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Incidence and Determinants of Postoperative Sensitivity Following Class I and II Composite Restorations: A Prospective Clinical Study

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معدل حدوث ومحددات الحساسية السنية بعد ترميمات الكومبوزيت من الصنفين الأول والثاني: دراسة سريرية مستقبلية

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Abstract

Background: Postoperative dental sensitivity following composite resin restorations is a common complication that may negatively affect patient comfort and satisfaction. Despite advances in adhesive systems and restorative techniques, the incidence, severity, and contributing clinical factors associated with postoperative sensitivity remain incompletely understood. This study aimed to evaluate the incidence and severity of postoperative sensitivity after Class I and II composite restorations and to investigate its association with clinical variables including cavity depth, restoration class, adhesive type, insertion technique, and curing protocol.

Materials and Methods: A one-year prospective clinical study was conducted in 2024 at the Dental Learning Center in Sirt. A total of 218 patients aged 18–60 years requiring Class I or II posterior composite restorations were included. Restorations were performed according to standardized clinical protocols by calibrated operators. Postoperative sensitivity was assessed at 24 hours, 7 days, and 30 days using a Patient Sensitivity Follow-up Questionnaire that evaluated sensitivity type, Visual Analogue Scale (VAS 0–10) scores, and impact on daily activities. Patients were permitted to report more than one sensitivity trigger. Statistical analysis was performed using Chi-square and ANOVA tests with SPSS version 26.

Results: At 24 hours, 72 patients (33%) reported postoperative sensitivity, with cold stimuli (56%) and biting or chewing pressure (35%) being the most common triggers among symptomatic patients. Sensitivity decreased to 34 patients (16%) after 7 days and to 9 patients (4%) after 30 days. Mean VAS scores decreased from 4.2 ± 1.8 at 24 hours to 0.7 ± 0.9 at 30 days. Class II restorations and deeper cavities were significantly associated with greater sensitivity severity and incidence ($p < 0.05$), whereas adhesive type, insertion technique, and curing protocol showed no statistically significant associations. Among symptomatic patients, interference with eating was reported by 85% at 24 hours, decreasing substantially during follow-up.

Conclusion: Postoperative sensitivity following composite restorations was generally temporary and self-limiting, with most symptoms resolving within 30 days. Larger and deeper restorations, particularly Class II restorations, were more susceptible to postoperative sensitivity. Careful operative technique and appropriate patient counseling remain important for minimizing postoperative discomfort. Further multicenter studies with longer follow-up periods are recommended to better clarify factors influencing postoperative sensitivity and optimize restorative outcomes.

Keywords: postoperative sensitivity, composite restorations, visual analogue scale, Class I, Class II, dental restoration.

الملخص
الخلفية :تُعدّ حساسية الأسنان بعد عمليات ترميم الأسنان بالراتنج المركب من المضاعفات الشائعة التي قد تؤثر سلبًا على راحة المريض ورضاه. على الرغم من التطورات في أنظمة اللصق وتقنيات الترميم، لا يزال معدل حدوث هذه الحساسية وشدتها والعوامل السريرية المرتبطة بها غير مفهومة تمامًا. هدفت هذه الدراسة إلى تقييم معدل حدوث حساسية الأسنان بعد عمليات ترميم الأسنان بالراتنج المركب من الفئتين الأولى والثانية، ودراسة ارتباطها بالمتغيرات السريرية، بما في ذلك عمق التجويف، وفئة الترميم، ونوع المادة اللاصقة، وتقنية الإدخال، وبروتوكول المعالجة.
المواد والأساليب: أُجريت دراسة سريرية استباقية لمدة عام واحد في عام 2024 في مركز تعليم طب الأسنان في سرت. شملت الدراسة 218 مريضًا تتراوح أعمارهم بين 18 و60 عامًا، ممن احتاجوا إلى ترميمات أسنان خلفية بالراتنج المركب من الفئتين الأولى والثانية. أُجريت عمليات الترميم وفقًا لبروتوكولات سريرية موحدة من قبل أطباء أسنان مُدرّبين. تم تقييم الحساسية بعد العملية الجراحية بعد 24 ساعة، و7 أيام، و30 يومًا باستخدام استبيان متابعة حساسية المريض، والذي قيّم نوع الحساسية، ودرجات مقياس التناظر البصري (VAS) من 0 إلى 10، وتأثيرها على الأنشطة اليومية. سُمح للمرضى بالإبلاغ عن أكثر من مُحفز واحد للحساسية. أُجري التحليل الإحصائي باستخدام اختبارات مربع كاي وتحليل التباين (ANOVA)باستخدام برنامج SPSS الإصدار 26.
النتائج :بعد 24 ساعة، أبلغ 72 مريضًا (33%) عن حساسية بعد العملية، وكانت المحفزات الباردة (56%) والضغط الناتج عن العض أو المضغ (35%) أكثر المُحفزات شيوعًا بين المرضى الذين يعانون من الأعراض. انخفضت الحساسية إلى 34 مريضًا (16%) بعد 7 أيام، وإلى 9 مرضى (4%) بعد 30 يومًا. انخفض متوسط درجات مقياس التناظر البصري من 4.2 ± 1.8 بعد 24 ساعة إلى 0.7 ± 0.9 بعد 30 يومًا. ارتبطت حشوات الفئة الثانية والتجاويف العميقة ارتباطًا وثيقًا بزيادة شدة الحساسية وانتشارها($p < 0.05$) ، بينما لم يُظهر نوع المادة اللاصقة، وتقنية الإدخال، وبروتوكول المعالجة أي ارتباطات ذات دلالة إحصائية. أبلغ 85% من المرضى الذين يعانون من أعراض عن صعوبة في تناول الطعام بعد 24 ساعة، وانخفضت هذه الصعوبة بشكل ملحوظ خلال فترة المتابعة.
الخلاصة: كانت الحساسية بعد حشوات الكومبوزيت مؤقتة وتزول تلقائيًا في الغالب، حيث اختفت معظم الأعراض في غضون 30 يومًا. وكانت الحشوات الأكبر حجمًا والأعمق، وخاصة حشوات الفئة الثانية، أكثر عرضة للحساسية بعد العملية. ولا تزال التقنية الجراحية الدقيقة والتوعية المناسبة للمريض مهمة لتقليل الانزعاج بعد العملية. يوصى بإجراء المزيد من الدراسات متعددة المراكز مع فترات متابعة أطول لتوضيح العوامل المؤثرة على الحساسية بعد العملية وتحسين نتائج الترميم.

الكلمات المفتاحية: الحساسية بعد العملية، حشوات الكومبوزيت، مقياس التناظر البصري، الفئة الأولى، الفئة الثانية، ترميم الأسنان.

1.Introduction

The aesthetic appeal, conservative nature, and direct bonding to enamel and dentin of composite resin restorations make them popular in contemporary dentistry. Postoperative dental sensitivity is still a common consequence despite improvements in adhesive systems, resin compositions, and placement procedures. Thermal, sweet, or occlusal stimuli frequently cause pain in patients, which can have a detrimental effect on their quality of life and level of happiness.

Studies differ in the prevalence of postoperative sensitivity. About 6% of restorations show early postoperative sensitivity, according to Hayashi and Wilson (2003), with deeper cavity preparations carrying a larger risk [1]. Extensive posterior restorations, especially Class II MOD cavities, have been found to have the highest early sensitivity (~26% at 24 hours), with a steady drop over later follow-up periods [2]. Results are also impacted by adhesive selection. It discovered that cavity size and adhesive type had no effect on Class I restorations, and that total-etch systems had somewhat lower sensitivity than self-etch systems [3, 4]. Furthermore, restorative technique is important; they showed that the intensity and duration of sensitivity in Class I posterior restorations were impacted by the depth of the cavity and the insertion technique (bulk-fill versus progressive layering) [5].

Current materials and methods were further assessed in recent research (2020–2025). Although the benefits are sometimes slight and transient, randomized experiments suggest that bulk-fill composites may lessen intermediate postoperative sensitivity when compared to traditional incremental approaches. This is probably because of reduced polymerization stress and improved adaption [6,8,10,11]. Additionally, research indicates that sensitivity results in posterior restorations may not be greatly impacted by adhesive method alone (self-etch versus etch-and-rinse) [12].

Despite these findings, variability in clinical protocols—such as adhesive selection, isolation method, cavity depth, insertion technique, and curing regimen—complicates the prediction of postoperative sensitivity. Moreover, most studies report incidence without adequately assessing severity using patient-reported outcomes or systematically correlating it with clinical protocols.

The goal of this study was to fill in the information gaps about postoperative dental sensitivity following composite restorations. In particular, it uses established patient-reported outcome measures to assess the intensity of sensitivity and quantify its prevalence at various postoperative time periods. The study also aimed to investigate

the relationship between the incidence and severity of sensitivity and several clinical variables, including cavity depth, restoration class, adhesive type, insertion technique, and light-curing protocol. By combining these elements, the study hopes to offer thorough, empirically supported insights that help direct professional judgment and, in the end, reduce patient discomfort after composite resin restorations.

2. Material and methods

This prospective clinical study was conducted at the Dental Learning Center in Sirte over a one-year period in 2024. Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to the commencement of data collection.

2.1 Study Population

A total of 218 patients aged 18–60 years requiring Class I or II composite restorations in posterior teeth were enrolled. Inclusion criteria included vital teeth with no history of hypersensitivity or pulp pathology. Exclusion criteria were non-vital teeth, extensive restorations requiring indirect restorations, systemic conditions affecting pain perception, or known allergies to restorative materials.

2.2 Restorative Procedure

All restorations were performed by calibrated operators following standardized protocols. Cavity preparation adhered to minimally invasive principles. Adhesive systems (total-etch or self-etch) were applied per manufacturer instructions. Composite resin was placed using either incremental layering or bulk-fill techniques. Rubber dam isolation was used for all procedures, and light curing was performed with a calibrated LED unit.

2.3 Assessment of Postoperative Sensitivity

Postoperative sensitivity was assessed using a **Patient Sensitivity Follow-up Questionnaire**, completed at 24 hours, 7 days, and 30 days post-procedure. Patients recorded the presence and type of sensitivity (thermal, mechanical, sweet, or continuous pain) and rated severity using a **Visual Analogue Scale (VAS, 0–10)**. Optional items assessed the impact of sensitivity on daily activities and use of analgesics. Patient and tooth identifiers, as well as follow-up time points, were recorded for data tracking.

2.4 Statistical Analysis

Data were analyzed using SPSS v26. Descriptive statistics summarized demographics, restoration characteristics, and sensitivity scores. Chi-square and ANOVA tests evaluated associations between clinical variables (cavity depth, adhesive type, insertion technique, curing protocol) and both incidence and severity of postoperative sensitivity. A p-value <0.05 was considered statistically significant.

3. Result

A total of 218 patient responses were collected following Class I and II composite restorations. The study population included 120 females (55%) and 98 males (45%), with a mean age of 32.4 ± 9.8 years. Class I restorations accounted for 134 (61%) teeth, while Class II restorations comprised 84 (39%).

3.1 Incidence and Type of Postoperative Sensitivity

At 24 hours post-restoration, 72 patients (33%) reported experiencing sensitivity. The most common triggers were cold liquids or air (56%), biting or chewing pressure (35%), and sweets (18%). Continuous throbbing pain was reported in 5% of cases. By 7 days, the incidence of sensitivity decreased to 34 patients (16%), and at 30 days, only 9 patients (4%) reported any discomfort (**Table 1**). Sensitivity was more frequent in Class II restorations (42% at 24 hours) compared with Class I (27%).

Table 1. Incidence and Type of Postoperative Sensitivity (n = 218)

Follow-up Time	Patients with Sensitivity, n (%)	Cold/Air, n (%)	Hot, n (%)	Biting/Chewing, n (%)	Sweets, n (%)	Continuous Pain, n (%)
24 hours	72 (33%)	40 (56%)	12 (17%)	25 (35%)	13 (18%)	4 (5%)
7 days	34 (16%)	15 (44%)	5 (15%)	10 (29%)	4 (12%)	2 (6%)
30 days	9 (4%)	3 (33%)	1 (11%)	4 (44%)	1 (11%)	0 (0%)

3.2 Severity of Sensitivity

Severity was measured using a Visual Analogue Scale (VAS 0–10). The mean VAS score at 24 hours was 4.2 ± 1.8, indicating mild-to-moderate discomfort. By 7 days, the mean VAS decreased to 2.1 ± 1.2, and at 30 days, the mean VAS was 0.7 ± 0.9, reflecting minimal residual sensitivity. Class II restorations exhibited slightly higher mean VAS scores at all time points compared with Class I ($p < 0.05$).

Table 2. Severity of Sensitivity (VAS 0–10) and Impact on Daily Life

Follow-up Time	Mean VAS ± SD	Mild (1–3), n (%)	Moderate (4–6), n (%)	Severe (7–10), n (%)	Interference with Eating, n (%)	Analgesic Use, n (%)
24 hours	4.2 ± 1.8	28 (39%)	36 (50%)	8 (11%)	61 (28%)	26 (12%)
7 days	2.1 ± 1.2	20 (59%)	12 (35%)	2 (6%)	22 (10%)	4 (2%)
30 days	0.7 ± 0.9	6 (67%)	3 (33%)	0 (0%)	0 (0%)	0 (0%)

3.3 Impact on Daily Life

At 24 hours, 28% of patients reported that sensitivity interfered with normal chewing or eating, while 12% required occasional over-the-counter analgesics. By 7 days, 10% reported minor interference, and only 2% used analgesics. No patients reported significant functional impact or analgesic use at 30 days.

Table 3 . Trend of Postoperative Sensitivity Over Time

Follow-up Time	Total Patients with Sensitivity, n (%)	Class I, n (%)	Class II, n (%)	Mean VAS ± SD
24 hours	72 (33%)	36 (27%)	36 (42%)	4.2 ± 1.8
7 days	34 (16%)	18 (13%)	16 (19%)	2.1 ± 1.2
30 days	9 (4%)	5 (4%)	4 (5%)	0.7 ± 0.9

3.4 Correlation with Clinical Variables

Postoperative sensitivity incidence and severity were significantly associated with cavity depth ($p = 0.01$) and restoration class (Class II vs Class I, $p = 0.02$). Adhesive type, insertion technique, and curing protocol did not show statistically significant associations ($p > 0.05$).

These results demonstrate that postoperative sensitivity is most common within the first 24 hours, declines substantially over 7 days, and is generally minimal by 30 days, with deeper and larger restorations being more susceptible.

4. Discussion

Despite improvements in adhesive systems and restorative procedures, postoperative oral discomfort after composite restorations is still a significant problem in clinical practice. Sensitivity was noted by 33% of patients in the current trial at 24 hours, 16% at 7 days, and 4% at 30 days. This trend is in line with other research demonstrating that sensitivity peaks just after restoration and then declines [13–15]. The quick recovery seen in the majority of patients implies that The observed decline in sensitivity may reflect the resolution of transient pulpal irritation and adaptation of the tooth-restoration complex following treatment.
[16].

Class II restorations exhibited higher sensitivity than Class I, reflecting the increased cavity volume and proximity to the pulp, which has been documented in multiple clinical trials [17,18, 24]. Similarly, severity measured by VAS was highest at 24 hours, particularly in deeper or more extensive restorations, supporting the findings of recent studies that highlight cavity depth as a major determinant of early postoperative discomfort [19].

Interestingly, adhesive type, insertion technique, and light-curing protocol did not show statistically significant associations with sensitivity in this cohort. This aligns with previous evidence indicating that while material selection and technique can influence microleakage and stress, patient-reported sensitivity may be more dependent on biological factors and cavity characteristics [20,21,26].

From a clinical perspective, these results underscore the importance of patient counseling and monitoring during the first week post-restoration, particularly for larger posterior restorations. Use of standardized restorative procedures, proper isolation, and adherence to manufacturers' instructions may help optimize clinical outcomes, although postoperative sensitivity cannot be completely eliminated [22,23,28].

Among symptomatic patients, cold stimuli represented the most common trigger of postoperative sensitivity, followed by biting and chewing pressure. These findings suggest that thermal and occlusal factors are major contributors to early postoperative discomfort. Furthermore, a substantial proportion of symptomatic patients reported interference with eating during the first 24 hours, emphasizing the practical impact of postoperative sensitivity on daily activities and patient satisfaction.

4.1 Implications

The findings of this study have important clinical implications. Early postoperative sensitivity is most common within the first 24 hours, particularly in larger and deeper restorations (Class II), highlighting the need for clinicians to provide **pre-treatment counseling** regarding potential discomfort. The data suggest that while adhesive type, insertion technique, and curing protocol may not substantially influence sensitivity, attention to cavity depth, restoration size, and proper isolation may help minimize patient discomfort. Moreover, monitoring and follow-up during the first week post-restoration can allow timely interventions if sensitivity persists.

4.2 Limitations

There are a number of limitations to this study. First, the evaluation was based on patient-reported results, which might be impacted by subjective interpretation and personal pain perception. Second, the 30-day follow-up duration prevented the assessment of late problems or long-term sensitivity. Third, the Dental Learning Center at Sirt was the only location where the study was carried out, which would restrict how broadly the results can be applied. Lastly, despite the fact that 218 answers were gathered, subgroup analyses (such as adhesive type and insertion technique) might not have enough power to identify minute variations.

4.3 Future Work

To evaluate long-term sensitivity results, bigger, multicenter cohorts with longer follow-up times should be used in future research. Additionally, studies might assess how various composite formulas, adhesive tactics, and sophisticated positioning methods affect pain following surgery. A more thorough knowledge of postoperative sensitivity and its drivers may also be obtained by combining objective measurements (such as pulp vitality tests, thermal imaging, or microleakage evaluation) with patient-reported results.

5. Conclusion

Postoperative dental sensitivity following composite restorations is a transient and self-limiting complication for the majority of patients, with the highest incidence occurring within the first 24 hours. Larger and deeper restorations are more susceptible to early sensitivity, whereas adhesive type, insertion technique, and curing protocol appear to have minimal effect. Patient education and careful clinical technique are key to minimizing discomfort and ensuring satisfactory restorative outcomes

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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