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JIDAK July- Sept. 2021, Volume 3 , Issue 3

JOURNAL OF INDIAN DENTAL ASSOCIATION - KOCHI

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Journal of Indian Association of Kochi Branch (JIDAK) is the official scientific publication of Indian Dental Association, Kochi Branch. It is a peer-reviewed journal published quarterly in e-format as well as print format.

The journal invites manuscripts from dental and other allied health sciences. It publishes manuscripts under categories of Original Research, Review and Case Reports.

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Chief Editor's Message

We the editorial team of JIDAK are pleased to release the third issue for the year.

We all have been witnessing extra ordinary times for the past 2 years. This global pandemic has been dramatic and has brought daily evolving changes with profound impacts on people's lives worldwide.

Just as important as providing evidence for dealing with the here-and-now challenges of the pandemic will be producing learning from the crisis. Some of the changes introduced now may restructure healthcare forever. Remote consultations and other forms of virtual care represent just one example of an approach many have sought for years to see implemented, and has now been introduced virtually overnight. But not all change is good. In a time of unprecedented innovation, generating knowledge about what works, what doesn't and why will have a key role both in the short-term and for long-term change.

The crisis and the changes associated with it will likely have a profound effect on our own field as well. We may emerge with new thinking about how to study quality and safety and how to undertake improvement work. Prior scheduling of appointments, restricting chair side time and delaying all possible elective procedures has been the norm for some time now.

We all have found out our own ways of getting accustomed to these in our practice.

In fact we have been blessed to have people to communicate with in our work life. This has involuntarily helped us feel a state of normalcy compared to many other professions where the entire day is spent within four walls of a room and gadgets. Lets all try to see the positive side of things prevailing.

Most of all we hope you, your families, your colleagues and your communities remain safe and well.

Enjoy reading!!!

Dr Vidhya Parameswaran
Chief Editor- JIDAK
IDA Kochi

CONTENTS

ORIGINAL RESEARCH

AWARENESS REGARDING DENTAL STEM CELLS AMONG PEDIATRIC DENTIST: A QUESTIONNAIRE BASED STUDY

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ABSTRACT

Introduction: The subject of dental stem cells (DSCs) research is advancing at a rapid rate. Several studies have indicated that oral tissues are a good source of stem cells, and so dentists can play an important role in the field of regenerative therapies. Dentists should be familiar with fundamental biology as well as stem cell storage and processing to investigate the various applications of oral stem cells. This study aimed to assess the knowledge, attitude, and practice regarding the applications of stem cells among pediatric dentists.

Materials and methods: The present cross-sectional study was a questionnaire-based survey. The study included 105 study participants. The mean age of the participants was 32.5619± 7.73096 years. The age of the participants ranged from 23 years to 50 years. The study was conducted using Google forms. For each question, the results were expressed as a number and percentage of responses, and inferential statistical analysis was done using the chi-square test.

Results: In this survey, 95% of participants were aware of the DSCs, 91% were aware of all types of DSCs, 84.8% were aware of all DSCs applications, and 89.55% were aware of non-DSCs uses. 97% of those who took part in the survey said they were interested in learning more about DSCs.

Conclusion: Dentists are supportive of employing stem cell-based regenerative treatments in their practice and are eager to learn more about them.

Keywords: Dental stem cells (DSCs), Dental pulp stem cells (DPSCs), Regeneration.

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INTRODUCTION

The regeneration of the dental-pulp complex with stem cells has been a keen area of research since the last decade (Ishimatsu et al. 2009, Kadar et al. 2009). Stem cells are defined as clonogenic unspecialized cells which are capable of both self-renewal for long periods and multilineage differentiation, contributing to the regeneration of specific tissues.[1] Stem cells have been isolated from many tissues and organs.[2] Dental stem cells (DSCs) have been widely studied due to their easy accessibility, and less invasive harvesting time. The main characteristics of these stem cells are their potential for multipotential differentiation and self-renewal ability. DSCs offer a very promising therapeutic approach to restore structural defects and this concept is extensively being evaluated.[3,4,5]

The DSCs isolated are dental pulp stem cells (DPSCs), stem cells from exfoliated deciduous teeth, stem cells from the apical papilla, periodontal ligament stem cells, and dental follicle progenitor cells. Stem cells are capable of differentiating into a variety of cells, such as neural cells, osteoblasts, chondrocytes, adipocytes, and myocytes (Miura et al. 2003, Kerkis et al. 2006, Wang et al. 2010).[2] Primary incisors and canines with no pathology and at least one-third of root length remaining are ideal candidates for stem cell isolation and harvesting.[6, 7, 8] Stem cells can be stored for a very long period and can be used in the treatment of many diseases including certain malignancies.[9,10,11,12]

Previous studies have found varying levels of DSC knowledge and attitude, as well as their prospective uses, among health professionals and students in health science colleges around the world. In India, for example, general dentists had a favorable attitude toward the use of DSCs in dentistry; however, their knowledge was inadequate (Katge et al., 2017)[13]. Students in other health disciplines, such as nursing students in Malaysia, demonstrated a modest level of understanding and a good attitude regarding therapeutic uses of DSCs (Lye et al., 2015).[14] A recent study conducted by Mohamed and Azzay et al found that a sample of nursing students had little awareness of DSCs, but had a favorable attitude towards stem cell therapy.[15]

To our knowledge, there are no published reports assessing knowledge and/or attitude regarding stem cells and their therapeutic potential applications among pediatric dentists in India. Hence this study was planned to assess the knowledge and awareness concerning DSCs among pediatric dentists.

METHODOLOGY

The present cross-sectional study was a questionnaire-based survey conducted from February to March 2020. The survey carried out was a knowledge, attitude, and practice study. The questions were formulated after going through similar studies and articles published in academic journals related to DSCs.[16, 17, 18, 19, 20] The questionnaire was subjected to a pilot study on 20 dentists which included postgraduate students as well as teaching faculty of Royal Dental College, Chalissery, Kerala. The suggested points were incorporated depending on their merits concerning the mentioned study. The final questionnaire consisted of 32 questions.

The questionnaire link was sent through email and via WhatsApp group which comprised of pediatric dentistry postgraduates residing in India, which included pediatric dentistry postgraduate students/ practitioners/ faculty/ practitioner and faculty. A total of 105 consenting dentists responded to the survey. The questionnaire was close-ended, self-administered, and conducted using Google forms.

The initial 11 questions pertained to socio-demographic variables. The socio-demographic variables included age, gender, area of work, qualification, and years of experience. The next set of questions assessed the awareness regarding stem cells, source of knowledge, tooth banking procedure, applications, ethical concerns, barriers toward the use of stem cells, and methods of increasing awareness regarding the same.

The data was entered into the excel sheet. The data were analyzed using SPSS (Statistical Package for Social Sciences) 20.0 version. Descriptive statistics were performed. The comparison between the groups was done using the Chi-square test. A P-value less than 0.05 was considered statistically significant. The confidence interval was set at 95%.

RESULTS

The study included 105 study participants. The mean age of the participants was 32.5619± 7.73096 years. The age of the participants ranged from 23 years to 50 years. The number of female participants was more as compared to male participants. Most of the participants of the survey were second-year postgraduate students followed by the dentist who was working as both faculty and practitioner.

Amongst the dentists (non-student) maximum were found to have working experience of fewer than 5 years. The response to any question did not differ significantly between the male and female dentists (p value>0.05).

The response to all the questions except for one question did not differ significantly between the students/practitioners/faculty/ practitioners and faculty group. The response to the question- "Are you aware of DSC banks in India?" differ significantly between the participants having different work profile.

A substantially higher proportion (84.6%) of dentists working as both 'practitioners & faculty' know about stem cell banks in India. However, only a lower proportion (36.8%) of dentists working solely as practitioners know about stem cell banks(Chi-square value- 11.914, df-3, p value<0.008).

The response to the question "Are there any ethical concerns regarding the use of stem cells in dentistry" was found to differ significantly from the experience of the dentist. A significantly greater proportion of dentists (75.0%) working for 5-10 years believe that there is no ethical concerns regarding the use of stem cells in dentistry whereas a significantly greater proportion (75.0%) of dentists working for more than 10 years believe that there are ethical concerns regarding the use of stem cells in dentistry (Chi-square value- 13.515, df-6, p value<0.036).

The perception of dentists regarding the preservation or storage of DSCs also varied significantly with the experience of dentistry. A significantly greater proportion (100.0%) of students believe that preservation or storage of DSCs should be done whereas a significantly lesser proportion of dentists having experience of 5-10 years believe that preservation or storage of DSCs should be done (Chi-square value- 10.425, df-3, p value<0.015). The response to other questions did not vary significantly between the dentists with different experiences (p value>0.05).

Gender	Number	Percentage
Male	47	44.8
Female	58	55.2
Total	105	100.0

Table 1. Gender-wise distribution of study participants.

Work	Number	Percentage
Student	52	49.5
Practitioner	19	18.1
Faculty	8	7.6
Practitioner & Faculty both	26	24.8
Total	105	100.0

Table 2. Frequency distribution of study participants based on work.

Experience of practice	Number	Percentage
Not applicable	28	26.7
Less than 5 years	35	33.3
5-10 years	22	21.0
More than 10 years	20	19.0
Total	105	100.0

Table 3. Frequency distribution of study participants based on experience of practice.

DISCUSSION

In this survey, 95% of participants were aware of the DSC, 91% were aware of all types of DSCs, 84.8% were aware of all DSC applications, and 89.55% were aware of non-DSC uses. This finding is consistent with a relevant study performed on dentists in South Africa (Basson et al., 2016).[21] whereas the same is contrary to a

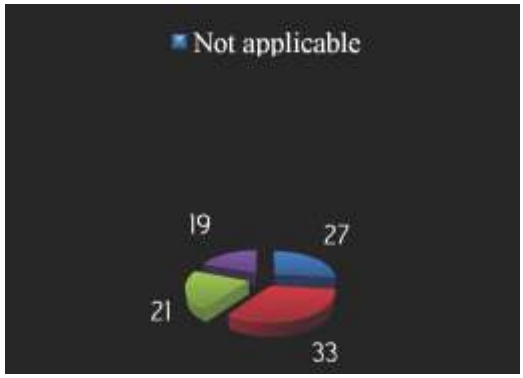

Figure 1. Frequency distribution of study participants based on experience of practice.

Figure 2. Frequency distribution of study participants based on the year of study

conducted in Italy that concluded two-thirds of participated physicians had no specific knowledge about stem cells (Frati et al., 2014).[22]

Participants had a reasonably good understanding of teeth being used for DSC banking, ethical considerations regarding the preservation of DSC, and how long DSC can be preserved (52%). Postgraduates had a better understanding of DSC because these are covered in postgraduate courses. The presence of DSC banks in India was unknown to more than half of the participants. The postgraduate participants were more aware of these procedural details. However, only around a quarter of the other faculties knew the procedures involved in DSC harvesting. When given the opportunity, 94.7% of participants said they would like to harvest DSCs in their professional practice if they were given the opportunity. High prices and a lack of patient information were highlighted as barriers to DSC banking by the participants. Other characteristics mentioned, such as a lack of operator skills and process competence, imply that, while theoretical understanding has increased in recent years, practitioners still lack practical knowledge and abilities.[23,24]

The primary barriers to seeking therapy with DSCs, according to 74.3% of dental professionals are the high cost, lack of awareness, ethical difficulties, and insufficient knowledge of DSC among dental practitioners. A report published by Chitroda et al,[25] and Goyal et al[19] agreed that the high cost, lack of awareness, and lack of sufficient understanding were preventing patients from receiving DSC treatment. These obstacles can be solved by raising public awareness through public seminars and talks, which will help to dispel common misconceptions about stem cells.[20]

Almost 53.3% of people are uninformed of the Indian Council of Medical Research's guidelines on DSCs. There is a need to raise knowledge of these recommendations among dental professionals which may assist them to improve the safety of procedures and treatments involving DSC.

Despite their lack of in-depth knowledge of DSC banking, isolation, and storage, the majority of dentists were eager to brush up on their skills and advise their patients to store their DSCs. This may be because dental professionals are recognizing that this is an emerging and rapidly growing area with advantages such as ease of extracting dental cells and the ability to differentiate into several cell lineages. 97% of those who took part in the survey said they were interested in learning more about DSCs. Conferences, journal articles, and the internet were all used to gather information and increase awareness about DSCs.

CONCLUSION

According to the findings of this study, there is a high level of knowledge about DSC. However, the dentists who took part in the survey lacked knowledge about procedural details and ethical concerns of DSCs. Postgraduates had a higher level of knowledge, which could be attributed to the revised and research-oriented curriculum. The respondents showed a constructive attitude toward upgrading their awareness of DSCs. This can be accomplished by integrating this topic into the college curriculum in greater

detail. Discussions on the topic in conferences, lectures, and scholarly journals will help with this. It's critical for dental professionals to keep their knowledge updated on DSC research and technology.

REFERENCES

1. Casagrande L, Mattuella LG, de Araujo FB, Eduardo J. Stem cells in dental practice: Perspectives in conservative pulp therapies. J Clin Pediatr Dent 2006;31:25 7.
2. Rodríguez-Lozano FJ, Bueno C, Insausti CL, Meseguer L, Ramirez MC, Blanquer M, Marin N, Martínez S, Moraleda JM. Mesenchymal stem cells derived from dental tissues. International endodontic journal. 2011 Sep;44(9):800-6.
3. Petrovic V, Stefanovic V. Dental tissue—a new source for stem cells. TheScientificWorldJOURNAL. 2009 Oct 14;9:1167-77.
4. Chalisserry EP, Nam SY, Park SH, Anil S. Therapeutic potential of dental stem cells. Journal of tissue engineering. 2017 May 20;8:2041731417702531.
5. Iohara K, Nakashima M, Ito M, Ishikawa M, Nakasima A, Akamine A. Dentin regeneration by dental pulp stem cell therapy with recombinant human bone morphogenetic protein 2. Journal of dental research. 2004 Aug;83(8):590-5.
6. Huang YH, Yang JC, Wang CW, Lee SY. Dental stem cells and tooth banking for regenerative medicine. J Exp Clin Med 2010;2:111-7.
7. Miura M, Gronthos S, Zhao M, Lu B, Fisher LW, Robey PG, et al. SHED: Stem cells from human exfoliated deciduous teeth. Proc Natl Acad Sci U S A 2003;100:5807-12.
8. Iglesias-Linares A, Yáñez-Vico RM, Sánchez-Borrego E, Moreno-Fernández AM, Solano-Reina E, Mendoza-Mendoza A. Stem cells in current paediatric dentistry practice. Arch Oral Biol 2013;58:227-38.
9. Masato K, Hiroko K, Toshitsugu K, Masako T, Shinya K, Masahide M, et al. Cryopreservation of PDL cells by use of program freezer with magnetic field for teeth banking. Dent Jpn2007;43:82-6.
10. Huang AH, Chen YK, Chan AW, Shieh TY, Lin LM. Isolation and characterization of human dental pulp stem/stromal cells from nonextracted crown-fractured teeth requiring root canal therapy. J Endod2009;35:673-81.
11. Zhang W, Walboomers XF, Shi S, Fan M, Jansen JA. Multilineage differentiation potential of stem cells derived from human dental pulp after cryopreservation. Tissue Eng 2006;12:2813-23.
12. TT-450-Stem Cells and Teeth Banks, ebiz News from Japan.
13. Katge F, Shetty AJ, Rusawat B, Vamsi KC. Knowledge and attitude of Indian dentists regarding dental stem cells: A cross-sectional descriptive survey. Indian J Dent Res 2017;28:367-74.
14. Lye, J., Soon, L., Nizam, W., Ahmad, W., Tan, S., 2015. Knowledge and attitude about stem cells and their application in medicine among nursing students in UniversitiSains Malaysia, Malaysia. Malays. J. Med. Sci. 22 (4), 23–31.
15. Mohamed, H., Azzazy, H., 2016. Effect of educational intervention on knowledge and attitude of nursing students regarding stem cells therapy. J. Nurs. Care 5 (8), 75–80.
16. Bhatt R, Bhatt A, Gurjar D, Dave L. Evaluating awareness on dental pulp stem cells and its applications amongst graduating dental students of Ahmedabad and Gandhinagar district: A cross-sectional survey. Adv Hum Biol 2014;4:54-9.
17. Sede MA, Audu O, Azodo CC. Stem cells in dentistry: Knowledge and attitude of Nigerian dentists. BMC Oral Health 2013;13:27.
18. Goyal A. Knowledge, awareness and attitude regarding stem cells among dental practitioners in Udaipur city, Rajasthan. Int J Adv Res 2015;3:677-84.
19. Utneja S, Nawal RR, Ansari MI, Talwar S, Verma M. A survey of attitude and

opinions of endodontic residents towards regenerative endodontics. J Conserv Dent 2013;16:314-8.

20. Goswami M, Kumar G, Sharma S. "Dental Stem Cells": Awareness, knowledge, and attitude of dental professionals—A cross-sectional study. Special Care in Dentistry. 2020 Jan;40(1):90-6.
21. Basson, R.A., Moodley, D.S., Oliviera, A., Basson, N.J., 2016. A survey of the opinions of Dentists regarding stem cells in Dentistry. S. Afr. Dent. J. 71 (8), 351–355.
22. Frati, P., Gulino, M., Pacchiarotti, A., D'Errico, S., Sicuro, L., Fineschi, V., 2014. A survey of Italian physicians' opinion about stem cells research: what doctors prefer and what the law requires. Biomed. ResInt., 9
23. Prue CE, Hammer HC, Flores AL: Effects of folic acid awareness on knowledge and consumption for the prevention of birth defects among Hispanic women in several U.S Communities. J Womens Health (Larchmt). 2010, 19 (4): 689-89.
24. Lie LY, Angelique L, Cheong E: How do male and female students approach learning at NUS?. CDTL Brief. 2004, 7: 1-3.
25. Chitroda PK, Katti G, Attar NM, Shahbaz S, Sreenivasarao G, Patil A. Stem cells in dentistry: A study regarding awareness of stem cells among dental professionals. Indian Journal of Dental Research. 2017 Nov 1;28(6):711.

REVIEW ARTICLE

ERA OF BIOMIMETIC RESTORATIVE DENTISTRY- A NARRATIVE REVIEW

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ABSTRACT

Advancement in restorative material science and better understanding of bonding have influenced the treatment approach for restoring dentition. Thus evolved the concept of biomimetics in the field of restorative dentistry. Biomimetic dentistry helps to recreate the form, function and aesthetics of the dentition in a natural way. This narrative review intends to give an overview of biomimetics in restorative dentistry.

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INTRODUCTION

The word 'biomimetic' is derived from a Latin word, where "bio" means life, and "mimetic" means imitation or mimicking.[1] Hence biomimetic is the art of mimicking nature. The term was put forward by biomedical engineer Otto Schmitt in the 1950s.[1] It is a multi-disciplinary approach, where inspiration elicited from nature is used to design products that mimic nature, so that it functions biologically. In the past two decades the principles of biomimetics have been incorporated and extensively explored across various fields of dentistry including remineralisation, restoration, endodontics, regeneration etc.

Biomimetics in restorative dentistry

For a restorative dentist an indubitable reference is the natural tooth itself. Biomimetics in restorative dentistry involve restoring the functional, mechanical and aesthetic requirement of teeth as naturally as possible[2]. Basically it aims to replace the damaged portion of teeth far more conservatively in contrast to the traditional tooth preparation which involves extensive and invasive preparations to facilitate retention and resistance forms. In brief the traditional restorative techniques was to prioritise the need of the material rather than tooth needs.[3] Biomimetics in restorative dentistry was facilitated and supported by the developments and evolution in dental composite resins, clinical adhesives and dental ceramics.[4,5]

Material of Choice for Biomimetic Restoration

Biomimetic restorative material should not only satisfy the aesthetic and mechanical requirement but also it should be bio-compatible. A thorough understanding of hard tissue arrangement of tooth is crucial for successful selection and usage of a material for biomimetic restoration.[2] Enamel and dentine act as a complex structure complimenting each other. In natural tooth the hard brittle and glass like enamel is supported by soft resilient dentin. The resilient dentin provides a cushioning effect by virtue of the collagen, which clinically arrests crack propagation from the enamel. In brief it compensates for the brittleness of enamel.[6] A biomimetic restoration should mimic these features. Further to it there should not be any discrepancy in the mechanical properties such as elastic modulus and surface hardness of teeth and restorative material. Such discrepancy if notable or remarkable can lead to fracture of tooth, marginal leakage, and plaque accumulation, which in turn would affect the clinical performance of the restoration in the long term.[7,8] In order to achieve biomimetics the enamel should be replaced with brittle, hard, glasslike, translucent material, whereas dentine which needs replacement should be substituted by resilient material.

From the clinical perspective let us take the example of few newer material used in contemporary dentistry. Newer dental ceramic made of lithium dislicate popularly called as LiDiSi has an elastic modulus (EM) ranging 60 - 95 GPa. This elastic modulus is comparable to that of natural enamel (EM 72-125). Added to this is the high aesthetic resemblance to the enamel of the tooth, whereas on the other hand dental resin composites have a EM of 13-18 GPa which is comparable to that of the natural dentine (EM-14 - 38Gpa) so can be a better alternative to replace dentin. This implies that in case of minimal to moderate tooth loss dental composites alone can behave as a good biomimetic restorative material (fig-I-A & I-B), which can re-enforce the remaining tooth structure[9]. And in case of larger defects usage of the newer LiDiSi having properties similar to enamel is deemed better(fig II-A,II-B,III-A& III-B)[10].

Adhesion - Corner Stone of Biomechanical Restoration

Dental adhesives commonly termed as bonding agents play a crucial role in achieving predictable outcome in biomimetic restoration. Perfect bonding between the restorative

Small defect on incisors (Fig-I A) corrected using Composite Resins (Fig-I B)
(Photo Courtesy – Dr Prasanth Dhanapal)

Large defect on molar (Fig-II A) corrected using LiDiSi inlay (Fig-II B)
(Photo Courtesy – Dr Prasanth Dhanapal)

Large defect on premolar (Fig III-A) corrected using LiDiSi onlay (Fig III-B)
(Photo Courtesy - Dr Prasanth Dhanapal)

material and the tooth creates a monoblock. This monoblock by virtue of absence of interfaces allows the functional stress to get dissipated through tooth structure. Thus restoring mechanical and biological function of the tooth optimally.[10] Proper selection and usage of state of art adhesives seals the gap between the material and the tooth structure optimally so as to prevent sensitivity, pain, bacterial leakage and pulpal damage in the long term[11]. It also contributes considerably for the tooth to handle functional stresses similar to the natural tooth.[12]

Utilization of adhesive protocols would eliminate the need for extensive tooth destructive mechanical retentive features which would enable tooth conservation to a larger extent satisfying one of the main objectives of biomimetic restorative dentistry.

The Protocols for Biomimetic Restorative Dentistry

The basic protocols for biomimetic restorative dentistry were found on an article 'silent revolution of adhesive dentistry'.[4] Further advancements were made by Japanese researchers, where in newer technologies were introduced to get a predictable bonding to dentine .[13,14]

The four paradigms of biomimetic dentistry involves,

- Maximum bond strength, which allows the restored teeth to function and handle stress like that of natural tooth.
- Good marginal seal so as to prevent further microbial invasion.[15]
- Increased pulp vitality leading to increases in fracture resistance three times than restored teeth[16].
- The ultimate goal of biomimetic restorative dentistry is to reduce the stress and maintain maximum bond strength hand in hand.[17]

The protocols that have been advocated to follow these paradigms can be classified in to two – stress reducing protocols and bond maximising protocols.

Stress reducing protocols include the usage of indirect restorations (to reduce the development of compressive stress), replacing the lost dentine with composite of similar EM so as to help absorb and dissipate the stress evenly, use of fibers on the pulpal floor and axial wall to cause hindrance to crack propagation), capping of the cusp thinner than 2mm, converting the tensile forces in to vertical compressive forces (compression dome concept.[8,9,18,15]

Compression dome concept (fig- I): A natural tooth is designed to tolerate compressive stress than tensile stress. Tooth can be compared to a dome of cathedral where the forces acting on the top portion of the dome produces vertical stress, and forces acting away from the top of the dome generate tensile stress (fig-IV). Based on this concept when the tooth margins are placed more cervical as if in conventional

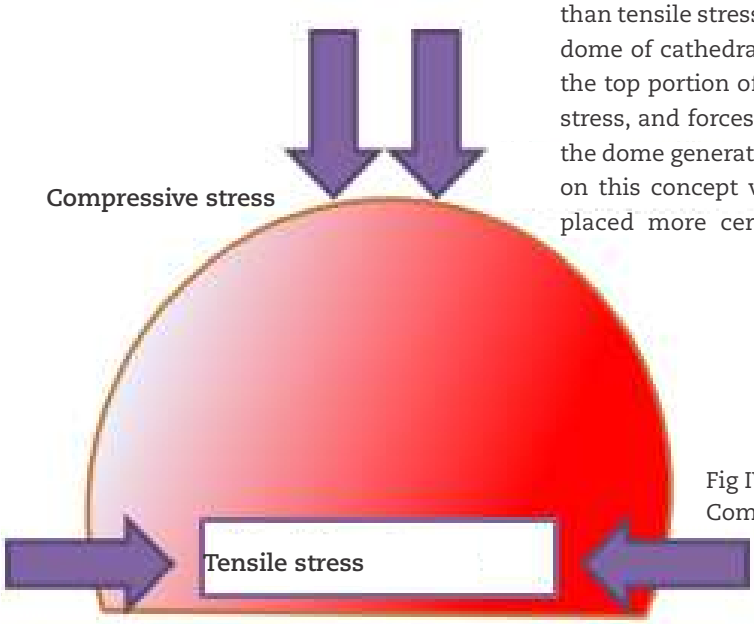

Fig IV
Compression Dome Concept

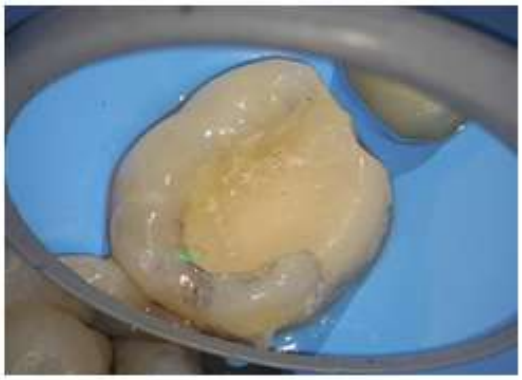

Fig-V A: Large defective restoration on mandibular molar

Fig-V B: Tooth preparation for table top restoration

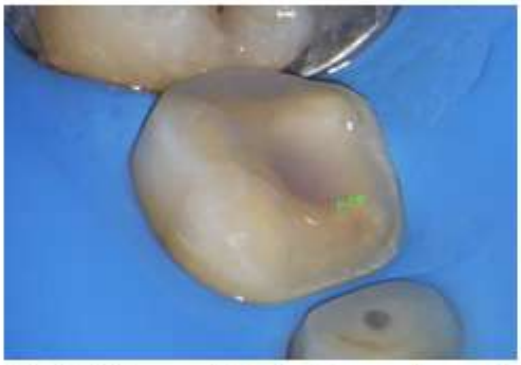

Fig-V C: Immediate dentine sealing and undercut blocking

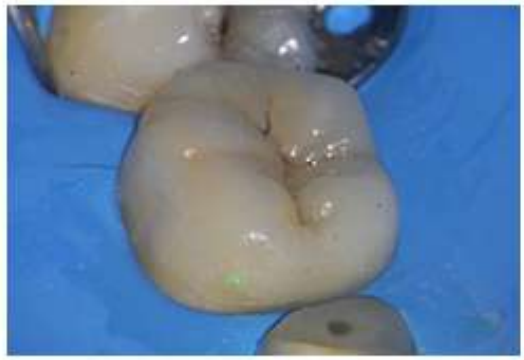

Fig-V D: Occlusal table top on mandibular molar

Fig V (B, C, D) - Placement of preparation margins more occlusaly to avoid tensile stress (Photo Courtesy - Dr Jojo Kottoor)

crown preparation lateral stresses are created which are more destructive in nature in comparison to the forces generated by margins placed far more occlusally as in case of onlays, overlays and tabletop preparations (fig-V). In a more occlusally placed margins the tensile stresses are transformed into a more vertical tangents which are better tolerated by the tooth.[19]

Bond maximisation protocols on the other side of the spectrum involves using of a good bonding agent, achieving a caries free healthy tooth as the bonding substrate, air abrading the underlying composite, de-activating of matrix metallo-proteinases, immediate dentine sealing and deep margin elevation whenever required.[20]

The combination of each protocol with due care and caution helps to attain a predictable long standing restoration.

CONCLUSION

In the past two decades numerous advancements in the field of biomimetic restorations have happened and it is still evolving positively. However, the proper understanding and utilization of available material, technology and protocols would prove to yield promising results which would definitely benefit the restorative dentist and the patient.

REFERENCES

1. Harkness, J.M. An idea man (the life of Otto Herbert Schmitt). IEEE Eng. Med. Biol. Mag. 2004, 23, 20–41.
2. Zafar M.S., Amin F., Fareed M.A., Ghabbani H., Riaz S., Khurshid Z. and Kumar N.(2020) Biomimetic Aspects of restorative

dentistry biomaterials. Biomimetics, 5(3), 34.

3. Magne P. and Belser U. (2002) Bonded porcelain restorations in the anterior dentition: a biomimetic approach. Quintessence Publishing Company
4. Roulet J-F, Degrange M. Adhesion: The Silent Revolution in Dentistry. Chicago, IL: Quintessence Publishing; 2000
5. Magne P, Douglas WH. Rationalization of esthetic restorative dentistry based on biomimetics. Journal of Esthetic and Restorative Dentistry. 1999 Jan;11(1):5-15.
6. Lin CP. Doudas WH. Structure-property relations and-crack resistance at the bovine dentin-enamel junction. J Dent Res 1994; 732 072-1 078.
7. Junior, R.; Adalberto, S.; Zanchi, C.H.; Carvalho, R.V.D.; Demarco, F.F. Flexural strength and modulus of elasticity of different types of resin-based composites. Braz. Oral Res. 2007, 21, 16–21.
8. Trindade, F.Z.; Valandro, L.F.; de Jager, N.; Bottino, M.A.; Kleverlaan, C.J. Elastic properties of lithium disilicate versus feldspathic inlays: Effect on the bonding by 3D finite element analysis. J. Prosthodont. 2018,27, 741–747.
9. Morin, D.; DeLong, R.; Douglas, W. Clinical science cusp reinforcement by the acid-etch technique. J. Dent.Res. 1984, 63, 1075–1078
10. Magne, P. Composite resins and bonded porcelain: The post amalgam era. CDA J. 2006, 34, 135–147
11. Brannstrom M. The hydrodynamic theory of dentinal pain: sensation in preparations, caries and the dentinal crack syndrome. Journal of Endodontics. 1986;1 2(10):453-457
12. . Alleman D, Magne P. A systematic approach to deep caries removal end-points: The peripheral seal concept in adhesive dentistry. Quint Int. 2012;43(3):197-208
13. . Nakabayashi N, Pashley DH. Hybridization of Dental Hard Tissues. Chicago, IL: Quintessence Publishing; 1998
14. . Fusayama T. New Concepts in Operative Dentistry: Differentiating Two Layers of Carious Dentin and Using an Adhesive Resin. Chicago, IL: Quintessence Publishing; 1980
15. Bottacchiari S. Composite Inlays and Onlays: Structural, Periodontal and Endodontic Aspects. Milan, Italy: Quintessenza Edizioni; 2016.
16. Kishen A, Vedantam. Hydrodynamics in dentine: Role of dentinal tubules and hydrostatic pressure on mechanical stress-strain distribution. Dental Mater. 2007;23(10):1296-1306
17. Versluis A, Tantbirojn D, Pintado M, De Long R, Douglas WH. Residual shrinkage stress distributions in molars after composite restoration. Dental Mater. 2004;20(6):554-564.
18. Belli S, Orucoglu H, Yildirim C, Eskitascioglu G. The Effect of Fiber Placement or Flowable Resin Lining on Microleakage in Class II Adhesive Restorations. J Adhes Dent. 2007;9(2):175-181.
19. Milicich G. The compression dome concept: the restorative implications. General dentistry. 2017 Sep 1;65(5):55-60.
20. Posterior indirect adhesive restorations The international journal of esthetic dentistry Volume 4, number 12 winter 2017

REVIEW ARTICLE

LIGHT CURING UNITS - AN INSIGHT

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ABSTRACT

Success of a composite resin restoration is dependent on multiple factors starting with case selection, tooth preparation, and the placement techniques for the restorative material. The clinical success of these light-cured resin composite restorations also hangs on the optimized polymerization of the adhesive and composite resin. At times dentists surmise that activating a light-curing device will reliably and predictably cure the material. However there are important factors that need to be taken into account to ensure the durability of the light curable restorations placed. This review intends to throw light on important factors that needs to be taken into consideration when selecting a light curing devices and specific requirements in employing these devices to polymerize few newly evolved dental materials

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INTRODUCTION

Dental resin composites in clinical practice are basically cured by a process of photo-polymerization. The term polymerization implies that a malleable resin composite converts into an insoluble polymer after it is subjected to light irradiation from a light emanating source.[1] Adequate photo polymerization of the resin is necessary for the long-term success of a composite restoration.[2] Inadequate and improperly cured composite restoration are bound to fail and can bring about associated problems such as recurrent caries due to microleakage, fracture due to reduced strength, sensitivity problems, pulpal damage and poor wear resistance.[3]

Optimized light curing techniques employing the best of the light curing devices plays a crucial role in achieving this objective. Even though it may appear that all curing lights will achieve an adequate result, it has been demonstrated that not all light curing devices are equivalent and many key variables affect the efficiency of the light curing devices. From that view point not all light curing devices available at the disposal of a clinician would provide the desired features in term of curing capabilities.[3]

How to evaluate a light curing unit:

Findings from several studies across the globe suggest that dentist often end up using improper light curing devices and mostly they are unaware of this deficiency of the light curing device in terms of inadequate amount of radiant exposure or improper wavelength to cure their resins.[3] Output of the light and the amount of time the light is turned on towards the resin are two important critical variable in evaluating the efficiency of light cure polymerization.[4] It is a common practice to describe the light output from a light curing device in terms of irradiance due to its ease of observation. Dental radiometers are utilized for this purpose to convince clinicians. Frankly this does not provide complete information on the potential performance of a light curing unit.[5] Light output from light curing units can seldom be accurately measured and never can be completely described by a commercial dental radiometer.[6] The inaccuracy and inefficiency of this method can be attributed to several factors such as variation in the active curing tip diameter, emission spectrum of the light curing unit (LCU), types of filters used in the radiometers.[6]

Depending on the shade and brand of composite used for a conventional 2mm thickness increment the minimum energy requirement to photo polymerize has been reported to be in the range of 6 J/cm² to 24 J/cm².[7] Importantly the irradiance can be very different at clinically relevant distances away from the light tip when curing dental resins within cavity preparations. Curing lights deliver significantly less irradiance, of often 75% or more, within a cavity preparation in clinical dental practice.[8] Manufacturers' stated irradiance values can give the impression that the clinician is using a powerful curing light, but the fact remains is that significantly less of irradiant energy is actually reaching the surface of the resin composite that the clinician intends to cure.[3]

Beam Profile from the LCU:

The light beam from the curing light unit tip disperses leading to inhomogeneous distribution of light intensity. So when the wand is moved away from the resin surface, the light intensity decreases thereby the amount of curing also decreases. This inhomogeneity can result in non uniform polymerization beneath the light guide tip.[9]

A beam profile demonstrates the locations and radiant intensities on the surface of the light tip from where light is being emitted. For some lights, the light being emitted is uniformly distributed over the entire surface of the light tip, referred to as a "top hat" appearance. While in some light curing units the light is predominantly delivered only at the center of the tip with a rapid fall-off at the edges of the light tip. While in case of few light curing units, the profile appears to be hills and valleys with an inconsistent and uneven light output.[10] Ideally the manufacturer should furnish report about the beam profile of a light curing unit thus enabling the clinician better understanding about the beam characteristic

which the surface of the composite resin would receive during photo polymerization. The clinical implications of a beam profile is that if an superimposed overlay of the beam profile were to be placed onto a tooth preparation, it would demonstrate the regions of the preparation that are not receiving adequate radiant exposure to cure a dental resin.[3]

Temperature changes in light curing units:

The light from a LCU can be also a source of heat, which can have biological effects. Hence arbitrarily increasing the exposure time to assure complete polymerization without understanding the effects of heat from the light source can be detrimental. For every 1°C degree rise in temperature the rate of reaction will increase by 1.90 %.[11] It is reported that 1 second after the light is turned on, the conversion rate becomes twice as fast when the initial temperature of the resin based composites (RBC) increases from 22 °C to 35 °C.[12] Composite resins polymerized at an elevated temperature (37°C) build up stress more rapidly than specimens at 23 °C.[13]

Polymerization of light-activated composite resins causes both an exothermic polymerization reaction and also a temperature rise from the light energy absorbed during irradiation. The heat generated depends on the bulk of material, the irradiance, and the rate at which the RBC polymerizes.[14] Many clinicians advocate either air cooling the tooth during extended light exposure and curing or allowing a cooling period of 2-3 seconds between every 10 second curing.[3]

Light curing device:

Source of light from a light curing unit such as quartz tungsten halogen (QTH) bulb, light emitting diode (LED), or plasma arc (PAC) plays an important role in the irradiance value, and the radiant exposure delivered to the tooth and the RBC being placed. Other variables include exposure time, configuration of the tips/ probes, energy source of the unit and the cooling mechanisms.

It has been observed that conventional and most popularly used QTH units exhibit more light scattering. On the other hand, more light is absorbed by composite resin when LASER light cure units are used.[15] Though the laser lights have better absorption, the devices have limited bandwidth and emit wavelengths closer to the absorption peak of certain photoinitiator in composite resin. Thus, QTH units are more efficient than LASER units for visible light cured composites. Conversely, due to inherent property of coherency of laser beam, there is no loss of power in the distance in laser units which is pronounced in QTH units. Therefore, laser units are preferable in curing composites in accessible areas.[16]

Exposure Time:

Increasing the power density of light curing units can reduce the exposure time required for a given depth while at the meantime increases the rate and degree of cure.[17] As the energy density is a product of intensity multiplied by exposure time, the same energy can be consumed at high or low intensities by modifying the exposure time to maximize the energy efficiency.[18] It has been reported that exposure times longer than those recommended are usually required to optimize the flexural strength for an incremental thickness of composite.[19] An exposure time of 40 secs is considered optimal for all curing light units used for resin based composites.[20]

Lamp output intensity:

Clinical life of a light curing unit mainly depends on the ability to maintain the units output intensity. This usually reduces over a period of time. This reduction can be attributed to alternative heating and cooling of the tip surface, leading to dulling or clouding of the tip due to condensation of vapors from bonding system solvents or moisture. Moreover, the resin composite itself adheres to the tip resulting in scattering of light and reduction in its effectiveness. Therefore, it is important to clean the mirror surface of the tip routinely using alcohol or methyl ethyl ketone solvents to preserve and renew the reflection effectiveness of the light source.[21]

Angulation of light tip:

A light beam creates a circular spot of light when it is held perpendicular to the restoration surface. In order to achieve maximal light intensity at the restoration surface, the wand tip of curing should be held parallel to the restoration surface . When the wand is tipped, the circular shape changes to an ellipse shape and thus there will be decrease in the light intensity as energy would be spread over a greater area.[22]

Distance of curing tip from composite Surface:

Light intensity striking the composite restoration surface is inversely proportional to the distance from the tip of the fiber optic bundle of the curing light to the composite surface.[16] Depth of cure generally decreases as the distance from the tip to the resin increases.[23] Ideally the tip of the light cure should be within 3mm of resin composite to be effective. For darker shades of composites, the increments should be limited to 1mm of thickness.[18]

Photo-initiator used:

Light cure polymerization of dental composites happens or in fact starts due to the presence of a substance called as photo initiator in the composite. Two commonly used photo-initiators used in dental composites are camphorquinone (CQ) and monoacyl phosphine oxide (TPO). CQ is a bright yellow type II photo initiator that absorbs light in the visible spectrum at a wavelength 467nm and in the UV region in the range of approximately 200-300nm.[1] TPO is light yellow type I photoinitiator and absorbs light in the range of approximately 295-390nm.[24] The two photoinitiators may be used either alone or in combination at different concentrations along with their co-initiators.[1] The output of the light cure unit should be in the range which can activate the particular photoinitiator in the composite being used, because all composites do not use the same photoinitiator and not in the same proportions. This mismatch between the unit output and the manufacture choice of photoinitiator can be major clinical issue.

In order to efficiently cure a wide range of composites with different photo initiator such as TPO, manufacturers of light curing units have introduced new polywave light curing unit. Monowave light curing units have LED source that emits output at approximately the same wavelength. The new polywave unit have different LED source combination enabling them to emit light of combination of different wavelength near the camphorquinone range and the 400-410nm range, which is close to the absorption range of TPO. This allows the polywave system to activate the resin composites more efficiently in which newer photo-initiators are been incorporated .

CONCLUSION:

Clinician's knowledge and skill in handling and maneuvering curing units play an important role in polymerization and final outcome of the resin based composite restorations. In order to address the problem associated with curing and to improve the chance of a successful restoration, it is important to understand the curing units along with its properties so that we can use this information to improve the clinicians ability to deliver sufficient light to resin based composites.

REFERENCES

1. Kamoun, E. A., Winkel, A., Eisenburger, M., & Menzel, H. (2014). Carboxylated camphorquinone as visible-light photoinitiator for biomedical application: Synthesis,characterization, and application. Arabian Journal of Chemistry .
2. Ferracane J, Watts DC, Barghi N, et al. Effective use of dental curing lights: a guide for the dental practitioner. ADA Professional Product Review. 2013;8(2):2-12.
3. Strassler HE, Price RB. Understanding light curing, Part I. Delivering predictable and successful restorations. Dentistry today. 2014 May;33(5):114-6.
4. Price RB, Strassler HE, Price HL, et al. The effectiveness of using a patient simulator

to teach light-curing skills. J Am Dent Assoc. 2014;145:32-43.

5. Shortall AC, Harrington E, Wilson HJ. Light curing unit effectiveness assessed by dental radiometers. J Dent. 1995;23:227-232.
6. Leonard DL, Charlton DG, Hilton TJ. 1999. Effect of curing-tip diameter on the accuracy of dental radiometers. Oper Dent 24(1):31–37.
7. Ferracane J, Watts DC, Barghi N, et al. Effective use of dental curing lights: a guide for the dental practitioner. ADA Professional Product Review. 2013;8(2):2-12.
8. Rueggeberg FA, Jordan D. Light tip distance and cure of resin composite. J Dent Res. 1992;71(special issue A). Abstract 661.
9. Arikawa H, Kanie T, Fujii K, Takahashi H, Ban S. Effect of inhomogeneity of light from light curing units on the surface hardness of composite resin. Dental materials journal. 2008;27(1):21-8.
10. Strassler HE. Successful light curing—not as easy as it looks. Oral Health. 2013;103:18-27
11. Hiemenz PC, Lodge T. 2007. Polymer chemistry. Boca Raton (FL): CRC Press
12. Price RB, Labrie D, Whalen JM, Felix CM. 2011. Effect of distance on irradiance and beam homogeneity from 4 light-emitting diode curing units. J Can Dent Assoc 77:b9.
13. Watts DC, Alnazzawi A. 2014. Temperature-dependent polymerization shrinkage stress kinetics of resin-composites. Dent Mater 30(6):654–660.
14. Bouillaguet S, Caillot G, Forchelet J, Cattani-Lorente M, Wataha JC, Krejci I. 2005. Thermal risks from LED- and high-intensity QTH-curing units during polymerization of dental resins. J Biomed Mater Res B Appl Biomater 72(2):260–267.
15. Oberholzer TG, Makofane ME, du Preez IC, et al. Modern high powered LED curing lights and their effect on pulp chamber temperature of bulk and incrementally cured composite resin. Eur J Prosthodont Restor Dent. 2012;20:50-55.
16. Emami N, Sjödahl M, Söderholm KJ. How filler properties, filler fraction, sample thickness and light source affect light attenuation in particulate filled resin composites. Dental Materials. 2005 Aug 1;21(8):721-30.
17. Bayne SC Thompson JY Taylor DF.Dental materials.In:Robertson TM,Heymann HO,Ritter AV, eds. Sturdvent's Art and Science of Operative Dentistry 4th ed.St.Louis, MO:Mosby;2002:134-234
18. Resin composite restorative materials.In:Powers JM, Sakaguchi RL,eds.Craigs's Restorative Dental Materials. 12th ed.St.Louis MO; 2007:189-182
19. Malhotra N, Kundabala M. Light-curing considerations for resin-based composite materials: a review. Part II. CompendContinEduc Dent. 2010;31(8):584-8.
20. Rueggeberg FA, Cole MA, Looney SW, Vickers A, Swift EJ. Comparison of manufacturer-recommended exposure durations with those determined using biaxial flexure strength and scraped composite thickness among a variety of light-curing units. Journal of Esthetic and Restorative Dentistry. 2009 Feb;21(1):43-61.
21. Antonson SA, Antonson DE, Hardigan PC. Should my new curing light be an LED?. Operative Dentistry. 2008 Jul;33(4):400-7.
22. Williams PT, Johnson LN. Composite resin restoratives revisited. Journal (Canadian Dental Association). 1993 Jun;59(6):538
23. Dunne SM, Millar BJ. Effect of distance from curing light tip to restoration surface on depth of cure of composite resin. Primary Dental Care. 2008 Oct 1;15(4):147-52.
24. Michaud, P.-L., Price, R., Labrie, D., Rueggeberg, F., & Sullivan, B. (2014).Localised irradiance distribution found in dental light curing units. Journal of Dentistry ,129-139.

THE POWER OF PSI (ψ) IN PEDIATRIC DENTISTRY

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ABSTRACT

Non-Pharmacological behaviour management techniques rely on the basic principles of psycology to manage child behaviour in the dental clinic. Effective application of these principles provides a positive atmosphere for the child to undergo a dental procedure. A positive experience will enhance good behaviour in future visits thereby making it easier for the clinician to provide effective dental treatment. Various non pharmacological techniques have thus been discussed in this article.

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INTRODUCTION

Managing a child patient on a dental chair can be a stressful experience to even the most experienced clinicians. The very thought of seeing a child patient on a dental chair can send chills down our spine. Dental treatments usually include a multitude of impulses, usually unpleasant in one of the most sensitive areas of our body. Many treatment procedures also require multiple visits. This makes it mandatory for a dentist to provide an experience that is as pleasant as possible, to the best of his abilities. This becomes even more challenging when the patient on the other side is a child. Non pharmacological behaviour management techniques make it possible for the dentist to deliver this care in a very safe environment.

Communication

One of the basic steps in behaviour management is effective communication. Communication in a dental setting can be verbal or non verbal. Facial expression and body language make up the non verbal component. Verbal component is primarily established through dialogue and voice tone.[1]

Steps to establish effective communication

1. Dentists Attitude

Dentists with a calm caring and empathetic approach are more likely to manage an anxious patient effectively[2]. Along with this the confidence that exudes out of the dentist when he sees a child is directly proportional to the probability of a successful dental appointment. Children will quickly experience the stress experienced by the dentist and easily try to get away from treatment by using techniques that have been successful earlier or at home.[3]

2. Eye Contact

Making a positive eye contact with the child is also an important aspect of communication. The child must be given a feeling that he is being cared for, and not just bossed around. A simple way to achieve this is to get down to the child's eye level and greet the child.[Fig1] You can also go that extra mile and ask them what they would like to be called. These actions develop a sense of trust among children leading to better behavior. Fig 1

Figure 1
Getting down to the child's level during initial communication

3. Childrenese

While speaking to children, especially the very young, it is important to use words and terms that they can relate to. Pediatric dentists often call this as CHILDERNESE. The key features of effective childrenese are, the words used for various dental equipment and procedures are constructed from words that are probably already a part of the child's vocabulary and which do not carry any negative connotations. [4]

4. Role of Parents

The paucity of evidence in any specific benefit of parental presence in the operatory, will lead us to falsely believe that they can be excluded from the operatory. However, if given a choice most parents would want to be present in the operatory when the child is undergoing dental treatment.[5] In today's scenario this is extremely important, as it helps to avoid any suspicions in the parents mind, should the child start to become upset during the course of the appointment. However to avoid any interference by the parent, their role can be made very clear. Parents should always be passive observers and /or silent partners of the dentist.[6]

Figure 2
Strategic placement of soft toys

5. Role of the Dental Office Environment

Smells and sounds serve as distractors to effective communication. Specific smells and sounds associated with dental clinics like eugenol or noisy air rotors can be a great barrier between you and the child patient. Many practices do not cater to children alone. So changing the décor when a child patient comes may not be possible, however strategically placed soft toys can definitely come to your rescue when you have a child dental patient. Unlike other visual distractors like television or tablets, soft toys can be strategically used during communication, so that we are able to get the child's attention and at the same time, we don't lose focus. [Fig 2] During treatment however, visual or audio distractors play a better role than these. Keeping Dental Equipment hidden from view inside cabinets, and well-ventilated clinics will also make the environment conducive for communication with children.

6. Role of Dental Team

The role of the front office staff, who is the first person the child is exposed to, cannot be overemphasized. Interestingly the specific attire worn by the team, plays little role, and is not as important as the general neatness and cleanliness. Attention to personal hygiene is of utmost importance.[7,8]

The First Appointment Dilemma

The first dental appointment for any child is always the most anxious one.[9] Making it as pleasant as possible is the key to reduce anxiety in future dental visits. Very invasive procedures, unless deemed an emergency should not be preformed at the first dental visit. The first dental visit with a child should always be aimed at estimating the level of anxiety of both the child and the parent. Any concerns regarding the specific needs of the child should be discussed with the parent. This holds true especially when multiple procedures need to be performed. Appointment scheduling should be tailored to the needs of the individual patients circumstances and the skills of the clinician. There should be a clearcut schedule

for children so that they don't eat up time from the main practice and at the same time ensuring that the children don't fall prey to procrastination or postponing treatment, which is what happens most often when anxious patients visit busy dental practices.

Informed Consent

All behaviour guidance decisions must be based on a review of the patients medical, dental and social history, followed by an evaluation of the current behaviour. Informed consent implies that all information was provided to the parent, risks, benefits and alternatives were discussed, questions were answered and permission was obtained prior to performing treatment.[10]

SPECIFIC BEHAVIOUR GUIDANCE MEASURES

Tell Show Do

Tell show do by technique by Addleston remains the oldest and the easiest behaviour management technique that can be used. The technique involves verbal explanation of the procedures in phrases appropriate to the developmental level of the patient; demonstration for the patient, of the visual, auditory, olfactory and tactile aspects of the procedure in a carefully defined non-threatening setting and without deviating from the explanation and demonstration, completion of the procedure.[11-14]

Ask Tell Ask

This is a small modification of the Tell Show Do technique, where the patient is first asked about his feelings towards a particular procedure, fears if any are addressed and then again, an enquiry of whether the child is convinced about the procedure is done. This method is more useful in older children and helps to allay, pretreatment anxieties, if any.[15]

Signalling

Signaling is the mechanism which helps to develop a sense of control in the child. The child is advised to signal by raising his left hand, whenever he feels an unpleasant stimulus. The withdrawal of the stimulus at the first signal, and at every consecutive signal will improve the trust of the child on the clinician. Initially the child may signal multiple times, and slowly as confidence is gained the child starts slowing done. Failure to comply with the child initially, will however, break the trust of the child and lead to disruptive behaviour.[16]

Positive Reinforcement

Positive reinforcement rewards desired behaviour, thereby strengthening their occurrence. These could be social, material or activity reinforcers.[1,12]

A verbal praise or a round of applause by all members of a dental team after successful completion of a procedure, act as social reinforcers. These can be presented not only after completion of treatment but also after successful completion of a significant step during a long procedure.

Activity reinforcers include engaging the child in activities like a short game of rock paper scissors, a small game of thumb fight or hand cricket. These can serve as a stimulus to behave better in anticipation of more of such breaks.

Material reinforcers are small toys or stationery that can be given to children at the end of the appointment.

Relaxation

Multiple relaxation techniques have been proposed like Ost's applied relaxation technique, Jacobsons progressive muscle relaxation response, the rapid relaxation technique, autogenic relaxation and relaxation response. Use of these techniques, however, requires special training and they are more useful in anxious adults than in children.[17]

Distraction

Diverting the patient's attention away from what could be an aversive stimulus is another way of managing child behaviour. These could be either auditory, visual or audio visual.[18]

Several gadgets like virtual reality glasses, blue tooth headsets to listen to soothing music, 2D or 3D glasses for watching movies are now available.[19] These can help distract the child without distracting the operator.

Modelling

Modelling, based on Bandura's principle of learning by observation, is also one of the techniques that can be easily used to manage a child's behaviour. Live models or video models can be used.[20] For best effects, the model should be of the same age as the target child, should exhibit appropriate behaviour and should be praised.

Voice Control

Though voice control is an easy technique to use, it is often found unacceptable to most parents.[21] If used however, should be only with parental consent. Short cryptic loud and clear instructions must be given so that the child quickly stops the disruptive behaviour.

Pharmacological Approaches To Behaviour Management

In every clinical practice, there will be a minority of children, especially very young or very anxious who may require pharmacological support like conscious sedation and general anaesthesia to allow for effective treatment. It is hence imperative to ensure that access to these means is also available. If not, clinician must be willing to refer to higher centres where such options are available.

CONCLUSION

Non pharmacological means of behaviour management not only helps us to have a successful dental appointment but also helps to instill a positive dental attitude in the patient. This positive dental attitude will make them more aware of their oral health needs. In future too they may not put off dental care visits, thus going a long way in preventing severe dental problems. After all, prevention is one of the main aims of pediatric dentistry and the power of PSI (ψ) in fulfilling this aim cannot be overemphasized.

REFERENCES

1. Chambers DW. Communicating with the young dental patient. J Am Dent Assoc 1976;93(4):793-9.
2. Roberts JF. How important are techniques? The empathic approach to working with children.J Dent Child 1995; 62: 38–43
3. Johnson R, Baldwin DC Jr. Relationship ofmaternal anxiety to the behaviour of young children undergoing dental extraction. J Dent Res 1968; 47: 801–805.
4. Fayle S, Crawford PJM. Making dental treatment acceptable to children. Dent Profile 1997;
5. Fenlon WL, Dobbs AR, Curzon MEJ. Parental presence during treatment of the child patient: a study with British patients. Br Dent J 1993; 174:23–28.
6. Frankl SH, Shiere FR, Fogels HR. Should the parent remain within the dental operatory? J Dent Child 1962; 29: 150–163.
7. Sheller B. Challenges of managing child behavior in the 21st century dental setting. Pediatr Dent 2004;26(2): 111-3.
8. Law CS, Blain S. Approaching the pediatric dental patient: A review of nonpharmacologic behavior management strategies. J Calif Dent Assoc 2003;31(9):703-13.
9. Murphy, M.G., Fields, H.W. and Machen, J.B. (1984) Parental acceptance of pediatric dental behaviour management techniques. Pediatr Dent 6: 193-198.
10. American Academy of Pediatric Dentistry. Behavior Symposium III: Conference Papers. Pediatr Dent 2014; 36(2):102-60.
11. Feigal RJ. Guiding and managing the child dental patient: A fresh look at old pedagogy. J Dent Educ 2001;65(12): 1369-77.
12. Townsend JA. Wells MH. Behavior guidance in the pediatric patient. In: Nowak AJ, Christensen JR, Mabry TR,

Townsend JA, Wells MH. eds. Pediatric Dentistry - Infancy through Adolescence. 6th ed. St Louis, Mo., Elsevier-Saunders Co.; 2019:352-70.

13. Law CS, Blain S. Approaching the pediatric dental patient: A review of nonpharmacologic behavior management strategies. J Calif Dent Assoc 2003;31(9):703-13.
14. Hamzah HS, Gao X, Yung Yiu CK, McGrath C, King NM. Managing dental fear and anxiety in pediatric patients: A qualitative study from the public's perspective. Pediatr Dent 2014;36(1):29-33.
15. Goleman J. Cultural factors affecting behavior guidance and family compliance. Pediatr Dent 2014;36(2):121-7
16. Thrash WJ, Marr JN, Boone SE. Continuous selfmonitoring of discomfort in the dental chair and feedback to the dentist. J Behav Assess 1982;4(3):273-84.
17. Botto RW. Chairside techniques for reducing dental fear. In: Mostofsky DI, Forgione AG, Giddon DB, editors. Behavioral Dentistry. Oxford: Blackwell; 2006:115–125.
18. Ram D, Shapira J, Holan G, Magora F, Cohen S, Davidovich E. Audiovisual video eyeglass distraction during dental treatment in children. Quintessence Int. 2010;41(8):673–679
19. American Academy of Pediatric Dentistry. Special issue: Proceedings of the conference on behavior management for the pediatric dental patient. Pediatr Dent. 2004;26(2):110–183.
20. Machen, J.B. and Johnson, R (1974) Desensitization, model learning, and the dental behaviour of children, J Dent Res 53: 83
21. Murphy, M.G., Fields, H.W. and Machen, J.B. (1984) Parental acceptance of pediatric dental behaviour management techniques. Pediatr Dent 6: 193-198.

AEROSOLS IN DENTISTRY

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ABSTRACT

In the current pandemic scenario much is debated over the aerosol production in dentistry. As everyone is aware, production of aerosols and splatter in dental procedure is inevitable. Infectious aerosols in dental setting is known to contribute indoor air pollution and has been associated with occupational health hazards. With the advent of diseases like SARS, COVID -19, dental operatory seems a potential risky area for dentist, auxiliaries and patients. This article comprehensively reviews various aspects of aerosol production and enlists the precautions that are to be adhered while practicing dentistry.

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INTRODUCTION

Production of aerosols and splatter in dental procedure is inevitable. Aerosol cloud containing particulate matter and fluid is particularly obvious during procedures such as ultrasonic scaling, tooth preparation, polishing and use of air water syringe. This cloud contains materials from treatment site as well as material from dental unit waterlines (DUWL). Infectious aerosols in the dental setting known to contribute indoor air pollution and have been associated with occupational health hazards. Infective agents may include bacteria, viruses, fungal organisms and possibly even prions, however little has been published on virus, fungus and prion-containing aerosols in the dental clinic.[1] With the advent of diseases like SARS, COVID - 19, dental operatory seems a potential risky area for dentist, auxiliaries and patients.

Dental Aerosol and Splatter

Aerosols were defined by Micik and Colleagues as particles less than 50 micrometers in diameter. Particles of this size are small enough to stay airborne for an extended period before they settle on environmental surfaces or enter the respiratory tract. The smaller particles of an aerosol (0.5 to 10µm in diameter) have the potential to penetrate and lodge in the smaller passages of the lungs and are thought to carry the greatest potential for transmitting infections.[2,3,4]

Splatter was defined by Micik and colleagues as airborne particles larger than 50 µm in diameter. Micik and colleagues stated that these particles behaved in a ballistic manner. This means that these particles or droplets are ejected forcibly from the operating site and arc in a trajectory similar to that of a bullet until they contact a surface or fall to the floor. These particles are too large to become suspended in the air and are airborne only briefly.[2-5]

The greatest air-borne infection threat in dentistry comes from aerosols due to their ability to stay air- borne and potential to enter respiratory passages.[6] However splatter also has the potential for infection. As the droplet begins to evaporate, the size of the droplet becomes smaller, and it then has the potential to stay airborne or to become re-airborne as a dust particle.[5] Splatter and droplet nuclei also have been implicated in the transmission of diseases like TB, SARS, measles and herpes viruses etc.

Sources of Airborne Contamination During Dental Treatment

There are at least three potential sources of airborne contamination during dental treatment:

1. Dental instrumentation
2. Saliva and respiratory sources
3. The operative site.

Dental Instrumentation

Contamination during the dental instrumentation result from the contaminated dental instruments and also from Dental unit waterlines. All instruments should wash thoroughly using soap and water and should undergo the proper sterilization protocols. To minimize contamination from DUWL, CDC recommended methods of treatments of DUWL should be followed.

The risk of cross-infections in dental settings can be tackled by implementing appropriate systems of proven efficacy. There are different chemical, physical or chemo-physical treatment systems of DUWLs, (e.g., per acetic acid, glutaraldehyde, chlorhexidine, chlorine dioxide, filtration, flushing, reverse osmosis, etc.)[7].

The Centre for Disease Control and Prevention (CDC) recommend that manufacturers should provide dental units with a separate reservoir, typically a container of about 1-liter capacity, from which tap water, deionized water and/or distilled water can be fed to the drill in order to cool it. Moreover, these separate reservoirs are also better suited for the input of biocides.[8] Use of hand pieces and turbines fitted with anti-reflux valves are recommended particularly when sterile safe water is not guaranteed. These valves are triggered when the turbine stops and prevent liquids, and hence also micro-organisms, from being aspirated when rotating instruments are used.

Particularly recommended by the CDC is flushing, which should always be carried out for 20-30s after each patient is treated. This

should be done for all devices that connect to a water line and enter patients' mouths, such as hand pieces, ultrasonic scalers and air/water syringes. This procedure is intended to physically flush outpatient material that might have entered the turbine, air or water lines.[8] As per a recent study, Flushing alone is not sufficient and that other strategies are required in order to improve water quality in dental practices.[9]

In order to reduce microbial contamination, and/or the formation of biofilm in DUWLs, Italian Health Ministry recommended the following guidelines.[10]

1. Any sections excluded from the flow currents should be eliminated from the network.
2. Install anti-stagnation devices to keep the water circulating continuously, particularly during non-working hours.
3. Supply the network with sterile solutions, after isolating it from the main water supply.
4. Disinfect the water by means of continuous or discontinuous treatments. These latter, which may be carried out periodically or between one patient and the next, prevent chemical contamination of the operating field, reduce the exposure of staff and minimize the risk of selecting resistant micro-organisms; however, they require a greater commitment of resources and attention than continuous treatments.
5. All devices that connect to a water line and enter patients' mouths, such as hand pieces, ultrasonic scalers and air/water syringes, should be switched on and flushed through before use: for at least two minutes at the beginning of each working day and for at least 20-30 s before each patient is treated.
6. Filters (≤0.2µm) that can trap micro-organisms coming from inside the water supply network should be installed immediately upstream of hand pieces.

In addition, in the case of invasive surgical procedures, only sterile water should be used.

Oral Cavity as Source of Contamination

Oral cavity carries microorganisms from deep periodontal pockets, dental plaque, throat, nasopharynx and respiratory tract. So any dental procedure that has the potential to aerosolize saliva will cause airborne contamination with organisms from some or all of these sources. These may include Mycobacterium tuberculosis, pathogenic streptococci and staphylococci, common cold and influenza viruses, SARS virus, Herpes virus and the Novel corona virus 2. It also should be assumed that all patients may have an infectious disease that has the potential to be spread by dental aerosols; thus, universal precautions to limit aerosols also should be in place.[5]

The use of personal barrier protection such as masks, gloves and eye protection will eliminate much of the danger inherent in splatter droplets arising from the operation site.[11] But any dental procedure that creates aerosols and splatter which have the capacity to re-aerosolize can enter the respiratory tree via leaky masks or if the operator removes the mask immediately after the procedure near the operatory.[5] A true aerosol or droplet nuclei may be present in the air of the operatory for up to 30 minutes after a procedure.[6] The airborne material was spread to a distance of at least 18 inches from the operative site.[5] So the operator should keep the above points while removing the personal protective equipments. Also, there is a potential for an airborne contaminant to enter the ventilation system and spread to areas of the facility where barrier protection is not used.

One method of reducing overall bacterial counts produced during dental procedures is the use of a pre procedural rinse. The use of a .01 percent chlorhexidine or essential oil–containing mouthwash for one minute before a dental procedure has been shown to significantly reduce the bacterial count in the air of the operatory.[12,13] 1% povidone iodine pre procedural rinse also found to be effective in reducing the microbial burden.[14] Studies have shown that povidone iodine has higher virucidal activity than other commonly used antiseptic agents, including CHX and benzalkonium chloride.[15] Recent investigations have proposed that 0.23% PVP-I mouthwash for at least 15 seconds before procedures may reduce salivary viral load, indicating its use in COVID-19-positive patients.[16]

During many dental procedures, the use of a rubber dam will eliminate virtually all contamination arising from saliva or blood. But In certain restorative procedures such as sub-gingival restorations and the final steps of crown preparation, it often is impossible to use a rubber dam. The use of a rubber dam also is not feasible for periodontal and hygiene procedures such as root planing, periodontal surgery and routine prophylaxis. This is of particular concern owing to the fact that periodontal procedures always are performed in the presence of blood and instruments such as the ultrasonic scaler, which has been shown to create the greatest amount of aerosol contamination, are used.

Contamination from Operative Site

Dental hand pieces, ultrasonic scalers, air polishers and air abrasion units produce the most visible aerosols. Each of these instruments removes material from the operative site that becomes aerosolized by the action of the rotary instrument, ultrasonic vibrations or the combined action of water sprays and compressed air. Using the bacterial growth method, the ultrasonic scaler has been shown to produce the greatest amount of airborne contamination, followed by the air-driven high-speed hand piece, the air polisher and various other instruments such as the air water syringe and prophylaxis angles.[17]

Two methods are available to reduce airborne contamination arising from the operation site. One method involves using devices that remove the contaminated material from the air of the treatment area after it has become airborne. The other is to remove the airborne contamination before it leaves the immediate area surrounding the operative site. The most frequently mentioned methods of removing airborne contamination from the air of the treatment room are the use of a high efficiency particulate air, or HEPA, filter and the use of ultraviolet, or UV, chambers in the ventilation system. While both of these systems appear to reduce airborne contamination, they are somewhat expensive.[5] Both approaches also have the problem that it takes an extended period for the air in the treatment room to cycle through the filter or UV treatment system.

From a practical point of view, it is easier to remove as much airborne contamination as possible before it escapes the immediate treatment site. The use of a high-volume evacuator, or HVE, has been shown to reduce the contamination arising from the operative site by more than 90 percent.[18] It should be emphasized that for a suction system to be classified as an HVE, it must remove a large volume of air within a short period. An evacuator that pulls a high vacuum, but does not remove a large volume of air, such as is used routinely for hospital suction, is not considered an HVE. The usual HVE used in dentistry has a large opening (usually 8 millimetres or greater) and is attached to an evacuation system that will remove a large volume of air (up to 100 cubic feet of air per minute). The small opening of a saliva ejector does not remove a large enough volume of air to be classified as an HVE.

CONCLUSION

It must be emphasized that no single approach or device can minimize the risk of infection to dental personnel and other patients completely. A single step will reduce the risk of infection by a certain percentage, another step added to the first step will reduce the remaining risk, until such time as the risk is minimal. This can be described as a layering of protective procedures.

In the reduction of dental aerosols, the first layer of defence is personal protective barriers such as masks, gloves and safety glasses. The second layer of defence is the routine use of an antiseptic pre procedural rinse with a mouthwash such as chlorhexidine. The third layer of defence is the routine use of an HVE either by an assistant or attached to the instrument being used. An additional layer of defence may be the use of a device to reduce aerosol contamination that escapes the operating area, such as a HEPA filter. The first three layers of defence are found routinely in most dental operatory, are inexpensive and can be made part of routine infection control practices easily.

Table 1
Differences between aerosols and splatter generated during dental procedures

No	Property	Aerosols	Splatter
1	Size	Size less than 50 micrometers.	Size more than 50 micrometers.
2	Distribution	Wide spread Can widely distribute in the dental clnic.	Immediate surrounding Most Radiated towards patient's chest and operators face.
3	Inhalation	Common	Uncommon
4	Skin and Surface Contact	Common	Common
5	Time	Remains in air for long time	Settle down immediately

Table 2
Methods to reduce airborne contamination

No	Methods	Advantage	Disadvantage
1	Barrier protection Methods-Personal protective devices Gloves, Masks, Eye protective devices, Face shield, Protective aprons	Part of standard precautions. Inexpensive Offers 3excellent protection if all instructions are followed.	Masks filter only 60-95% aerosols. Subject to leakage if fitting is not proper.
2	Pre procedural rinses	Reduces the bacterial count in the mouth, saliva, and air Inexpensive	Does not affect microorganisms in biofilm, and blood
3	High volume evacuation	Reduces most materials, including bacteria, viruses, blood and aerosols from the operatory	Expensive
4	High efficiency particulate air room filters	Highly effective in reducing the number of airborne organisms	Expensive May require engineering changes to the ventilator system

REFERENCES

1. P.A. Leggat, U. Kedjarune. Bacterial aerosols in the clinic: a review. International dental Journal 2001; Vol 51,no.1:39-44.
2. Micik RE, Miller RL, Mazzarella MA, Ryge G. Studies on dental aerobiology, I: bacterial aerosols generated during dental procedures. J Dent Res 1969;48(1):49-56.
3. Miller RL, Micik RE, Abel C, Ryge G. Studies of dental aerobiology, II: microbial splatter discharged from the oral cavity of dental patients.J Dent Res 1971;50:621-5.
4. Micik RE, Miller RL, Leong AC. Studies on dental aerobiology, 3: efficacy of surgical masks in protecting dental personnel from airborne bacterial particles. J Dent Res 1971;50:626-30.
5. Harrel SK, Molinari J. Aerosols and splatter in dentistry: a brief review of the literature and infection control implications. J Am Dent Assoc. 2004 Apr;135(4):429-37. doi: 10.14219/jada.archive.2004.0207. PMID: 15127864; PMCID: PMC7093851.
6. Hinds WC. Aerosol technology: Properties, behavior, and measurement of airborne particles. New York: Wiley; 1982:6-8.
7. Spagnolo AM, Sartini M, Cristina ML. Microbial Contamination of Dental Unit Waterlines and Potential Risk of Infection: A Narrative Review. Pathogens. 2020 Aug 13;9(8):651. doi: 10.3390/pathogens9080651. PMID: 32823641; PMCID: PMC7460066.
8. . Kohn, W.G.; Collins, A.S.; Cleveland, J.L.; Harte, J.A.; Eklund, K.J.; Malvitz, D.M. Centers for Disease Control and Prevention (CDC). Guidelines for infection control in dental health-care settings-2003. MMWR Recomm.Rep. 2003, 52, 1-61.
9. Alkhulaifi, M.M.; Alotaibi, D.H.; Alajlan, H.; Binshoail, T. Assessment of nosocomial bacterial contamination in dental unit waterlines: Impact of flushing. Saudi Dent. J. 2020, 32, 68–73.
10. Italian Health Ministry. Guidelines for Prevention and Control of Legionellosis; Rome, Italy, 2015. Available online: http://www.salute.gov.it/imgs/C_17_pubblicazioni_ 2362_ allegato.pdf.
11. Infection control recommendations for the dental office and the dental laboratory. ADA Council on Scientific Affairs and ADA Council on Dental Practice. JADA 1996,127:672-80.
12. Logothetis DD, Martinez-Welles JM. Reducing bacterial aerosol contamination with a chlorhexidine gluconate pre-rinse. JADA 1995;126: 1634-9.
13. Fine DH, Korik I, Furgang D, et al.Assessing pre-procedural subgingival irrigation and rinsing with an antiseptic mouthrinse to reduce bacteremia. JADA 1996;127(5):641-2, 645-6.
14. Domingo MA, Farrales MS, Loya RM, Pura MA, Uy H. The effect of 1% povidone iodine as a pre-procedural mouthrinse in 20 patients with varying degrees of oral hygiene. J Philipp Dent Assoc. 1996 Sep-Nov;48(2):31-8. PMID: 9462082.
15. Kariwa H., Fujii N., Takashima I. Inactivation of SARS coronavirus by means of povidone-iodine, physical conditions and chemical reagents. Dermatology. 2006;212(Suppl. 1):119–123. [PMC free article] [PubMed] [Google Scholar]
16. Mady L.J., Kubik M.W., Baddour K. Consideration of povidone-iodine as a public health intervention for COVID-19: utilization as “Personal Protective Equipment” for frontline providers exposed in high-risk head and neck and skull base oncology care. Oral Oncol. 2020;105:104724. [PMC free article] [PubMed] [Google Scholar]
17. Miller RL, Micik RE. Air pollution and its control in the dental office. Dent Clin North Am 1978;22:453-76.
18. Harrel SK, Barnes JB, Rivera-Hidalgo F. Reduction of aerosols produced by ultrasonic scalers. J Periodontol 1996;67(1):28-32.

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