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Editorial

From the time Buonacore introduced the BIS-GMA molecule to dentistry more than 5 decades ago, composite resins have been continuously researched and developed by both, academic researchers & commercial houses. It has indeed metamorphosed to a material of high esthetic value with good clinical performance. As against the predictions of critics of composite resins these materials today enjoy an important place in dentistry and are here to stay. The steady development in the bonding systems have not only aided in higher bond strength and marginal seal but also have made the change in classification necessary. Today instead of being classified into I, II or V generations, we have just two systems, 'Total etch' & 'self etch'.

The materials have become more user friendly, less technique sensitive, have better shelf life and optical properties that defy detection in the oral cavity. Multibottle systems have given way to single bottle systems that has reduced the chair side time and increased work efficiency. The fillers used in these resins have also been improvised. The prepolymerised polymer is a popular choice as a filler in composites today. Composite resins have been widely used as veneering & core build up materials because of its improved mechanical and aesthetic properties.

The advantages of direct filling and the indirect composite resin material today have made possible quality dentistry to be practised with greater predictability of treatment outcomes.

Minimum interventional protocols as propagated in dentistry today by prosthodontists is possible with modern day composite resins. Conservation of tooth structure and protection by minimum intervention makes us practise the minimum appropriate protocol for a patient. With the plethora of materials & techniques at our disposal, today it is the basic needs of a particular patient and demands of that case that will dictate our practise.

In my earlier editorials too, I have constantly stressed on patient centered approach. I strongly believe that the above dictum is the one which calls the shots in Prosthodontics.

Dr. (Mrs.) S. J. Nagda

Editor - JIPS

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The articles will be reviewed by the Editor and the advisory board. The Editor and the Journal Committee reserves the right to reject any articles without giving any explanations thereof. All published articles will become the property of Journal of Indian Prosthodontic Society.

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TEXT : Introduction : It should be brief and precise, review the important literature only. Clearly state the purpose and objectives of study and avoid extensive review of literature.

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Tables : Tables should be typed on separate sheets of paper, double spaced, without any text matter on the page. Table should be self explanatory, should supplement and not duplicate the text, numbered in roman number, according to order in the text. All foot notes should immediately follow the table and all abbreviations used should be defined in the foot note.

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Post and Core through the ages - part1

MRS. S. J. NAGDA, M.D.S.*

Bygone are the days when extraction was the choice of relieving pain and agony of patients with extensive caries and decay. Loss of teeth has always been a traumatic and psychologically harrowing experience for patients. Thus preservation of tooth structure is one of the prime objectives of dental practice today. Various preventive and corrective measures have evolved. Techniques and materials have also been evaluated and practiced to fulfill these objectives. Endodontic therapy has provided the solution to maintain mutilated teeth, thus aiding psychological acceptance, arch integrity proprioception and bone preservation. A large number of endodontically treated teeth are restored to their original function with the use of intraradicular devices. These devices vary from a conventional custom cast post and core to one visit techniques using commercially available prefabricated post systems.

The advent of post and core began in the 18th century when wooden wedges were inserted in to the root canals. However the wooden wedges absorbed water and swelled up thus exerting pressure within the root canal.

The father of modern dentistry Pierre Fauchard (1928) described the technique of "in tooth". He prepared the canal with the help of a watchmaker's reamer. The post fabricated from metal was then fitted and secured in the canal. Clark F. H. (1849) developed a device consisting of a metal tube in a canal and the split metal dowel inserted into it. Harris (1871) in his text "the principles and practice of dentistry" described the dowel preparation to serve as an anchor. Richmond (1880) introduced a new design. His design consisted of a threaded tube in the canal which used to hold the screw placed through the crown. This design was later simplified to eliminate the tube and the dowel was made unthreaded and an integral part of the final crown. Davis introduced bracing of the crown structure at the cervical level before placement of the crown. These designs remained in practice for a long time.

Various materials for posts have been tried. To achieve optimum results the material used for the post should have physical properties similar to

that of dentin, it should also be able to bond to the tooth structure and be compatible in the oral environment. Traditionally posts were made of metal alloys. Several studies have examined post and cores of various alloys and other materials with different rigidity and demonstrated that rigid materials resisted greater forces without distortion. Due to the use of various alloys, corrosion resistance also played an integral part. It was found that of various alloys used for posts, titanium alloys were the most corrosion resistant. Alloys containing brass had lower strength and lower corrosion resistance. Noble metal alloys were found to be corrosion resistant but their cost was higher. With the introduction of non-metallic post materials the corrosion factor was eliminated.

It was initially common in clinical practice to routinely reduce the coronal structure to the level of the gingiva before post and core fabrication. However this practice is now considered outdated and should be avoided. It has been found that extension of the axial wall of the crown apical to the missing tooth structure provides what is known as a ferrule and is thought to help bind the remaining tooth structure together preventing root fracture during function.

Since the middle of this century there has been fast development in the post and core systems prefabricated and custom made. The post designs are tapered and parallel. These designs have varied length and diameter. Various surface configurations have been developed ranging from smooth, serrated to threaded with post shafts modified to either hollow or solid or split and vented or non-vented. These systems are retained in the canal by screwing or by cementation. These posts come with a prefabricated core or the core can be built up with pins and composite resin. Various studies have been conducted to evaluate the effect of these systems. Foundation restorations as they are known today, form the base for attachments to be used in overdentures and in other prostheses. Foundation restorations help in preservation of the roots and the bone. The proprioceptive ability is maintained leading to the longevity of health of the stomatognathic system.

- Continued

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Report of 6th National Convention of Prosthodontic Postgraduate Students

**Hosted by Bangalore Prosthodontic Forum in association with
The Oxford Dental College**

27 - 29 August, 2004.

The inauguration was held in the Oxford Dental College and was well attended by not only the delegates and prosthodontic faculty but also practitioners and faculty members from different Dental Colleges in Bangalore. Video Conferencing on CAD-CAM was the attraction for the first day. "Gurukula", an event arranged before and after conference hours, was appreciated by one and all. Significant topics in Prosthodontics was allotted to different teachers and a group of about 30 students interacted with the teachers. The Gala banquet and cultural evening was very well arranged. Dr. Satish Babu, organizing Secretary and Dr. Ray, the Chairman of the conference, deserve accolades for holding the mega event where the student registration was maximum. The Poster Presentation was also excellent. Student papers showed that every year the effort and quality of the scientific matter is on a rise. Our President Dr. Sabita Ram congratulated the organizing committee of the 6th National Prosthodontic Convention of Post Graduate Students at the Valedictory Function. The conference has indeed been a trend setter for "Gurukulas" to be held during Student Conventions. We congratulate the entire Bangalore Team for holding such a wonderful event.



Dr. Carl O. Boucher Birth Centenary Year

October 14, 1954 – March 11, 1975

Modern day complete denture Prosthodontics owes its progress to this great Prosthodontist. We all fondly remember this great teacher, educationist, practitioner, and the first editor of Journal of Prosthetic Dentistry (Mosby Publications). **Dr. Carl O. Boucher** passed out in 1927 from Ohio State University (OSU) and since then dedicated himself towards Prosthodontic Practice and Education. The Carl O. Boucher conference, which was started in 1965, was a living tribute to him. He not only held continuing education programmes for practitioners and prosthodontists but his passion for the subject and its development was seen in Ohio State University where he was teaching. He even spent the Sunday afternoons treating cleft palate children at a children's home. He edited the complete denture book by Swenson and continued to do it for different editions published during his life time. His concepts and ideas in complete denture prosthodontics are just invaluable. Dr. Boucher was founding editor of the Journal of Prosthetic Dentistry from 1951 and remained the editor until 1975. He held the editor's conference for the benefit of others in the writing profession.

Carl O. Boucher Memorial Conference Room, located on the third floor of The OSU Dental School was dedicated on April 12th, 1996. We the members of Indian Prosthodontic Society and from the Journal of Indian Prosthodontic Society, which is sponsoring organization of the Journal of Prosthetic Dentistry pay our respects to this great "Complete Denture" man.

An invitro study to compare and evaluate the Fungicidal and Stain removal abilities of Five Denture Cleaners

TULSI SUBRAMANIAM*, SABITA M. RAM**

ABSTRACT

The fungicidal effect on *Candida albicans* and stain removal ability of five denture cleaners was evaluated and compared. The cleaners used: Steradent, Hygident, Clinsodent, Denturite & Fittydent were alkaline peroxide based. Clinsodent and Steradent were potent in their action against *C.albicans*. Fitty Dent had the greatest stain removal potential.

INTRODUCTION:

Denture hygiene is compromised both due to the limitations of the denture material as well as the lack of manual dexterity of the denture wearers. Denture plaque,⁴ of which *Candida* organisms constitute a significant part, plays an important role in the pathogenesis of denture stomatitis. Removal of both denture plaque as well as stains on the denture surface is thus vital to denture hygiene maintenance and ultimately to oral health of the denture wearers.

The mental trauma of the edentulous state coupled with age factors acts against both, the will and ability to remove denture plaque and stains from the denture surface by mechanical means. A chemical agent namely a denture cleaner would thus be the optimal solution in the given situation. A wide range of denture cleaners whose composition in most cases remains a closely guarded secret are available in the market at the disposal of the patient.

MATERIALS AND METHODS

Five Immersion denture cleaners were selected (Table I).

TABLE I : DENTURE CLEANERS USED IN THE STUDY

Code	Proprietary Name	Manufacturers	Details
A	Steradent	Reckitt & Coleman	White Powder
B	Hygident	Elan Pharmaceuticals	White Powder
C	Clinsodent	ICPA, Mumbai	White Powder
D	Denturite	Bharucha Brothers, Mumbai	White Powder
E	Fitty Dent	Altwirth & Schmitt, Austria	Green Tablet

Condensed from thesis presented for the partial fulfillment of the requirement for MDS (PROSTHETICS) submitted to Mumbai University.

Acknowledgement - Colgate Palmolive India (Ltd.) who have partially funded this research project.

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Sample solutions were prepared according to manufacturer's directions. *Candida albicans* was obtained from Haffkine Research Institute, Mumbai.

The fungicidal effect of the five denture cleaners was evaluated by the following methods :

Yeast Lytic Test: A spectrum Photometer was used to survey the turbidity and interpret the effect of the denture cleaners on *C.albicans* cell suspension.

Fungicidal Test: Viable counts were carried out to evaluate the decrease in the colony forming units of *C.albicans* as a result of the denture cleaners.

Candida removing test: The acrylic resin plates were first subjected to *C.albicans* cell suspension. These plates with *C.albicans* adhering to them were then subjected to the denture cleaners. The ability of the denture cleaners in preventing the adherence of *C.albicans* to acrylic resin plates was evaluated microscopically.

YEAST LYTIC TEST

Preparation of fungal suspension⁶ *C.albicans* was precultured in Sabrouaud glucose broth at 37°C. The cultures were centrifuged and fungal cells were washed three times with 10me phosphate buffered saline (PBS) (ph 7.2) and then were resuspended in PBS. The cell suspension was diluted to 3×10^7 cells/ml.

Assay A 5ml portion of the fungal suspension was added to a 5ml sample solution in a test tube (control-added to 5ml of sterile distilled water; blank-PBS without fungi). The tube was incubated at 37°C for 5, 30, 60, 90 and 120 minutes. The optical density (OD) of the tubes was surveyed at 560nm by a spectrum photometer. Results were expressed by the following equation.

$$\% = \frac{\text{OD of sample} - \text{OD of control}}{\text{Initial OD of sample} - \text{initial OD of control}} \times 100$$

FUNGICIDAL TEST

Preparation of fungal suspension⁷: *Calbicans* was precultured in Sabrouaud glucose broth at 37°C. The cells were washed with PBS and were resuspended in PBS. The cell suspension was diluted to 3×10^7 cells/ml.

Assay A 5ml portion of the fungal suspension was added to a 5ml sample solution in a test tube. The tube was incubated at 37°C for 5, 30, 60, 90 and 120

minutes. Samples were drawn at each interval and serial dilution and plating procedures (Sabouraud's medium) were carried out. After 48 hours incubation at 37°C, colonies were counted.



Fig. 1 : Denture Cleaners used in the study.

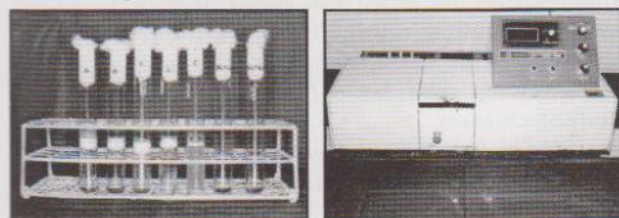


Fig. 2 : Setup of apparatus for spectrum Photometer studies.

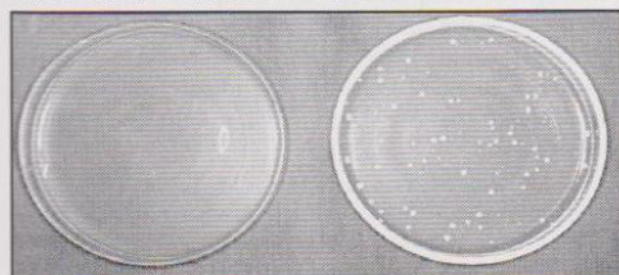


Fig. 3 : Agar plate showing (left) no growth & (right) showing porcelain white colonies.

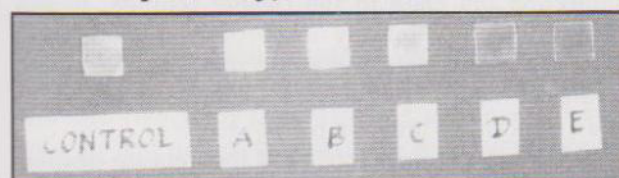


Fig. 4 : Acrylic plates used in Candida removal test.

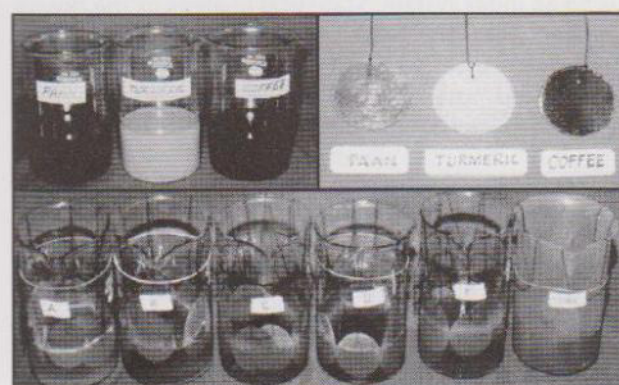


Fig. 5 : Setup for stain removal test.

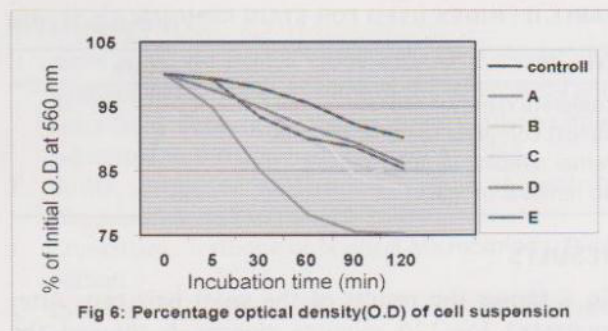


Fig 6: Percentage optical density(O.D) of cell suspension

CANDIDA REMOVING TEST

Preparation of fungal suspension³ *C.albicans* grown in 4% glucose, 2% peptone, and 0.2% yeast extract broth incubated at 37°C for 48 hours were used. The cells were centrifuged and washed with PBS and resuspended in saline. The cell suspension was diluted to 3×10^7 cells/ml.

Preparation of acrylic resin disks. According to the method of Tamamoto et al,⁷ acrylic disks (10 x 10 x 0.75mm) were prepared and washed under running tap water for 48 hours.

Assay Six acrylic disks were placed in a Petri dish, covered with 20ml of fungal suspension, and incubated at 37°C for 90 minutes. The disks were washed with PBS, immersed in 50ml of sample solution at 37°C for 60 minutes and washed with PBS. According to the method of Tamamoto et al,^{6,7} fungal cells adhering to the acrylic resin surfaces were fixed with formaldehyde and were counted by microscopy. Results were expressed as the ratio of cells remaining after each cleaner acts in comparison with the control group 10 readings in various fields for each disk were carried out.

STAIN REMOVAL ABILITY

Preparation of specimen for stain removal. The specimen for stain removal was prepared in a standard die of diameter 5cm and thickness 0.75cm. The specimen had a rough stippled surface on one side and a smooth surface on the other side. These heat cured specimens were then suspended in aqueous staining agents of Turmeric, coffee and paan for 10 days as suggested by Thakral⁸ and Bhatt¹. The specimens were then washed and dried for 2 hours. Then 3 disks of each stain were suspended in the various denture cleaners and in plain water (control) for a period of 8 hours. They were then removed, dried and evaluated using the criteria mentioned in Table 2. A similar scoring criteria was used by Thakral⁸ and Bhatt¹.

TABLE II : INDEX USED FOR STAIN REMOVAL

Criteria	Score
Complete removal of Stain	3
Almost complete removal of Stain	2
Partial removal of Stain	1
No removal of Stain	0

RESULTS

Fig 6 shows the results of the yeast lytic test. After treatment for 120 minutes cleaner A showed the maximum lytic activity followed by C, B, E, D, and Control. Table 3 shows the results of a fungicidal test. Table 4 shows the results of the Candida removal test. Table 5 shows the results of the stain removal test.

TABLE III : FUNGICIDAL TEST

Number of Surviving Cells (colony forming units)						
Time	0mts	5mts	30mts	60mts	90mts	120mts
Control	5.4x10 ⁵	5.2x10 ⁵	4.9x10 ⁵	4.8x10 ⁵	4.6x10 ⁵	4.7x10 ⁵
A	3.1x10 ⁵	2.7x10 ⁵	3.0x10 ³	8.6x10 ²	10	13
B	2.5x10 ⁵	1.2x10 ⁵	8.0x10 ³	5.0x10 ³	1.1 x10 ³	6.2x10 ²
C	4.9x10 ⁵	4.6x10 ⁵	20	10	2	2
D	3.2x10 ⁵	1.4x10 ⁵	1.0x10 ⁴	2.3x10 ²	2.1x10 ¹	18
E	3.9x10 ⁵	3.3x10 ⁵	7.1x10 ⁴	6.8x10 ⁴	1.9x10 ⁴	5.3x10 ³

TABLE IV : CANDIDA REMOVAL TEST

Number of cells adhering to acrylic plates						
	Control	A	B	C	D	E
1	28	-	-	-	-	-
2	30	-	-	-	-	-
3	15	-	-	-	-	-
4	3	-	-	-	-	-
5	43	-	-	-	-	-
6	16	-	-	-	-	-
7	18	-	-	-	-	-
8	22	-	-	-	-	-
9	20	-	-	-	-	-
10	11	-	-	-	-	-

TABLE V : STAIN REMOVAL ABILITY OF DENTURE CLEANERS

Stains	Disk No.	Control	A	B	C	D	E
Turmeric	1	0	3	1	3	2	3
	2	0	3	1	2	2	2
	3	0	3	1	2	2	2
Paan	1	0	2	3	2	3	3
	2	0	1	3	2	2	3
	3	0	3	2	2	2	3
Coffee	1	1	3	2	1	3	3
	2	1	1	2	2	2	3
	3	1	2	2	3	2	3
Total		3	20	17	19	20	25
Percentage		11.11%	74.07%	62.96%	70.37%	74.07%	92.59%

DISCUSSION

Denture hygiene is compromised due to both intrinsic and extrinsic factors.^{2, 4, 5} Intrinsic factors include

mainly the porous acrylic resin. Extrinsic factors include oral hygiene and habits which the denture wearer may indulge in, resulting in stains and deposits on the denture surface, which is said to be the main factor in denture induced stomatitis.

Denture cleaners are chemical agents which help in maintenance of denture hygiene. In this study 5 commercially available alkaline peroxide based denture cleaners were evaluated.

The yeast lytic test or turbidimetric method of spectrum photometer was done to evaluate the efficacy against *C.albicans* cell suspension. The results were expressed in terms of the fall in optical density of the solution as surveyed by the spectrum photometer at 560nm. Stastical analysis of the results showed that the yeast lytic ability of all the denture cleaners was significant; and time has an influence on the yeast lytic ability of the denture cleaners. Nakamoto et al^{6, 7} had done a similar study on 5 denture cleaners.

The fungicidal test was done to evaluate the efficacy of the denture cleaners against *C.albicans*. In this study, Cleaner C showed maximum fall in CfU/ml (colony forming units) at time 30 minutes as compared to the other cleaners, thus could be deemed the most rapid acting cleaner. At time 120 mts, Cleaner A, B and D showed a significant fall in cfu/ml establishing that they too were potent but after a longer period.

The *C.albicans* removing test was done to determine the efficacy of the denture cleaners in preventing adherence of *C.albicans* onto the denture base. The results were expressed in terms of *C.albicans* cells adhering to the acrylic resin plates after subjecting the plate to the cleaner solution. In this test, which is clinically important, the adhering *C.albicans* cells were efficiently removed by all five cleaners. The control showed definite adherence of the *C.albicans* to the resin plate.

The stain removal ability of the denture cleaners and the control were evaluated after an 8 hour period using an index system. Statistical analysis of the results showed that the stain removal ability of all the denture cleaners was significant. Cleaner E emerged as the most potent stain remover, followed by D, A, C and B respectively. The control by itself did not show any significant stain removal ability.

SUMMARY & CONCLUSIONS

An Invitro study was conducted to compare and evaluate the efficacy of five denture cleaners viz. Steradent, Hygident, Clinsodent, Denturite and Fittydent.

Their activity against *C.albicans* one of the most opportunistic and chief causative organism of denture

stomatitis was studied. The evaluation was based on the results of turbidimetric monitoring by spectrum photometer; Fungicidal activity determination by viable counts and Candida removal activity as studied directly under the microscope.

The study showed that Clinsodent and Steradent are potent in their activity against *C.albicans*. Fittydent had a higher stain removal potential as compared to the other cleaners. All the denture cleaners were significantly better in maintaining the hygiene of the denture, both microbiologically and esthetically as compared to cleaning with plain water, thus establishing the need to use denture cleaners routinely for denture care and maintenance.

Activity of denture cleaners against the whole range of aerobic and anaerobic microorganisms present in the oral cavity requires to be studied. In vivo microbiologic evaluation of denture cleaners is a daunting task, but a challenging field left open for further investigation.

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Abstract

EFFECT OF SEQUENTIAL VERSUS CONTINUOUS IRRADIATION OF A LIGHT - CURED RESIN COMPOSITE ON SHRINKAGE, VISCOSITY, ADHESION AND DEGREE OF POLYMERIZATION

Purpose : It has been suggested that marginal adaptation of resin composites can be increased by polymerising the material at a reduced rate. Variation of light power during the irradiation process leads to decreased marginal leakage. Thin study correlated the development and degree and depth of polymerisation, shrinkage amounts, viscosity and surface hardness of a resin composite material with the type of using method.

Material & Methods : Five tests (surface hardness, adhesion, shrinkage, viscosity and residual monomer concentration/degree of polymerisation) were performed in the study on PERTAC composite. For each test, the resin was used by using both the variable irradiation and continuous irradiation for comparison.

Results : Once the total dose of irradiation was delivered, surface hardness remained constant and the type of dose did not affect hardness results. Marginal adhesion was weakened by fast polymerisation and may be improved with a low-intensity polymerisation period. Total shrinkage was essentially independent of the various light - curing intensities used during the curing process.

The composite eventually achieved the same viscosity changes during the 40 second cure process regardless of which 2 irradiation methods was used. All composite specimens had an equivalent level of residual acrylate monomers and thus comparable levels of polymerisation.

Conclusion : A sequential approach to light curing lead to equally good shrinkage, surface hardness and residual monomer concentration as long as the total irradiation dose was adequate. However, marginal adhesion may be improved to sequential polymerisation.

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Obstructive Sleep Apnea and its Prosthodontic Management

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ABSTRACT

Obstructive sleep apnea, in India, has been given little attention, particularly because the signs and symptoms are overlooked or treated with disregard for their origin. Hence, most often it goes undiagnosed despite its high prevalence and this has tremendous medical and economic consequences not only for the individual but for the society as well.

Since the dentist peers into the oral cavity so often, we are in the best position to detect signs indicative of this condition. Hence, this paper deals with the etiology, pathophysiology, signs and symptoms, diagnosis and treatment of obstructive sleep apnea.

INTRODUCTION:

Obstructive sleep apnea syndrome is a widely prevalent problem with significant medical, psychological and social consequences that are both quality of life related and potentially lethal.

Cessation of breathing for ten seconds or longer is termed as apnea (from Greek-without breath). When thirty or more apneic episodes occur in the course of seven hours of sleep, resulting in excessive sleepiness during waking hours, a person is described as having sleep apnea syndrome¹. It is characterized by cessation of airflow through upper airway, while diaphragm movement continues. This condition may begin at any age, but incidence increases with age. It is more prevalent in males (up to 16%) than in females (upto 5%).

ETIOLOGY

Based on the etiology, apnea can be classified into 3 types.^{2,3}

- 1) **Central apnea** - It may be defined as inadequate breathing during sleep due to diminished or absent respiratory effort, when there is no airflow and no chest movement.
- 2) **Obstructive apnea** - There is no airflow despite chest wall movement because of upper airway obstruction.

Key Words : Obstructive sleep apnea, dental appliances in the management of obstructive sleep apnea, mandibular advancement splints.

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- 3) **Mixed apnea** - Apnea results from both the above mechanisms.

PATHOPHYSIOLOGY OF SLEEP APNEA^{4,5,6}

The critical event in obstructive sleep apnea and its variants is the narrowing and collapse of the pharyngeal airway with the onset of sleep. This can occur anywhere along its length, from the soft palate to just above the epiglottis. The collapse can be complete (apnea) or partial (when snoring is present) and leads to increased inspiratory efforts, sometimes to pleural pressures of -80cms of water or so.

The combination of intrapharyngeal negative pressure and decreased muscle activity and movement of tongue and soft palate towards the posterior wall of the pharynx results in the complete blockage of the airway. External compression (e.g. Mass loading by fat) also tends to cause closure against which the pharyngeal muscles must act. Another important factor affecting the balance of forces in the pharynx is the starting size of the lumen. If the lumen is encroached on by, for example, tonsillar hypertrophy, or abnormal tissue deposition (e.g. in acromegaly, hypothyroidism and mucopolysaccharidoses), then it is easier for the lumen to be further obliterated. Any of these conditions coupled with assuming the supine position may cause a restricted or completely blocked airway space. Other important provoking anatomical factors are the dimensions of the face which include posteriorly positioned maxillae and mandibles, steep occlusal planes, over erupted anterior teeth, large gonial angles, anterior open bites, in association with long tongues, posteriorly placed pharyngeal walls, retrognathic mandibles, large tongue and soft palate and anteroposterior discrepancies between maxilla and mandible contribute to the development of sleep apnea. This particular facial shape may to some extent be hereditary, although there is also evidence that prolonged mouth breathing as an infant can produce similar changes (sometimes called the adenoidal facies). Micrognathia, acromegaly and Down's syndrome may be predisposing conditions. Studies have shown that the tendency to have sleep apnea correlates better with neck circumference than with general obesity, and that a neck circumference of more than 43cms (17inches) is the most significant predictor of the presence of obstructive sleep apnea syndrome. Sedative drugs such as alcohol and benzodiazepines, reduce muscular tone in the pharynx and can produce snoring or provoke obstructive sleep

apneas in snorers. Thus it is important to enquire about alcohol and sedative use in patients with suspected sleep apnea.

PEDIATRIC ASPECTS⁴

Obstructive sleep apnea syndrome is being increasingly recognized in children and is mainly caused by tonsillar enlargement (occasionally only minimal). It has been linked to Sudden Infant Death Syndrome.

Tonsillectomy virtually always leads to rapid relief of symptoms, which are often less specific than in adults: they include hyperactivity, bad behavior, poor school performance and enuresis, as well as the loud snoring.

SYMPTOMS IN OBSTRUCTIVE SLEEP APNEA^{2,3,7}

Common (>60%) - These include loud snoring, excessive daytime sleepiness, feelings of choking or shortness of breath at night, restless sleep, unrefreshing sleep, changes in personality and nocturia.

Less common (10-60%) - These include morning headaches, enuresis, reduced libido, spouse worried by apneic pauses and nocturnal sweating.

Rare (<10%) - These include recurrent arousals/insomnia, nocturnal cough and symptomatic esophageal reflux.

Besides the above, lack of sleep and poor quality of sleep can also cause insomnia, excessive fatigue, memory and judgment impairment, cognitive dysfunction, irritability, nocturia, fatigue, depression and an increased tendency for accidents. Hypoxia resulting from apnea may lead to severe medical conditions.

SIGNS ASSOCIATED WITH SLEEP APNEA

These include edematous soft palate or uvula, long soft palate and uvula, decreased oropharyngeal dimensions, nasal obstruction, maxillary hypoplasia, retrognathia, central adiposity/increased neck circumference, hypertension and other cardiovascular consequences and conditions/syndromes associated with sleep apnea.

POTENTIAL SEQUELAE OF SLEEP APNEA

Neuropsychological - sleepiness, impaired memory and cognition, decreased vigilance, increased accident risk, anxiety and depression, chronic headache, intracranial hypertension.

Cardiac - Hypertension, ventricular ectopy, decreased cardiac output, ischaemic heart disease, cerebrovascular disease, and right heart failure, arrhythmia, myocardial ischaemia.

Pulmonary - Hypoxaemia, hypercapnia, pulmonary hypertension.

Endocrine - Decreased growth hormone and testosterone levels, diabetic instability

Gastro-intestinal tract - Gastro-esophageal reflux.

Hemodynamic changes may place certain patients (such as those with diabetes) at greater risk for stroke or coronary vasospasm.⁸

DIAGNOSIS AND RECOGNITION OF OBSTRUCTIVE SLEEP APNEA

Case History - The potential for obstructive sleep apnea should be evaluated as part of the routine dental examination using patient questionnaire and extended clinical examination, which was formulated by Ivanhoe et al (1999). Body Mass Index is the most commonly used predictor of obstructive sleep apnea in clinical practice.⁹ Routine evaluation of height and weight is advised and Body Mass Index is done as follows:

Body Mass Index = weight in Kgs/(Height in meters)²

A person with Body Mass Index greater than 35 should be considered as a potential sleep apnea patient.

Physical Examination^{10, 11} - This includes a nasal examination and evaluation of blood pressure. Patient profile and examination of the craniofacial skeleton give an estimate of the bony positioning, especially of the maxilla and mandible, which provide anterior support for the upper airway. If the soft tissue point pogonion is greater than 2mm behind a vertical line drawn from the vermilion border of the lower lip when the patient is placed in Frankfurt horizontal position, mandibular retrognathism is present, and it should be further evaluated with cephalometrics. Similarly, the occlusion can also provide an idea of the position of the mandible.

The next field of examination is the oral cavity and the oropharynx. As the dental profession peers into the oral cavity very often, it will be easy for us to spot changes associated with obstructive sleep apnea. The placement and size of the tongue is noted. The arch of the palate is also examined, as a high arch palate may be present in patients with obstructive sleep apnea. The oropharyngeal examination includes the soft palate, tonsils, uvula and the pharyngeal walls.

Polysomnography¹² - It is the gold standard test for obstructive sleep apnea.

Split Night Polysomnography¹² - Instead of studying the patient with obstructive sleep apnea over two nights as in case where first night was for diagnosis and second night for PAP (Positive Air Pressure) titration, the night can be split into two halves, one half for diagnosis and the other half for titration.

Radiographic and Other Imaging Techniques¹³ - A number of different imaging modalities have been used to evaluate the upper airway and surrounding bony and soft tissue structures. These include acoustic reflection, Fluoroscopy, flexible fiber optic nasopharyngoscopy, cephalometry, conventional electron beam computer tomography and magnetic resonance imaging.

Other evaluations like portable home monitoring of sleep and multiple sleep latency test can also be done.¹²

TREATMENT OF OBSTRUCTIVE SLEEP APNEA SYNDROME

Once the diagnosis of obstructive sleep apnea syndrome has been established, the treatment plan is dictated based on the classification of the condition into mild, moderate and severe and also based on the severity of the symptoms. Regardless to which treatment plan is chosen, it is important to caution the patient regarding the possible effects of drugs that depress the central nervous system and affect breathing. Alcohol, tranquilizers, sleeping pills, barbiturates and similar drugs should be avoided or used only after careful consideration of their potentially serious effects.¹⁴

The treatment options available to successfully manage patients with obstructive sleep apnea can be classified into two categories as follows:

- 1) Non-surgical
- 2) Surgical

NON-SURGICAL MANAGEMENT

Conservative management can include measures like weight loss, avoiding supine position or use of pharmacological agents like protriptyline or theophylline or positive pressure therapies like nasal continuous positive air pressure (CPAP), bilevel positive air way pressure or variable auto titration. head and neck extension may also be used.^{8,14,15}

DENTAL APPLIANCES:

There are four basic categories of dental appliances used in the treatment of obstructive sleep apnea, categorized by mode of action.¹⁶

Class	Application
1. Soft palate lifters	Adjustable soft palate lifter (ASPL)
2. Tongue posture trainer	Tepper oral proprioceptive stimulator (TOPS)
3. Tongue retainers	Tongue retaining device (TRD)
4. Mandibular repositioners	Nocturnal Airway Patency Appliance (NAPA), Herbst, Elastomeric Sleep Appliance, Snore Guard (Dental Disorder prevention, INC), Sleep and Nocturnal Apnea Reducer (SNOAR)

The more popular of these are Class3 and 4, which add to reposition the tongue and mandible anteriorly respectively, thereby reducing the risk for obstruction at this level.

Soft Palate Lifter^{16,17} - In case the airway occlusion is posterior to the soft palate (Type I occlusion), the mandible should be postured down and forward to hypothetically allow the anterior displacement of the tongue and create sufficient place for soft palate to move forward. This is somewhat naïve anatomical explanation as most obstructive sleep apnea patients sleep in a supine position and have flaccid pharyngeal musculature. Neither of these factors is conducive to the soft palate moving vertically up and away from the posterior pharyngeal wall. Type I occlusions are, therefore, the most difficult to treat with dental appliances, even with Class I appliances such as the adjustable soft palate lifter. The soft palate lifter is an intraoral device designed to lift the soft palate or reposition the uvula (equalizer). These appliances are poorly tolerated by patients and therefore of limited practical benefit.

Tongue Retaining Device (TRD)^{18,19} - TRD was described by Cartwright and Samelson in 1982. The TRD helps to overcome the airway obstruction by holding the tongue slightly forward by using negative pressure (suction) caused by placing the tongue into a cup or a bubble positioned between the anterior teeth in the lingual compartment of the device. It is effective as long as the suction seal is maintained.

Mandibular repositioner/Mandibular advancement Appliance (MAA)/Anterior mandibular repositioner (AMP)/Mandibular advancement splint (MAS) - Even though there are several kinds of MAA, they all share a common functional mechanism. The effect of the oral appliance is based on creating anterior position of the mandible by several millimeters while passively bringing the tongue with it, thereby keeping the pharyngeal airspace patent during sleep. The second less endorsed theory is that the device causes stretch induced activation of pharyngeal motor system. This motor activation provides enough stiffness to the system to prevent collapse of the airway. This theory has been supported by the observation that electromyographic activity of the tongue has been shown to increase with AMP.²⁰

A number of cephalometric predictors have been described, where a favorable response to MAS may be expected. These include reduced lower anterior facial proportions, orthognathic maxilla and mandible, high position of hyoid, normal soft palate area and tongue proportions and relatively normal post-palatal and post-lingual airway.²¹

At present many models of Mandibular Advancement Devices (MAD) are available. They can