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Research Article

THE INFLUENCEOF CAVITYCONFIGURATION FACTOR (C-FACTOR) ON THE EFFICIENCY OF DIRECT DENTAL RESTORATIONS WITH RESIN COMPOSITE MATERIALS

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ABSTRACT

In modern dentistry, the term C- factor, or Configuration Factor, has just recently gained popularity. Itsworth is determined by a direct restoration's initial polymerization stress assessment. It's also worth noting that, in today's dentistry, composite materials with excellent aesthetic, physical, and mechanical benefits are the most popular way of treating defects in the hard tissues of the tooth. The concern of shrinkage during the polymerization of the material, as previously mentioned, remains relevant. In cavities with high C-factor values, the impact of polymerization stress is especially noticeable. These difficulties, as well as their impact and solutions, will be discussed in this thesis.

KEYWORDS

Cavity configurations (C-Factor) direct dental restorations, resin-based composites.

INTRODUCTION

Polymerization, polymerization shrinkage, and polymerization stress were all introduced with the advent of composite filler materials. These factors lowered the quality and longevity of composite tooth restorations. Each of these phenomena will be discussed in greater depth and detail later in this research.

Study Objective: Influence of the cavity configuration factor (C-Factor) on the effectiveness of direct dental restorations with resin-based composites.

MATERIALS AND METHODS

The polymerization reaction causes the substance to transition from a liquid to a solid state, resulting in the curing of polymeric materials. Polymerization is a reaction that results in the creation of free radicals when a photo initiator/co-initiator interacts with blue light having a wavelength of 400-500 nm. Free radicals break the carbon double bonds during polymerization, allowing the monomers to react and form bonds. A decrease in the spacing between the molecules causes a large change in volume in this scenario, and the material is compressed as a result. As a result, polymerization shrinkage processes occur, which is the primary cause of most difficulties, such as postoperative sensitivity, filling leakage, and the repercussions that follow (pulp irritation, the presence of cracks in the enamel, the possible appearance of secondary caries, etc.). Shrinkage during polymerization, which occurs during the material's curing, causes tensions in the cavity, known as polymerization stress. Polymerization shrinkage of the composite material occurs when monomer molecules form polymer structures, resulting in the replacement of van der Waals spaces with covalent bond spaces. When the material is still brittle and easily distorted, shrinkage is at its maximum. This is known as the gel phase, and it is at this time that bonds are

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established. Monomers, on the other hand, are not crosslinked. The substance becomes stiff as the monomers crosslink (form bonds). The rate of shrinkage is slower at this point, but the stress level is significant. As a result, polymerization shrinkage is the percentage reduction in the volume of the material during the polymerization reaction compared to the original. The stress that a material undergoes during the development of polymerization shrinkage is known as polymerization stress.

The following are some elements that lead to the incidence of these stresses:

1. The cavity's geometry, which is primarily defined by the "configuration factor," or "C-factor";
2. The composite material's constitution;
3. The proportion of monomer conversion, i.e., a polymerization reaction that is more or less complete;
4. The manner of light irradiation is related to the previous factor.

The C-factor index was calculated by a group of American scientists in 1987 for various types of cavities.(Setting Stress in Composite Resin in Relation to Configuration of the Restoration A.J. FEILZER, A.J. DE GEE, and C.L. DAVIDSON). The C-factor is the ratio of the number of composite material surfaces attached to the cavity walls to the number of free surfaces, which is one of the key stress metrics induced by polymerization. Given that the less bonded surfaces and the more free walls, the less polymerization shrinkage and polymerization stress, experts propose preparing the walls to minimize the C-factor rather than using the "biological expediency" method. As a consequence, the less contact the adhesive layer has with the hollow walls, the less polymerization stress develops in the adhesive layer. The C-factor was created as a result of this. We may obtain the following numbers using the formula above, depending on the type of restoration:

- Class IV cavities 0.5
- Class III cavities 1
- Class II cavities 2
- Class I cavities 5

Scheme 1. Five common types of cavities and their C-factors, which are calculated using the diagonal direction of cube modeling. The cylinders at the bottom depict various types of samples that correlate to various C-factors (the ratio of bonded surfaces to free surfaces). Each cylinder's upper edges are bonded to steel discs. The glass plate is attached to their base, and the side sides match the free surfaces. Thus, in class V cavities with a C-factor of 5, the stress associated with polymerization shrinkage is the primary cause of restoration failure.

RESULTS AND DISCUSSION

Several clinical trials of Class V restorations have found that composite materials that generate a lot of stress increase the risk of marginal gaps[12].

Several approaches to minimize the c-factor value have been identified to reduce the risk of gap formation in cavities when it is unable to shift the resulting stresses by the surrounding tissues.

Modern methods for lowering the configuration factor and stress levels.

1. Small amounts of restorative material. Clearly, the smaller the material part, the lower the stress force during polymerization. As a result, the first amounts put on the restoration's bottom should be minimal. Do not apply a single layer of composite to the cavity's bottom and walls right away.[8] The same is true for the last layer, which restores the enamel layer. Because tooth enamel cannot sustain sharp or severe pressures, it can break around the restoration's margins.
2. Small thickness of the composite material layer.[8]Creation of a shock-absorbing layer from a low-modulus flowable composite as a liner lining with a thickness of not more than 1-2 mm.
3. "Soft start". This is a feature of some curing lamps. For the first 10 seconds, low-intensity light is provided, followed by full strength for 20 seconds. The gel phase has been lengthened a little. However, in practice, this does not produce a measurable result.
4. Technique of delayed cure. The initial layer, say 1 mm, is polymerized for 3-5 seconds using this process. Then, over the next 20 seconds, a secondlayer is added and polymerized. The key is that while the secondlayer is being modeled, the first layer will remain in a gel state. It usually takes about 2-3 minutes.
5. Use of materials that do not cause polymerization stress during curing — SDR, bulk fill.

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6. During preparation, change the shape of the cavity into a plate-like shape rather than a cup-shaped one. The bonding area of the walls to the restorative material will be reduced with this preparation design.

Conclusion

Standard preparation (according to G.V. Black)[1] produces a cavity with a C value of 5 in cavities of classes V and I, and a C value of less than 1 in cavities of class IV. Polymerization shrinkage and polymerization stress are maximum in cavities of classes V and I, and vice versa in class IV, according to the C-factor principle.[7] It is preferable to cut the cavity in a dish-shaped form to decrease the impact of these factors.

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