were samples frozen in the cryostat machine after which tissue sections 2-3 micron meter thick were sectioned in the machine collected on silane coated slides and fixed in pre-cooled acetone for a period of 10 minutes.

Which was followed by application of peroxidase block for a period of 20 minutes followed by washing in Tris buffered solution (TBS) for 5minutes after which the application of p53 antibody (clone DO-7) after which it was washed in TBS for 10 minutes.

The application of HRP labeled polymer antibody is done for a period of 30 minutes after which it was washed in TBS for 10 minutes.

Finally, the application of DAB and hematoxylin is done for 30 minutes, after which is washed for 10 minutes with TBS. Similar, procedure was carried out for IHC in paraffin embedded sections which was also collected on silane coated slides.

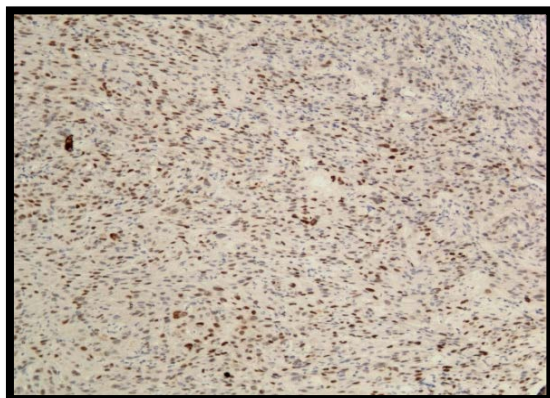
The fixation here is done with Neutral buffered formalin for 24 hours. And the antigen retrieval is done for a period of 30 minutes. The remaining procedure for these sections remains the same as the latter.

The complete procedure of IHC staining in frozen section requires a time period of approximately 2 hours.

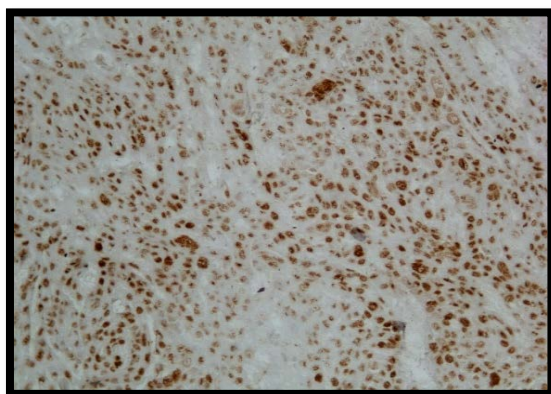
### III. RESULTS

25 out of 30 samples exhibited positive staining for frozen sections as well as paraffin embedded sections. More sharper and extensive p53 protein expression was seen in frozen section as compared to formalin fixed paraffin embedded sections.

However the cellular morphology is more definite in formalin fixed tissue. This is because of the loss of antigen during tissue handling, fixation and processing.



Expression of p53 in Formalin fixed tissue, (10x view)



Expression of p53 in Frozen tissue, (10x view)

Therefore, we can determine that frozen section is more derivative in accordance with time as compared to formalin fixed tissues for determining the expression of p53 by IHC and as an important investigation to modify resection by using various tumor markers.

It will also act as a guide to the surgeon in order to determine where to stop the resection which will also help in preservation of important structures which

otherwise might have been resected to rule out the possibility of recurrence. Hence, ultimately be beneficial to the patient as well.

### IV. DISCUSSION

It has been observed that patients suffering from OSCC have very low that is about 5 year survival rate of 50%. No increase in the 5 year survival rate of

patients with OSCC has been documented in the last 10 years. The main cause of death from OSCC after surgery is either due to formation of second primary tumor or recurrence of OSCC.

It is here that the role of field cancerization comes into play. In many cases field cancerization cannot be diagnosed by routine hematoxylin and eosin staining procedure. Hence, arises the need for more aggressive treatment modalities and newer diagnostic tools. We advocate the identification and removal of cancer and field on frozen section IHC as a routine treatment protocol for better prognosis.

IHC has frequently been considered a domain of research rather than for treatment and routine diagnostic procedure. There is an urgent need to change this line of thinking and integrate frozen IHC as a routine diagnostic tool for better assessment of margins and fields which will lead to better treatment and improved survival rate in patients with OSCC. Frozen IHC thus can be an important diagnostic, prognostic as well as research tool.

Removal of modified radical neck dissection protocol and repair requires a time period of about 5 to 6 hours.

Frozen section IHC which is an important diagnostic tool can be incorporated as a routinely used procedure during the course of surgery.

This could help in better management of margins which remain undetected otherwise but show positivity with molecular markers. Hence, the management of such condition on priority basis during surgical intervention could lead to better prognosis in patients with OSCC and will negate the need for recurrent surgeries.

## V. CONCLUSION

We conclude that frozen section IHC, is a viable technique which can be carried out during the course of surgical intervention and the result equals if not exceeds the results that are seen by conventional IHC procedure having equally significant prognostic value.

Also, though technique sensitive it is an easy procedure to conduct and does not require special training and can be conducted by technician who is able to perform routine IHC.

This procedure requires a time period of only 2 hours as compared to conventional IHC that requires approximately 26 hours.

Also, most of the antibodies that can be used for conventional IHC can be used for frozen IHC as well. There are certain misconceptions about frozen IHC such as it is difficult to conduct being time consuming and requires special training.

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## Complete Denture Prosthodontics: An nsight into Past, Present and Future

By Dr. Sharad Vaidya, Dr. Mahesh Suganna Golgeri & Dr. Charu Kapoor  
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*Abstract-* The loss of teeth can be an extremely traumatic and an upsetting experience. The art & science of denture therapy has been espoused and debated for almost a century. This paradigm has been repeatedly passed from “tutor-to-pupil”, with modifications & amalgamations of various philosophies. The “pupil-in-time-becomes-the-tutor” & the process continues as such. One cannot deny that various procedures involved in making of complete dentures have advanced through keen observation, experience, empiricism, anecdote, artistry & science. The dental profession has come far in terms of better materials, tools & techniques. Newer materials & technologies are driving newer, more efficient & successful clinical treatment & yet there is so much left to do.

*GJMR-J Classification: NLMC Code: WU 166, WU 500*



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# Complete Denture Prosthodontics: An Insight into Past, Present and Future

Dr. Sharad Vaidya <sup>α</sup>, Dr. Mahesh Suganna Golgeri <sup>σ</sup> & Dr. Charu Kapoor <sup>ρ</sup>

**Abstract-** The loss of teeth can be an extremely traumatic and an upsetting experience. The art & science of denture therapy has been espoused and debated for almost a century. This paradigm has been repeatedly passed from “tutor-to-pupil”, with modifications & amalgamations of various philosophies. The “pupil-in-time-becomes-the-tutor” & the process continues as such. One cannot deny that various procedures involved in making of complete dentures have advanced through keen observation, experience, empiricism, anecdote, artistry & science. The dental profession has come far in terms of better materials, tools & techniques. Newer materials & technologies are driving newer, more efficient & successful clinical treatment & yet there is so much left to do.

## I. INTRODUCTION

The future success of edentulous patient care is dependent on the development of shared goals for both the edentulous patient and the clinical team. This requires careful exposition of a goal and strategies to lessen or eliminate edentulism. Success will be achieved when therapeutic success is similarly viewed by the clinician and the patient. The selective use of technology to improve denture fabrication should be guided by factors that improve the process and outcome of denture fabrication and use as viewed by the denture wearer.<sup>1,2</sup> The causes of edentulism are many. While largely the result of genetic or microbial diseases that have strong individual and behavioral influences, total tooth loss can be the result of iatrogenic, traumatic, or therapeutic causes. Unfortunately, in addition to patient neglect and poor oral hygiene, the failure of prostheses is a real issue facing individuals and populations with comprehensively restored dentitions.<sup>3,4</sup>

## II. CURRENT DEMOGRAPHICS

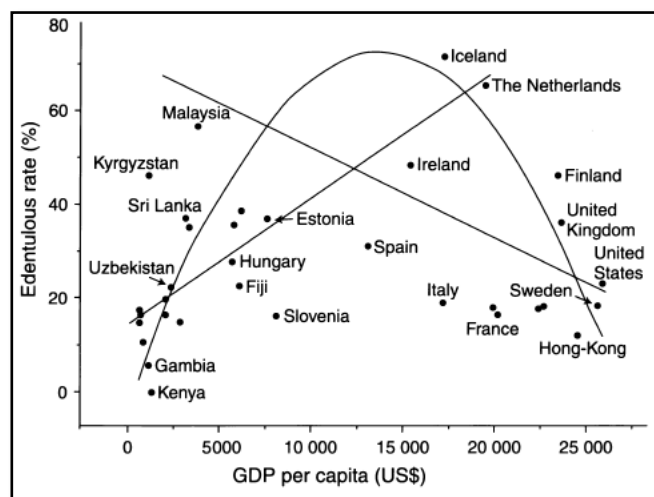
The truth about edentulism is that it has not disappeared nor is it disappearing. India has a large geriatric population of 77 million, comprising 7.7% of its total population. One of the major handicaps in the elderly is loss of teeth, affecting their mastication, dietary intake and nutritional status. According to Govt.

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Statistics b/w 12-30% Indians over the age of 60 years are suffering from complete tooth loss so the prevalence of edentulism is increasing in India. Nearly 19% of the population aged between 65-74 years is edentulous.<sup>5-8</sup>



## III. CLINICAL IMPLICATIONS

The clinical skills required to deliver excellent complete denture care are also paramount to successful prosthodontics, and esthetic dentistry. Even so, the opportunities to develop these skills and the interest appear to be decreasing at the same time that the need is projected to increase. In service to our patients, the profession must examine this trend closely.

The dental profession has come far in terms of superior materials, gears and techniques. Advances in both methodologies and therapeutic agents have been remarkable. The restoration of the completely edentulous patient's dentition through the use of dental implants, for example, has turned patients' lives around. Newer restorative materials and technologies are driving newer, more efficient and successful clinical treatment—and yet there is still so much left to do.<sup>1,2, 9-15</sup>

## IV. COMPLETE DENTURE IMPRESSIONS

### a) Materials and Techniques

Beeswax, used by a German surgeon, is the first referenced material used to make dental impressions. Although a poor impression material by today's standards, it was capable of being removed from undercut areas in the mouth. Other materials were

introduced in the 1800s, including guttapercha and plaster of Paris.<sup>16-27</sup>

The name, plaster of Paris, was coined from a large gypsum deposit found at Montmartre in Paris, France. It was commonly used up to the 1900s, and was often fractured in order to remove it from undercuts, then reassembled outside the mouth. In England in 1857, Charles Stent combined guttapercha with an animal fat (stearine) and talc to develop a modeling compound. This became a popular impression material, especially when used with copper bands. A colloid made from seaweed (agar-agar) was the main ingredient of reversible hydrocolloid, and was patented by an Austrian named Alphons Poller. This was the first flexible material that could be removed from undercut areas and retain its memory. It was used only for complete dentures until 1935, when AW Sears advocated its use for impressions for fixed partial dentures. Since most of the agar-agar material came from Japan and became scarce during World War II, irreversible hydrocolloid, known as alginate (salts of alginic acid), was developed. The agar (reversible hydrocolloid) and the alginate (irreversible hydrocolloid) impression materials are both elastic and hydrophilic but they have two disadvantages: (1) they must be poured immediately since the loss of water, if left in a dry environment, would cause dimensional instability; and (2) they have poor tear strength, which is a problem when recording thin areas such as the gingival sulcus. These two hydrocolloid materials were used exclusively until the introduction of polysulfide material in 1953. First developed as an industrial sealant for gaps between sectional concrete structures, this polysulfide material gained popularity quickly because it reduced the two main problems associated with the hydrocolloids.<sup>18-23</sup>

In late 1965, polyether impression material was introduced. This material had the necessary feature of being hydrophilic and, therefore, is more forgiving in a wet environment. An additional advantage to the polyether material is that it undergoes a cure polymerization reaction upon setting, which has no unstable molecular by-product, resulting in good dimensional stability. The elastic modulus of the polyether is high, resulting in a very rigid material, which is why it can be more difficult to remove from the mouth and the stone cast.

In the early 1960s, silicone impression materials that cured through condensation were introduced. These materials also had dimensional changes occurring after removal from the mouth because of the evaporation of the ethyl alcohol by-product, but their use was justified because the changes were less than was seen with alginates. The dimensional stability grew worse the longer the delay in pouring the impression (sufficient stability was maintained only for about 6 hours). This created a problem in sending the impression to the laboratory by mail.<sup>23-32</sup>

A more dimensionally stable impression material (polyvinyl siloxane) that set by an additional cured polymerization reaction was introduced in the 1970s. This impression material does have a by-product from the polymerization reaction (hydrogen gas) but has a dimensional change of nearly zero during the reaction. Both types of silicones have good elastic properties but were very hydrophobic.

#### b) *Techniques.....*

Prior to 1600 era, complete denture replacement were not made due to lack of understanding of retention and replacement. Closed mouth impression technique was introduced in 1900s. Release/escape vents within the final impression trays to prevent build up of excessive pressures was advocated. In 1950s emphasis was given to the biologic factors affecting complete denture impression making i.e. on flanges, border molding and denture extensions. More attention was given to posterior palatal seal area and to esthetics.<sup>35-39</sup>

Recently in 2006, Joseph Massad introduced a novel impression technique. The procedure demonstrates a building, or layering, method of impression making that maintains the integrity between layers of the impression materials of varying viscosities. To provide a more detailed and customized impression of the edentulous patient, this procedure utilizes both the static and functional concepts of impression making.<sup>32-35</sup>

## V. SMILE DESIGN: AN OLD NOTION

Esthetic restorative dentistry has broadened the awareness of smile design; however, dentists and technicians have long replaced missing anterior teeth with a focus on esthetics. Tooth size, shape, color, position, arrangement and display have been classically taught to dental and laboratory technician students for decades. Clinicians and technicians both seem to forget that the process of selecting and arranging artificial teeth in space—as required in complete denture construction—is really the best venue for studying the esthetic ceramic and polymeric materials used for individual teeth.<sup>39-42</sup>

## VI. RECENT AND FUTURE TRENDS<sup>23-45</sup>

Thermoplastic materials for dental prosthesis are not a recent invention. They were first introduced in 1950's and consisted of different grades of polyamides (nylonplastics). Rapid injection systems originated in 1962 introducing Flexite thermoplastic material which was a fluoropolymer (Teflon like). Next introduced nylon based resin was Valplast, a flexible, semi-translucent thermoplastic resin. While the material was not strong enough to allow for conventional tooth borne rest seat, the flexibility added to patient comfort in wearing the appliances.



BPS denture meets the esthetic demand of patients with its unique Ivoclar teeth, which replicate anatomy of the natural tooth. Ivoclar teeth are made up of 3 layers of cross-linked acrylic resin that contribute to a life-like appearance and resistance to wearing. BPS system uses a controlled heat/pressure polymerization procedure during which time the exact amount of material flows into the flask to compensate for shrinkage, which ensures a perfect fit. This pressure also optimizes the physical properties of the denture.

Ivoclar Vivadent has released the latest in their line of top quality removable prosthetic teeth in Phonares NHC. The new Nano-Hybrid Composite teeth are hardened to a level that can only be compared to traditional porcelain denture teeth and they're available at a much more competitive price point. Phonares teeth include new moulds that show amazing aesthetics and lingual definition unmatched by any other tooth in the industry.

Few reports have described the use of computer-aided technology for complete dentures. Maeda et al, a group of Japanese investigators, are credited with the first published scientific report on the concept of using computer-aided technology to fabricate complete dentures. The clinical and laboratory protocols for both systems (Dentca and Avadent) incorporate many principles previously described in the literature on digital dentures. Both commercial manufacturing systems allow fabrication of complete dentures in 2 clinical appointments. The first clinical appointment is for systematic data gathering (impressions, occlusal vertical dimension (OVD), maxillo-mandibular relationships (MMR) and tooth selection), and the second appointment is for denture insertion and adjustments. There is a dire need for clinical trials on computer-aided dentures that can affect individual patient care, dental education, research and health around the world. The ability to manufacture complete dentures using computer-aided technology has myriad educational, investigational, and clinical possibilities for the future.<sup>23-45</sup>

## VII. CONCLUSION

Given the demographic data on population ageing, it is likely that the need to rehabilitate edentulous patients will remain considerable for many more decades. Complete dentures are and will remain the mainstay of treatment for the vast majority of edentulous patients; most are satisfied with their dentures but some others are unable to adapt. Complete dentures will continue to play a central role in the rehabilitation of edentulism thus, research, teaching and specialist training in complete denture prosthodontics must continue, and in fact be intensified rather than reduced.

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## Modified Cast Dowel Core for Treatment of Mutilated Crowns – Case Reports

By Dr. Anand, Dr. Devika Shetty, Dr. Nandish Shetty & Dr. Ali Jabir  
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*Abstract-* Dislodgement of crown is not uncommon in routine clinical practice. Inadequate support for the core is the most common reason for such failures. With the advent of fibre posts and resin cements, core build up has become more effective. But sin certain conditions with severe deep bite, supra-eruption and mutilation, cast metal dowel core offer greater advantage compared to non-metallic posts and composite core. This paper presents two case reports in which modified cast dowel cores were used to restore severely mutilated teeth one with a buccal defect and other with severe deep bite and supra-eruption.

*Keywords:* modified dowel, crown dislodgement.

*GJMR-J Classification:* NLMC Code: WU 113, WU 105



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# Modified Cast Dowel Core for Treatment of Mutilated Crowns – Case Reports

Dr. Anand <sup>α</sup>, Dr. Devika Shetty <sup>σ</sup>, Dr. Nandish Shetty <sup>ρ</sup> & Dr. Ali Jabir <sup>ω</sup>

**Abstract-** Dislodgement of crown is not uncommon in routine clinical practice. Inadequate support for the core is the most common reason for such failures. With the advent of fibre posts and resin cements, core build up has become more effective. But in certain conditions with severe deep bite, supra-eruption and mutilation, cast metal dowel core offer greater advantage compared to non-metallic posts and composite core. This paper presents two case reports in which modified cast dowel cores were used to restore severely mutilated teeth one with a buccal defect and other with severe deep bite and supra-eruption

**Keywords:** modified dowel, crown dislodgement.

## I. INTRODUCTION

Post endodontic restoration is a very important phase in root canal treatment. Recurrent caries and fractured restorations in an endodontically treated tooth can lead to dislodgement of crowns, retreatment of which can be a real challenge to a restorative dentist. Patients often turn up late for treatment due to lack of confidence in the dentist and the procedure. In due time the remaining crown structure will be severely mutilated and weak. Supra-eruption and migration of adjacent teeth may also limit the treatment options. In some cases lack of inter arch space and severe proclination may necessitate a modification of the core. In such extensive loss of coronal structure a post is used to retain the core<sup>1</sup>. This paper presents two different cases which were treated using modified cast post and core designed to suite specific conditions. (A) A grooved cast post and core fabricated on a severely mutilated tooth, modified to avoid an iatrogenically created defect on the mid buccal finish line. (B) A wrapped cast post and core modified on a grossly decayed canine with severe deep bite and supra-eruption.

## II. CASE REPORT (1)

A 45 year old female patient reported with a dislodged crown in relation to 46. On examination it was found that 45, 47 and 48 were missing and 46 tooth structure was grossly destroyed with a perforation on the mid buccal finish line (fig.1). IOPA radiograph revealed that 46 was root canal treated. A post with a modified core was planned so as to avoid the buccal

defect as well as to restore the crown. The remaining carious dentinal structure was removed and post preparation was done with gates glidden bur and peso reamers. Primary post space preparation was done in the distal canal while two short secondary post preparations were done in the mesial canals to provide support to the core.

Auto polymerizing resin (DPI- India) was packed into the canal with a thin resin sprue after lubricating the canal with petrolatum. When the resin was tough and doughy the pattern was inserted in and out of the canal to ensure that it did not lock into any undercuts in the canal<sup>2</sup>. After retrieving it from the canal, the resin core was modified along the buccal aspect to form a groove which helped to avoid the iatrogenically created buccal defect. The incorporation of a groove also helped to create a narrow occlusal table there by reducing the occlusal forces and greater retention for the crown. A narrow longitudinal groove was cut in side of the distal post to create a cement escape channel. It is desirable to complete reduction and contouring in resin, because it is both difficult and time consuming to shape the metal after the dowel core has been cast<sup>2</sup>.

The resin post and core was then casted [fig.2]. A small knob of the sprue was left attached to the casting and a dental floss was tied to it to act as a safety line<sup>2</sup>. The cast post and core was tried and tooth preparation was completed for 44 to receive a metal ceramic fixed partial denture in relation to 44, 45 and 46. Necessary modifications were done to obtain parallelism. The buccal groove was well defined to avoid the defect so that the final prosthesis can be contoured accordingly. Finally the occlusal preparation was completed and the dowel was ready for cementation.

Glass ionomer cement (GC-Fugii) was mixed and inserted into the canal using a lentulospiral. The dowel core was slowly inserted so that the excess cement may escape allowing it to seat completely (fig3). Impression was made with polyvinyl Siloxane, one stage putty wash technique. (Aquasil, Dentsply) Metal ceramic fixed partial denture was cemented with Ploy Carboxylate cement (Poly-F, Dentsply) (fig.4).

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FIG-1



FIG-2



FIG-3



FIG-4



FIG-5



FIG-6



FIG-7



FIG-8

### III. CASE REPORT (2)

A 55 year old female patient reported with dislodged crown in relation to 13. On examination it was found that 14, 15 and 44 were missing while 16, 43 and 45 were severely supra-erupted (fig 5). IOPA radiograph revealed that 13 was root canal treated. To correct the occlusal discrepancy 45 required extraction while 16 needed intentional root canal treatment followed by crown lengthening procedures. Due to the severe deep bite caused by 43 on 13 a wrapped cast core covering the labial surface of the canine was planned. After the extraction of 45 and intentional root canal treatment of 16, 13 was modified to receive the cast post and core (fig 6, fig 7). As discussed in case report (1), resin pattern using direct technique was used in this case also. Crown lengthening was done on 16 and the tooth was prepared to receive a metal ceramic fixed partial denture (fig 8). A removable partial denture was planned after healing of the lower ridge.

### IV. DISCUSSION

Endodontically treated tooth should be properly restored to receive a crown. Dislodgement of the crown occurs when they are not properly supported or the abutment is weak due to secondary caries. Any remnant caries should be removed completely during the initial stages of root canal treatment. Radicular support is required when the abutment is weak. The principles of crown preparation should be followed rather than depending on the adhesiveness of the restorative cements<sup>2</sup>. Cements leach out in due time which may cause accumulation of plaque and food debris between crown margins leading to secondary caries. Composite material is the most popular core material. But it shrinks during polymerization, causing gap formation in the areas in which the adhesive is weakest. It absorbs water after polymerization, causing it to swell<sup>3</sup> and undergoes plastic deformation under repeated loads<sup>4</sup>, <sup>5</sup>. Its adhesion to dentine on the pulpal floor is generally not as strong or reliable as to coronal dentine<sup>6</sup>. Fibre posts are a better choice as post material because its flexibility. A post that flexes together with the tooth during function should result in better stress distribution and fewer fractures<sup>7</sup>. But a flexible post allows movement of the core, resulting in increased micro-leakage under the crown. This is more important when there is minimal remaining coronal tooth structure. Because the post is considerably thinner than the tooth, it may be necessary that the post have a higher modulus of elasticity (greater stiffness) to compensate for the smaller diameter<sup>8</sup>. A cast metal post and core was preferred for case(A) because it was a severely mutilated molar and patient did not want to extract the tooth. In case(B) wrapped cast post and core was the only choice due to the severe supra-eruption. Cast post

and cores can be fabricated either by direct or indirect technique<sup>2</sup>. Direct technique with resin pattern was used in both cases. One major advantage of using direct technique with resin pattern is that the restorative dentist can modify the core to suite specific situations. Cast dowel cores are very rarely done on molars, because they have divergent canals that require elaborate castings<sup>2</sup>. Post should be placed in the largest straight canal. Rarely if ever is more than one post required in a molar<sup>8</sup>. Placement of a post also may increase the chance of root fracture<sup>9</sup>. Post length should be more or equal to the crown length to reduce fractures and minimum 4-5mm of gutta-percha should remain apically to maintain an adequate seal<sup>10, 11, and 12</sup>. Taking into consideration all the above factors, a modified cast dowel core was the right choice for these patients.

### V. CONCLUSION

Cast post and cores modified for specific situations offer a definite and economical solution. In the anterior region aesthetic core should be given when all ceramic crowns are planned. But in posteriors metal post and cores are effective in giving support to severely mutilated crowns. The rigidity of the cast post and core is a cause of concern because of possible fracture of roots if the post is not properly extended or if occlusal load is heavy. While selecting cases for treatment of severely mutilated crowns all these factors should be taken into consideration.

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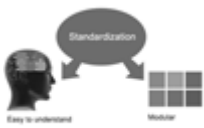
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### Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

### Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art. A few tips for deciding as strategically as possible about keyword search:



- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

*Acknowledgements: Please make these as concise as possible.*

#### References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

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The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

#### Tables, Figures and Figure Legends

*Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.*

*Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.*

#### Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

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*Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.*

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#### TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

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**3. Think Like Evaluators:** If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

**4. Make blueprints of paper:** The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

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**7. Use right software:** Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

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**22. Never start in last minute:** Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

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**24. Never copy others' work:** Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

**25. Take proper rest and food:** No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

**26. Go for seminars:** Attend seminars if the topic is relevant to your research area. Utilize all your resources.





**27. Refresh your mind after intervals:** Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

**28. Make colleagues:** Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

**29. Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

**30. Think and then print:** When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

**31. Adding unnecessary information:** Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

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**33. Report concluded results:** Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

**34. After conclusion:** Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium through which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

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### Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

### Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.



Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

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- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

- Use standard writing style including articles ("a", "the," etc.)
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- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

## Approach:

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- Leave out information that is immaterial to a third party.

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The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently. You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.



## Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
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- Present a background, such as by describing the question that was addressed by creation an exacting study.
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### Approach

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- Give details all of your remarks as much as possible, focus on mechanisms.
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- Try to present substitute explanations if sensible alternatives be present.
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- Recommendations for detailed papers will offer supplementary suggestions.

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Topics	Grades		
	A-B	C-D	E-F
<i>Abstract</i>	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form  Above 200 words	No specific data with ambiguous information  Above 250 words
<i>Introduction</i>	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
<i>Methods and Procedures</i>	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
<i>Result</i>	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
<i>Discussion</i>	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
<i>References</i>	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



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