IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 20, Issue 10 Ser.9 (October. 2021), PP 45-47
www.iosrjournals.org

Bonding Agent- The Need of the Hour

PAYAL VASUDEVA
(Manav Rachna Dental College , Faridabad)

Abstract
Making our preparations as conservative as possible is the need of the hour, because we know that tooth structure once lost cannot be regenerated, can only be replaced and hence, we have spent years trying to master this art.
Following the advancements in science, our understanding about adhesion has increased the scope for implementing better techniques for the bonding of restorative material to both enamel and dentin. Thus, making our preparation conservative leading to less loss tooth structure, along with reduction in micro-leakage, and henceforth increasing the longevity of the restoration.
Key Words: *Adhesion, Bonding, Etchant, Primer, Bonding agent, Smear layer, Hybrid layer.*

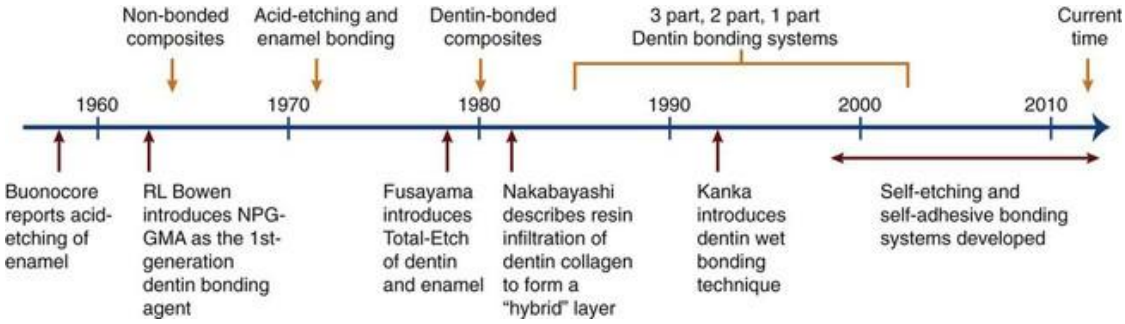
Date of Submission: 15-10-2021 Date of Acceptance: 30-10-2021

I. Background

Emergence of 1st dentin bonding agent dated back to 1955, when Buonocore 1st reported that the surface of enamel can be altered by acid, which renders it more receptive to adhesion.

He discovered that the human enamel could be bonded to that of acrylic resin, after 85% phosphoric acid conditioning.

And from then on changes are taking place in the structure and the composition of the agent making it better suitable for bonding, as shown in the flowchart below.



II. Introduction

As our understanding of the science increases, so is our craving to master the art of restoration, and because of that we have seen a big shift in trend from treatment to preservation or likewise un dentistry from extension to prevention to conservation, and finally to minimum invasion.

And for all this to happen successfully the most important step came forth is bonding or adhesion, which has helped us to preserve the maximum tooth structure while treating.

Hence, **ADHESION** is the force or energy between the atoms or the molecules at an interface that holds the two phases together and the substance processing this property of adhesion is an adhesive.

FACTORS AFFECTING ADHESION

It is a well-known fact that greater is the surface energy, lower is the surface tension and greater is the wettability, better is the bonding. As is seen with enamel after carrying out a series of experiment it has been established that acid etching (with 37% phosphoric acid) of the enamel increases its surface energy by creating micro-pores in its structure, thereby decreasing the surface tension and hence leading to increase in its bond strength.

BONDING IN DENTIN

Bonding in dentin is not as simple as that of enamel, as mineral or the inorganic content of dentin is quite less compared to that of enamel, and water within the dentinal tubules also hamper the process of dentinal bonding. Hence, its bonding must be dealt separately.

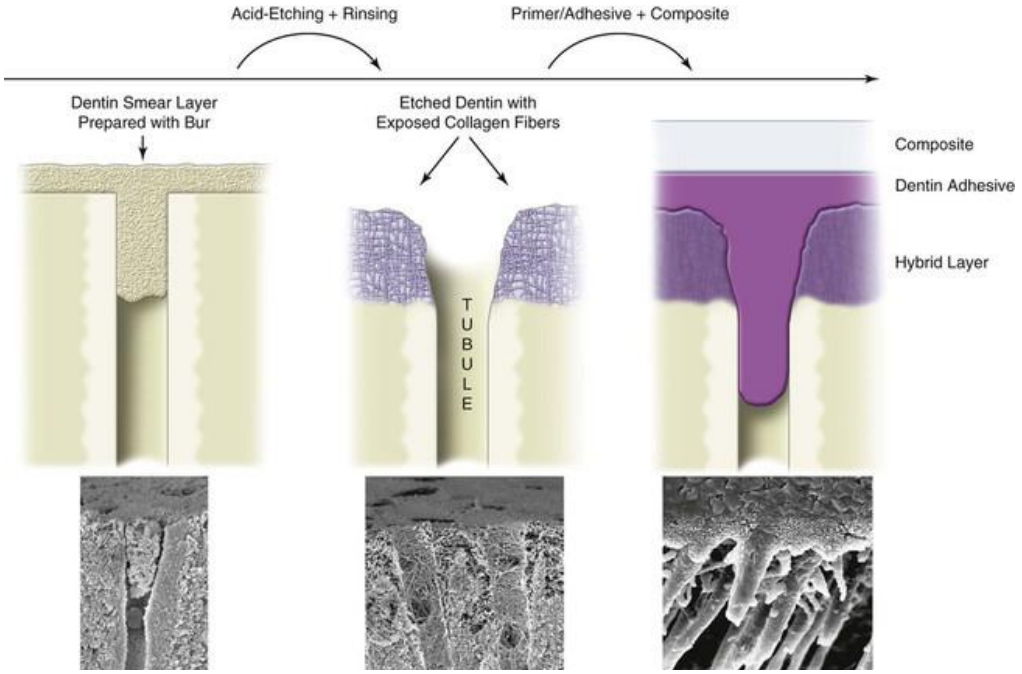
Along with it another concept of significance in dentin bonding is smear layer.

SMEAR LAYER

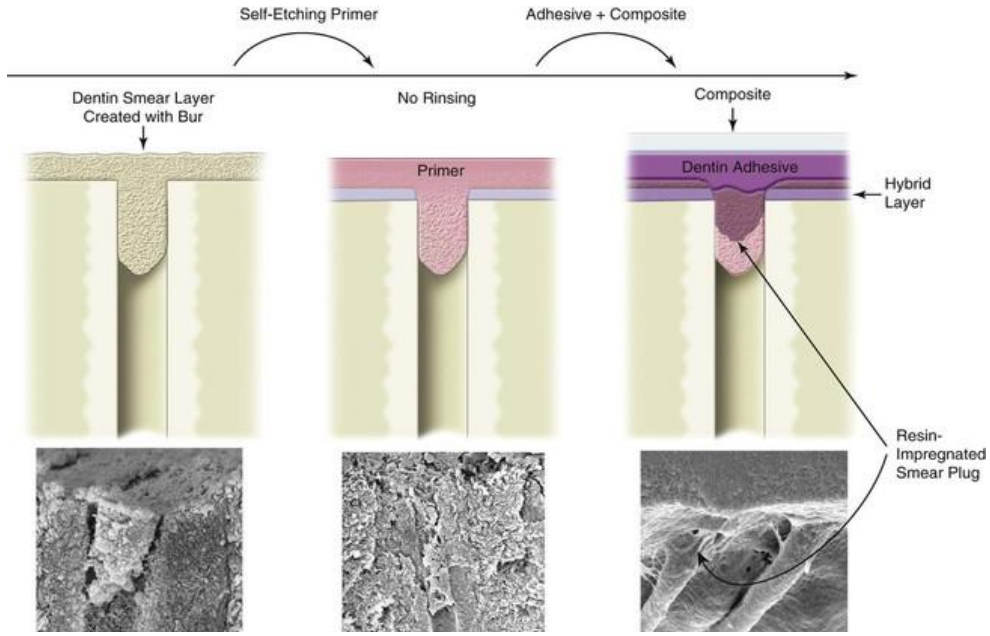
According to Shwartz- "Any debris, calcific in nature, produced by reduction or instrumentation of dentin, enamel or cementum or as a contaminant that precludes interaction with the underlying pure tooth tissue."

And these inorganic debris if not removed hampers bonding by blocking the dentinal tubules, but if is retained reduces the chance of sensitivity.

Hence, its removal to improve bonding or its preservation to reduce sensitivity is still a topic of discussion among scientists.



Hence, smear layer when is completely removed leads to formation of deep hybrid layer enhancing dentinal bonding, shown in the above picture. (As seen in 4th generation etchant, with complete etching).



Whereas when smear layer isn't removed completely, leads to formation of hybrid layer of less depth (as shown in the above picture) reducing bond strength compared to what is seen with complete etching. But it has also by far known to show better resistance to sensitivity.
As seen in self etch-primer, with 6th generation etchant.

To summarize smear layer formed after tooth preparation blocks the dentinal tubules, which when is completely removed as in total etch technique (seen with 4th generation bonding agents) by applying acid on the tooth surface, exposing the collagen and making it readily available for bonding. After that washing and drying of the prepared surface is carried out followed by the placement of primer, resulting in the formation of deep hybrid layer (deep within dentinal tubule), leading to better bonding but less resistance to sensitivity.

Hence, after noticing this common complain of sensitivity from patients, some scientist decided to retain some amount of smear layer blocking the tubules as smear plug, as seen in self-etch technique. Where acid and primer are applied together on the tooth surface, in which primer reduces the penetration of acid within the tubules leading to formation of smear plug.

With all these advancements, different generations of dentin bonding agents have emerged from time to time, leading to shift from total etching as seen with 4th generation dentin bonding agents to self-etching as seen with 6th generation dentin bonding agents.

Also attempts are made from time to time to reduce the steps of the process, by combining one or two agents together, so that it can be finished quickly, with greater ease and with better bonding.

GENERATIONS OF DENTIN BONDING AGENTS

DECADE	BONDING AGENT	FEATURES
1960s 1970s	FIRST GENERATION SECOND GENERATION	• DENTIN ETCHING WAS CONTRAINDICATED • ADHESION WAS TO SMEAR LAYER • WEAK BOND STRENGTH
1980s	THIRD GENERATION	• ETCHING ENAMEL & DENTIN • PRIMING-A SECOND STEP WAS DONE • BETTER BOND STRENGTH
EARLY 1990s	FOURTH GENERATION	• TOTAL ETCH CONCEPT WAS INTRODUCED • WET BONDING & HYBRID LAYER CONCEPTS INTRODUCED • MULTIPLE TECHNIQUE SENSITIVE CLINICAL STEPS
MID 1990s	FIFTH GENERATION	• PRIMER & ADHESIVE COMBINED IN ONE BOTTLE • HIGHER BOND STRENGTHS
LATE 1990s	SIXTH GENERATION	• INTRODUCTION OF SELF-ETCHING PRIMERS • POST OPERATIVE SENSITIVITY WAS REDUCED • LOWER BOND STRENGTHS
EARLY 2000s	SEVENTH GENERATION	• ALL IN ONE/ONE STEP BOND CONCEPT INTRODUCED • BOND STRENGTH LOWER THAN 4TH & 5TH GENERATIONS

III. Conclusion

To conclude bonding forms the basis of conservation, better we bond more is the chance to minimize the loss of tooth structure and it is of utmost importance as enamel when lost cannot be formed again.
Also, better bonding reduces the chance of micro-leakage, increasing the longevity of restoration.
Adhesive techniques have also expanded the range of possibilities for esthetic dentistry increasing patient's compliance.
Hence, retaining or completely removing smear layer is still a topic of debate among scientists but as we have seen newer generation products have shown to adopt the process of self-etching, to increase patient's acceptance and making their healing less cumbersome.

References

[1]. IOSR Journal of Dental and Medical Sciences e-ISSN: 2279-0853, p-ISSN:2279-0861. Volume 14, Issue 11 Ver.7.
[2]. Buonocore MG. "A simple method of increasing the adhesion of acrylic filling material to enamel surfaces." Journal of Dental Research 34 (1955): 849-853.
[3]. Bowen RL, Eick JD, Henderson DA, Anderson DW. Smear layer: removal and bonding considerations. Open Dent Suppl. 1984; 3:30-34.