



Sculpting in Dentistry – Requirements, Methods and Limitations in Aesthetic Dentistry: A Minireview

N. Hegde^a, V. Sadananda^{a*}, M. N. Hegde^a, R. Mathew^a and Priya^b

^a *Department of Conservative Dentistry and Endodontics, A. B. Shetty Memorial Institute of Dental Sciences, Nitte (Deemed to be University), Deralakatte, Mangaluru – 575018, India.*

^b *University of Quebec Trois, Rivières, Quebec, Canada.*

Authors' contributions

All authors have contributed to the designing of the study, performance of analysis, writing of the protocol and first draft of the manuscript, analyses of the study, managing the literature searches and approval of the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i51B33513

Editor(s):

(1) Dr. Farzaneh Mohamadpour, University of Sistan and Baluchestan, Iran.

Reviewers:

(1) Mohammed Al Moaleem, Jazan University, Saudi Arabia.

(2) A. Selvabalaji, The Tamilnadu Dr. M. G. R Medical University, Adhiparasakthi Dental College and Hospital, India.

(3) Neha Pathania, Himachal Dental College, India.

Complete Peer review History, details of the editor(s), Reviewers and additional Reviewers are available here:

<https://www.sdiarticle5.com/review-history/77990>

Received 11 September 2021

Accepted 23 November 2021

Published 24 November 2021

Mini-review Article

ABSTRACT

The skill of sculpting is an interesting and important part of restorative and esthetic dentistry. This review article will help achieve an understanding on what we know about this art, the hurdles we have faced, advances achieved, the limitations we still face and would help to gain knowledge and information on how to further advance in the art of manipulation and sculpting of dental restorations. This article aimed to review available literature on manipulation techniques, to summarize the importance of sculpting and to identify methods to face the current limitations of the art.

Keywords: *Aesthetic dentistry; composite veneers; optical coherence tomography; voids; composite manipulation techniques; plastic phase.*

1. INTRODUCTION

In the past tooth colored restorations were considered to be lacking in biomechanical properties and strength, thus affecting longevity of the restoration. The materials such as dental amalgam were proved to possess superior physico-mechanical properties and although these restorations necessitated less conservation of natural tooth structure to achieve a mechanical bond, there were far too many limitations when it came to resin based materials, that people and clinicians' preferred to not consider esthetics as a primary component of treatment planning. But over the years we have observed a great change in this practice with the advent of patient awareness about esthetic restorations and the intensive research being undertaken in the tooth colored restorative materials. The disadvantages such as polymerization shrinkage, poor chemical bond strength, staining of restorations, larger particle size and even the complex and highly technique sensitive manipulation and restorative techniques have all seen intensive development. Research has today proven that resin based cements and other tooth colored restorative materials to be as competent if not even superior to most restorative materials used priorly, in not just material aspects, but overall, thus marking esthetics in today's dental restorative sciences a priority [1-16]. Esthetic dentistry is a science requiring precession in order to provide the best possible results to a person. Today, with preventive dentistry gaining momentum and the decrease in caries prevalence, the focus has shifted toward dental esthetics [3]. For this reason, the field is ever growing in scope and must be aided by proper knowledge and understanding of each procedure involved in achieving such perfection is required. In recent years, the information available on esthetic dentistry and also an enhanced awareness of beauty and esthetics is making both patients and clinicians very aware of the skills required to achieve such results. This article reviews the known importance that sculpting plays in esthetic dentistry and to discuss the limitations in manipulation and sculpting of restorative materials. It would also act as a tool to identify possible methods to overcome such limitations in the future, for the betterment of dental precision.

2. MATERIALS AND METHODS

The search was carried out on electronic databases, including PubMed, Google Scholar, Science Direct reference of literature within the last 15 years.

After conducting an advanced PubMed search using MeSH terms such as aesthetic dentistry, composite veneers, tooth carving and Optical coherence Tomography (OCT) in dentistry, plastic phase in dentistry over the last 15 years the number of results were 3,745; 1,111; 43; 7 and 907 respectively. By conducting an advanced search on Google scholar by filtering results pertaining to the past 15 years, esthetic dentistry provided 5,780 search results, composite veneers provided 2,060 results, tooth carving provided 205 results and OCT in dentistry provided 3,560 search results. By conducting an advanced search on Science Direct for results pertaining to the past 15 years, the results were as follows: Esthetic dentistry- 11,064 articles of which 6,370 were research articles and 1,095 were review articles. Composite Veneers – 4843 articles of which 3071 were research articles and 366 were review articles. Dental composite techniques – 12,832 articles of which 12,255 were research articles and 262 were review articles. Tooth carving – 405 articles of which 213 were research articles and 24 were review articles. OCT in dentistry – 83 articles of which 31 were research articles and 11 were review articles.

The articles that have been referred to in this article have been done so on the basis of relevance to the topic which will provide a clear understanding into the aim of this paper.

3. REVIEW

Dental esthetics is a wide field of study which includes a multi-disciplinary knowledge and an approach with a wide outlook, as beauty or ideal esthetics proves to be such a perspective art. Cavity preparation has been well documented, and considerable evidence suggests the most appropriate designs. Shape, contour, and dimensions are all rigorously detailed, but the final morphology and functional requirements of the restoration is not as well described. Standards as to what is acceptable also are not well documented, at least for direct restorations. A few examples of carving can be found in the literature, but they are generally limited to small restorations and do not provide an overall guide that may be satisfactory for all types of restorations. Carving that is taught in the Dental Anatomy course is highly theoretical without keeping the principles of clinical carving in mind [5]. For posterior restorations, small incremental techniques have been recommended so that the after effect of shrinkage stress can be reduced.

Table 1. Advanced searches in dentistry over the last 15 years

2005-2021	PubMed	Google Scholar	Science Direct
Aesthetic Dentistry	3,745	5,780	11,064 (Research – 6,370) (Review – 1095)
CompositeVeneers	1,111	2,060	4,843 (Research – 3071) (Review – 366)
Tooth Carving	43	205	405 (Research – 213) (Review – 24)
OCT in Aesthetic Dentistry	7	3,560	83 (Research – 31) (Review – 11)

But in anterior composite restorations, though the placement of successive increments aids to knockdown the effects of polymerization shrinkage stress, errors in manipulation and layering techniques result in restorations which are too opaque. This is because the techniques are highly sensitive. To overcome this a technique should be lucid, technically sound and easy to understand and reproduce⁶. It was also observed that the type of composite used and filling techniques employed affected the CS, μ TBS, UTS, and mechanical properties of restorations [7].

4. DISCUSSION

Dental esthetics is of utmost importance when it comes to the completeness of any restorative procedure. The dental component has been proven to be the most recognizable and a major determinant of beauty from times immemorial. The lower third of the face is responsible for maximum depiction of a person's expression and the lips being a hypermobile muscle attracts immediate attention to the persons smile design. It is hence needless to thus mention the key role of a dentist in restoring the natural esthetics of a patient's dental component keeping in mind that natural might not always mean ideal. For this reason, esthetics and smile design is both an art and a science, as it involves the clinician's perception, a keen eye for perfection and at the same time, the patient's intricate requirements to be kept in mind. Today, dental aesthetics and research on Smile Design knows no bounds with advances in every field, including diagnosis, instrumentation, shade selection,

material sciences, manipulation techniques and so on.

5. CONCLUSION

It could be concluded that a thorough understanding of the current information available on esthetic restorations, currently used methods of manipulation of composite material, knowledge on the basis of why precision is a must while sculpting a restoration and also how optical coherence tomography has been inculcated for various applications in dental diagnosis and testing including calculation of voids in resin materials in dentistry was achieved and a limitation, which is micro voids in certain restorative materials, if surpassed, could be an advancement towards the betterment of the artistry which is esthetic dentistry.

6. LIMITATIONS

Perfectionism in the art of manipulation and sculpting of materials in their plastic/moldable phase requires knowledge of the material aspects as well as the limitations of different materials. One of the major disadvantage of resin based materials, polymerization shrinkage, cannot be eliminated completely although various techniques and protocols have been suggested in the manipulation and restorative procedures for these materials to minimize the shrinkage and associated stresses⁸. Another limitations of materials in their plastic phase arises when manipulation and carving gives rise to the inclusion of voids or tiny air bubbles within the restorative material mass leading to

decreased density of the material. Various studies have tried to overcome this limitation by exploring various other manipulation techniques and restorative materials and have concluded that further research and development is necessary in this field [9]. Prior studies have already identified this limitation and have used advanced methods, to evaluate the void frequency (VF) and void volume (VV) in different flowable composites using swept-source optical coherence tomography (SS-OCT), micro-CT, dyes and by block sectioning [10-14], but have not been able to develop a standardized method to overcome this limitation. Void content in composites is represented as a ratio, also called void ratio, where the volume of voids, solid material, and bulk volume are taken into account.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Chun KJ, Lee JY. Comparative study of mechanical properties of dental restorative materials and dental hard tissues in compressive loads. *J Dent Biomech.* 2014;5(0):1758736014555246.
2. Geštakovski D, The injectable composite resin technique: minimally invasive reconstruction of esthetics and function. *Clinical case report with 2-year follow-up.* 2019;50(9):712-719.
3. Samorodnitzky-Naveh GR, Geiger SB, Levin L. Patients' satisfaction with dental esthetics. *J Am Dent Assoc.* 2007;138(6):805-8.
4. Thongbai-on N, Chotvorarak K, Banomyong D, Burrow MF, Osiri S, Pattaravisitsate N. Fracture resistance, gap and void formation in root-filled mandibular molars restored with bulk-fill resin composites and glass-ionomer cement base. *J Investig Clin Dent [Internet].* 2019;10(4). Available: <http://dx.doi.org/10.1111/jicd.12435>
5. Kilistoff A. A Systematic Technique for Carving Amalgam and Composite Restorations. *Oper Dent.* 2011;36(3):335-39.
6. Rudrapati L, Chandrasekhar V, Badami V, Tummala M. Incremental techniques in direct composite restoration. *J Conserv Dent.* 2017;20(6):386.
7. Bicalho AA, Pereira RD, Zanatta RF, Franco SD, Tantbirojn D, Versluis A, et al. Incremental filling technique and composite material--part I: cuspal deformation, bond strength, and physical properties. *Oper Dent.* 2014; 39(2):E71-82.
8. Malhotra N, M K, Acharya S. Strategies to overcome polymerization shrinkage – materials and techniques. A review. *Dent Update.* 2010;37(2):115-25.
9. Arbildo-Vega HI, Lapinska B, Panda S, Lamas-Lara C, Khan AS, Lukomska-Szymanska M. Clinical effectiveness of bulk-fill and conventional resin composite restorations: Systematic review and meta-analysis. *Polymers (Basel).* 2020;12(8):1786.
10. Nazari A, Sadr A, Saghiri MA, Campillo-Funollet M, Hamba H, Shimada Y, et al. Non-destructive characterization of voids in six flowable composites using swept-source optical coherence tomography. *Dent Mater.* 2013;29(3):278-86.
11. Opdam NJM, Roeters JJM, Joosten M, Veeke O vd. Porosities and voids in Class I restorations placed by six operators using a packable or syringable composite. *Dent Mater.* 2002;18(1):58-63.
12. Jacker-Guhr S, Ibarra G, Oppermann LS, Lührs A-K, Rahman A, Geurtsen W. Evaluation of microleakage in class V composite restorations using dye penetration and micro-CT. *Clin Oral Investig.* 2016;20(7):1709-18.
13. Soares CJ, Rosatto C, Carvalho VF, Bicalho AA, Henriques J, Faria-E-Silva AL. Radiopacity and porosity of Bulk-fill and conventional composite posterior restorations-digital X-ray analysis. *Oper Dent.* 2017;42(6):616-2.

14. Alves CL, Oliveira JS, Tannus A, Tarpani ACSP, Tarpani JR. Detection and imaging of damages and defects in fibre-reinforced composites by magnetic resonance technique. *Materials (Basel)*. 2021;14(4): 977-5.
15. Vakay R. Advances in composite restorative materials support conservative dentistry. *Compend Contin Educ Dent*. 2020;41(2):118–9.
16. Kalotra J, Gaurav K, Kaur J, Sethi D, Arora G, Khurana D. Recent advancements in restorative dentistry: An overview. *J curr med res opin [Internet]*. 2020;3(07). Available:<http://dx.doi.org/10.15520/jcmro.v3i07.31>

© 2021 Hegde et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

*The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/77990>*