Post-operative sensitivity in direct resin composite restorations: 
Clinical practice guidelines

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Abstract: Pain is one of the most frequent reasons for seeking dental treatment and clinical observations confirm that patients complain of dentinal sensitivity under different conditions and degrees of intensity. This is a very frequent problem after dental restorations with resin composite, even when there is no visible failure in the restoration. The aim of this bibliographic review was to identify the causes of post-operative sensitivity in resin composite restorations and how it can be avoided so that professionals can use this information to reduce the occurrence of this inconvenience in their daily practice. Complete texts of relevant articles on the subject were analysed. There are various causes of post-operative sensitivity in direct resin composite restorations related to failures in diagnosis and indications for treatment and/or cavity preparation, the stages of hybridization of hard dental tissues, insertion of the material, and finishing and polishing the restoration. To avoid or minimize the occurrence of post-operative sensitivity, it is imperative to make a good diagnosis and use the correct technique at all stages of the restorative procedure.

Keywords: composite resins, dental restoration, operative dentistry, toothache.

Introduction

Dentistry has possibly evolved more in the last few years than in all of its previous history, and this is due to a physicochemical phenomenon called adhesion. The adhesive, which previously required different treatments for different dental substrates, can now be used on both enamel and dentin, and it may be possible to dispense with acid etching. The latest generation of adhesives has attained a bond strength of 30 MPa, or more, and they are formulated to interact simultaneously with enamel and dentin after total acid etching of the tooth surface (total etch) (1) or, in the so-called self-etching adhesives, to etch, prepare and bond to the tooth surface simultaneously (2,3), forming an interdiffusion zone called the hybrid layer (1). An understanding of the principles of adhesion has allowed satisfactory aesthetic procedures to be performed, with a protective effect on the remaining tooth (4).

In the last few years, there has been a trend towards replacement of amalgam restorations by more aesthetic restorations, especially using resin composite. This trend leads one to believe that for most restorations, the dentist’s first choice is restorations using adhesive characteristics, and consequently, resin materials are used. Thus, to understand the reasons for post-operative sensitivity, it is natural to focus on the bonding procedures (5,6).

Despite great progress, restorative techniques still present a certain rate of failures (7,8). Discoloration, marginal leakage, recurrent caries and loss of the restoration are the main problems related to restoration failures. Class I and II resin composite restorations are the most predisposed to failure. Perhaps the most intriguing and challenging problem is post-operative dentin sensitivity, one of the disadvantages of using direct resin composites in posterior teeth (7).
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After restorations with resin composite, especially in posterior teeth, clinical observation has shown that patients complain of dentinal sensitivity at different levels and in different situations. This is a common problem, even with no visible failures in the restoration (9). Pain is always a warning signal of possible aggression, and although it does not have a direct relationship with the pathological processes, it is one of the most common reasons for seeking dental treatment, either in public service or private clinics (4).

Post-operative sensitivity in resin composite restorations is a common occurrence that causes discomfort in the patient and inconvenience to the professional, because it has various causes. Although frequent, it has still not been fully explained. Therefore, it is important to study the problem to establish a work routine to avoid it.

The aim of this bibliographic review was to identify the causes of post-operative sensitivity in resin composite restorations and how it can be avoided, to enable professionals to reduce the occurrence of this inconvenience in their daily practice.

**Dentinal sensitivity**

The main morphological characteristic of dentin is that it is a tubular structure, filled with fluid, connecting the pulp to the enamel–dentine junction. The lumen of dentinal tubules are surrounded by thin cuffs of mineralized tissue, called peritubular dentin. The matrix interposed between this cylindrical structure, the intertubular dentin, contains around 30% by volume of mineralized collagen type I fibrils (10,11) perpendicular to the long axis of the tubules (11). Much smaller quantities of collagen (10% by volume) are present in peritubular dentin (10). Dentinal permeability is, therefore, a direct consequence of this structural pattern.

The closer one gets to the pulp, the greater is the value of this porosity (45,000–65,000; 29,500–35,000; 15,000–20,000/mm²) and the diameter of the tubules (2.5 µm close to the pulp; 1.2 µm in the intermediate region; 0.5 µm at the enamel–dentine junction). This explains the increase in dentin permeability in the area close to the pulp chamber (12).

The widely accepted hydrodynamic theory proposed by Brännström and Ästron in 1964 (13) seeks to explain the painful phenomenon that occurs in dentin by the movement of fluid within the dentinal tubules after certain stimuli, which causes intratubular pressure changes, thus leading to excitation of the pulp nerve terminals, producing a sensation of pain (4,14). Therefore, due to the disposition, size and pattern of dentinal tubules, the type of dentin has a direct relationship with dentinal sensitivity.

Reduction in fluid movements and propagation of molecules through dentin occur due to reduction in the tubular openings with the deposition of peritubular dentin or the formation of other intratubular material. Reparative dentin, in contrast to secondary dentin, does not have continuous tubules, thus leading to diminished permeability and fluid movement, and this results in a reduction in sensitivity (14). Therefore, teeth with recently cut secondary dentin have a greater propensity to develop sensitivity after direct restorations.

**Post-operative sensitivity in resin composite restorations**

Sensitivity is characterized as being a response given by the body to say that something is wrong, and this response may be originated by an aggressive stimulus or in a spontaneous manner (15). The sensory potential of the pulp makes it capable of reaction with an immediate painful response, even when the stimulus is applied at a distance from the pulp tissue, such as in the superficial layers of dentin (4).

Clinical studies on sensitivity arising after resin composite restorations have reported a frequent and very variable prevalence of between 0 and 50% (16–20), with predominance in posterior teeth and Class II restorations. As the patient can have considerable discomfort, professionals are sometimes obliged to change restorations because of the inability to eliminate the problem (21). Patients have described it as a moderate pain, of short duration, that appears spontaneously when chewing, with hot and cold foods (4,8) and on rare occasions with sweet and acid foods, and it disappears when the stimulus is removed (4).

Innumerable restorative procedures are performed on a day-to-day basis in dental offices, and some stages of the procedure may generate stimuli that result in pain or potentiate already existing sensitivity. Therefore, it is important to know what a resin composite restoration is not: simply removing carious tissue and inserting restorative material in small increments. Instead, it comprises various steps that must be carefully performed so that the...
restoration will be successful; that is, a perfectly sealed restoration that restores the shape and function of the tooth, and is comfortable for the patient (15).

Post-operative sensitivity can be caused by multiple factors and does not originate from one isolated aspect. It results from the interaction between the restorative technique, the clinical condition of the tooth to be treated (health of the pulp and remaining hard dental tissue) and the restorative material. Therefore, there is a permanent and unpredictable possibility of sensitivity occurring (4). In addition, there are other factors related to the cause of post-operative sensitivity, such as the individual profile of each patient, the shape and extension of the cavity preparation and protection of the dentin–pulp complex (22).

**Pre-operative causes**

It is extremely important to establish a precise diagnosis before any restorative procedure, in order to be certain that the pain reported by the patient does not originate from pre-existing causes, such as cracks, tooth fractures, dentinal sensitivity resulting from dentin exposure in the cervical region, or reversible or irreversible inflammatory processes in the pulp. A meticulous anamnesis associated with careful clinical and radiographic examination will allow other pathological processes that can affect the pulp and the dental periapex to be excluded.

**Cracks and fractures**

Cracked tooth syndrome is an entity characterized by the presence of incomplete cracks or fractures of the enamel or enamel and dentin in a tooth, with symptoms of pain when chewing and inexplicable sensitivity to cold (23). The difficulty in visualizing the crack and the patient’s report of symptoms, which are not always well explained, sometimes make it a complex diagnosis, and the symptoms may be confused with post-operative sensitivity.

**Cervical dentinal exposure**

Areas of cervical dentinal exposure may present as insensitive before the restoration, and may be stimulated during the operative procedure due to prolonged contact with the clip, or inadvertently, by the prolonged presence of phosphoric acid during cavity etching, which could lead to difficulties in diagnosing the pain, and may lead to re-intervention in the restoration (4). Thus, a meticulous examination should be performed to identify the presence of exposed dentin, whether there is a record of painful symptoms or not, and avoid possible procedures that may trigger or exacerbate existing pain.

**Pulp condition**

A determinant factor before restoring the tooth is to establish the condition of the pulp. Radiographic examination should be done, previous procedures should be observed, the presence or absence of symptoms reported by the patient should be recorded and pulp vitality tests should be performed. All these procedures are essential to minimize the risks of sensitivity. Frequently, inadequate instrumentation during cavity preparation, without a detailed analysis of the pulp condition, may cause irreversible pulp damage due to the increase in harmful stimulus on pulp that has been debilitating by pre-existing conditions (15). In the presence of pulp inflammation, it is necessary to make a meticulous evaluation of the condition of the pulp to consider whether endodontic treatment should be done before the restoration.

**Operative causes**

Pain of dentinal origin is intimately related to restorative procedures, and may occur by cutting and exposing healthy dentin due to dentin dehydration and the release of toxic substances from the restorative material, among other causes.

**Abusive dental structure wear**

The use of burs and diamond tips with excessive cutting or wearing pressure, without the use of adequate cooling, may generate frictional heat and dentin dehydration. Even if this happens for only a short time, it causes displacement of the tubular fluid and a painful pulp response. Zach and Cohen (24) have shown that an increase in temperature of 5.6 ºC may trigger various degrees of inflammation or even pulp necrosis. Blunt burs and diamond tips demand greater pressure during cavity preparation, inducing a rise in temperature. Diamond tips are subject to increasing degrees of wear and diamond particle loss, as they are submitted to a larger number of cavity preparations, and must be replaced. A previous study has attested that their use after the fifth preparation is questionable, and they must therefore be replaced after the fourth preparation (the author’s unpublished data).

Excessive dentin dehydration may also occur by repetitive cavity drying during preparation of the tooth and/or while performing the restoration, causing pain due to pulp fluid displacement, with
pulp alterations that are generally reversible. Dehydration is limited by the resultant smear layer, but prolonged exposure, especially after acid etching, may induce a more severe pulp trauma due to dehydration (25). These types of damage can be avoided with the use of new burs and diamond tips, adequate cooling and cutting with intermittent movements.

Incomplete carious tissue removal

The environment found under restorations presents favourable conditions for microbial growth between the restorative material and the cavity wall (26). Incomplete carious tissue removal leads to the possibility of bacteria remaining between the restoration and the cavity wall, increasing the susceptibility of the pulp to leakage of the bacteria themselves and their toxins (4). Bacterial activity results in pulp infection or inflammatory reactions resulting from bacterial products (26). Consequently, post-operative sensitivity results from pulp aggression caused by the presence of carious dentin and the low quality of the adhesive bond to dentin. The deficient bond causes marginal gaps and consequently, microleakage, recurrent caries and pulp inflammation (4).

The presence of bacteria and their products may be detected at any stage of the restorative procedure. Contamination of the cavity may occur during cavity preparation with the presence of carious dentin, by saliva penetration during cavity preparation, while performing the restoration, with the use of contaminated instruments, or in the post-operative stage due to the presence of marginal leakage (4).

Negligence in protecting the dentin–pulp complex

Undoubtedly, dentin is the best pulp protection material. At the time of deciding about protecting the dentin–pulp complex during a resin composite restoration, dentinal permeability and the type and quality of remaining dentin should be assessed. Whether dentin is removed by pathological or professional means, if its thickness is reduced the dentinal tubule openings are increased, making it more permeable and consequently, more susceptible to irritation by chemical or bacterial agents.

Another very important factor is cavity depth, which varies from shallow to medium and deep, and it is fundamental to know how to act in each case. Shallow and medium cavities present a larger quantity of dentin, which favours the maintenance of the number of odontoblasts. The larger the number of odontoblasts, the greater the repair capacity of the pulp. In deep cavities, there is a smaller quantity of odontoblasts remaining, which may be diminished even further during the restorative procedure, drastically reducing the chances of pulp recovery (15).

The increase in cavity depth is proportional to the dentinal permeability and significantly predisposes the dentin to post-operative sensitivity. Restorations in deep cavities present four times greater risk of failure, whereas cavities with pulp exposure have a 14 times higher risk of failure, compared with restorations in cavities with a greater dentin thickness (8).

The quality of remaining dentin found between the cavity floor and the pulp is of important in preventing pulp complications caused by operative procedures. The patient’s age must also be considered. A young tooth has a larger pulp cavity than an adult tooth, which has received more physiological stimuli or injuries during the course of life, and in which more reparative dentin has formed, and consequently, the pulp chamber is reduced in size (15).

The use of resin composite materials during restorations is a controversial but important topic. It has been questioned whether it is really necessary to use a lining material under a composite restoration, when a good seal can be obtained with the application of an adhesive system. Furthermore, why cover the dentin, which is an excellent bond surface, with a lining of questionable value? (27–29).

To some authors, an almost perfect seal is very difficult to achieve clinically, therefore, under the condition of a not so perfect seal, a cavity floor lining may still be of great value. Liners, when used, must support (and continue to support) the restorations superimposed upon them, since any decomposition will result in a defective base, causing a pumping action and marginal percolation during chewing, resulting in sensitivity (14,15). The indiscriminate use of calcium hydroxide linings to stimulate secondary dentin formation continues to be controversial. On the one hand, it is argued that secondary dentin will form in any case, as a response to the repair process. On the other hand, the need to form secondary dentin is questioned when there is good cavity sealing (22,30–34). Irrespective of this, the use of calcium hydroxide is recommended in very deep cavities in which the remaining dentin thickness (<500 µm) is not capable of protecting the pulp against the possible
undesirable effects of toxicity of adhesives and composite resin (35,36).

Post-operative sensitivity may be minimized with the use of protective materials that will act on the dentin–pulp complex, such as glass ionomer cement, calcium hydroxide and resin-based adhesive systems. These materials must present bacteriostatic and bactericidal characteristics, protect the pulp against thermal or electrical stimuli, and have good compatibility with the pulp and restorative material. It is desirable for these characteristics to be present simultaneously, however, there is still no material that presents all these features. The professional must have full knowledge of the type of action that is required for each cavity in order to select the best protective material possible (37). Consideration of the need for mechanical protection (tubular obliteration) or biologic protection (need for a material with greater biologic compatibility and capacity to induce reparative dentin formation) may be the key to improved protection of the dentin–pulp complex.

The thickness of the adhesive layer applied to the tooth may also help to reduce sensitivity, and multiple layers of adhesive may have a better effect than one thinner layer. The use of resin-reinforced glass ionomer cement as a lining on the pulp and axial walls before the use of acid has produced the same effect (16). All these procedures lead to obliteration of the dentinal tubules, and consequently, to eliminating or lowering the incidence of cases of post-operative sensitivity.

Inadequate isolation of the operative field

Absolute isolation is indicated to reduce two issues that cause post-operative sensitivity generated by penetration of saliva into the operative field: contamination of the cavity by microorganisms that cause pulp inflammation and contamination by humidity, which harms the bond and facilitates marginal leakage (4). The study of Auschill et al. (8) showed that the type of isolation, with a rubber dyke or cotton wool rolls, has no influence on the occurrence of post-operative pain, provided that cavity contamination is avoided.

Failure in dental tissue hybridization

Hybridized dentin is prepared at the interface of the surface demineralized by previous acid etching to expose the collagen fibers in the dentin matrix and allow infiltration of adhesive monomer into the exposed fiber network (38). Therefore, dentin hybridization is a process that creates a mixed layer of resin monomers and collagen fibrils, altering the physical and chemical properties of this tissue (39).

The formation of a bond interface that is as perfect as possible and minimizes or prevents the entry of bacterial fluids is fundamental to guarantee greater longevity of resin composite restorations. Inadequate formation results in marginal leakage, resin discoloration and post-operative sensitivity (3,33,40,41). Therefore, dentin hybridization, acid etching, application and light activation of the adhesive system must be meticulously performed.

Previous acid etching transforms the tooth surface, making it more receptive to bonding with the adhesive system and resin composite, and facilitating the formation of resin tags within the dentinal tubules, which gives the restoration greater resistance and durability (34,42).

Acid etching for a longer time than that recommended by the manufacturer leads to many conditions that result in sensitivity. Most acids are hypertonic and cause pulp fluid displacement, leading to movement of the odontoblasts as a pulp response. Acid solutions used in excess of the recommended time (15 s) denature the collagen fibers, increase dentin permeability and humidity, facilitate chemical aggression by the adhesive system and bacterial infiltration, and for all these reasons, harm the bond and may cause pain (4).

Dentin demineralization of over 5 µm is not of much value to the clinical procedure, and may result from longer exposure of dentin to the acid. An increase in the demineralized dentin layer will not guarantee the formation of a thicker hybrid layer and a better bond, as the primer/adhesive may not have the capacity to infiltrate throughout its entire thickness, causing exposure of the collagen within and at the base of the hybrid layer, which could lead to degradation and leakage. The greater the flow of adhesive between the collagen fibrils and through the complex of demineralized channels, the better will be the quality of the hybrid layer, giving it a higher degree of resistance to hydrolysis and offering greater protection against microleakage (4,43). An increased dentin etching time is another clinical error responsible for the occurrence of post-operative sensitivity (4).

With the advancements in adhesive dentistry, simplified techniques and improved clinical developments are increasingly being sought. Adhesive systems began to present two forms of application according to whether or not previous
acid etching was necessary. Self-etching adhesives have an advantage over adhesives that require acid etching. As the primer is acidified, acid etching is performed without the need for washing. Although the hybrid layer formed is thinner, the entire etched area is occupied by adhesive, thus diminishing the chances of hydrolysis occurring in the area. Research has indicated that one of the disadvantages is lower resin bonding to enamel as a result of the acidic primer buffering. Due to this limitation, attempts have been made to combine the two techniques and tests have suggested the use of phosphoric acid on enamel before the self-etching adhesive is applied throughout the cavity, with the intention of enhancing the bond to enamel, providing good marginal sealing and greater longevity of the restoration (44). The use of total-etch or self-etch adhesives presented no statistically significant difference with regard to the occurrence of post-operative sensitivity (45,46).

For the step-by-step performance of hybridization, the tooth must be kept moist. Without adequate humidity, the exposed collagen fibrils collapse and make it difficult for the adhesive system to penetrate into the demineralized tissue. The exposed fibrils at the margins and within the restoration allow the passage of fluids and bacterial enzymes that may attack the collagen (47–50). The cumulative effect of these actions may be debilitation of the integrity of the restoration margin (43).

The definition of humidity may vary from one operator to another, and a larger or smaller quantity of water on the dentin, available for interacting with the adhesive system, may interfere in the adequate formation of the hybrid layer, favouring the presence of gaps and fluid accumulation at the tooth–restoration interface.

Although good bond efficiency can be obtained with acetone-based adhesives in vitro, the high sensitivity of these types of adhesives, particularly the two-step type, may lead to poorer results in the long term (3,51–53). Acetone in contact with moist dentin induces an increase in the remaining water vapor pressure (54), which, if it is not in a sufficiently high quantity, rapidly reduces dentin permeability, making it difficult for the resin monomers to penetrate (55) and form the hybrid layer. The difficulty of standardizing dentinal humidity may be more prejudicial to the bond strength of aceton-based adhesive system than that of water and alcohol-based systems (56). Thus, the use of adhesives with acetone as solvent may increase the possibility of developing dentinal sensitivity after restorative treatment and demands greater attention from the professional with regard to the application technique.

Handling restorative material

Resin composites are have a broad range of indications in clinical dentistry. They consist of an organic matrix permeated with inorganic particles surrounded by a bonding agent that makes them adhesive to the resin matrix. The organic base of contemporary resin composites is composed of the monomer bisphenol A-glycidyl dimethacrylate (bisoner A-dimethacrylate (Bis-GMA) in combination with other di-methacrylates such as triethylene glycol dimethacrylate (TEGDMA), urethane dimethacrylate (UDMA) and bisphenol A-glycidyl dimethacrylate ethoxylate (BiSEMA) (57). Despite the differences in their formulations, all the methacrylate-based composite are polymerized by the generation of free radicals (58). In this process, the approximation of the methacrylate monomers to establish covalent bonds with one another during the polymerization reaction causes a significant reduction in the volume of resin after polymerization (59), thereby leading to the greatest inconvenience of resin composites: polymerization shrinkage (60).

To reduce the polymerization shrinkage stress of dental composites, a new compound, called Silorane was developed using a monomer system with low shrinkage, derived from the combination of siloxane and oxirane radicals. It has a different polymerization mechanism based on the opening of cationic rings of the oxirane radicals (61), which is responsible for the low shrinkage and low stress generation, while siloxane give the material its hydrophobic properties. Thus, the main characteristic of the new composite is less than 1% polymerization shrinkage, in comparison with more than 2% in methacrylate-based resins (59,61).

Although reduced in the more recent resins, polymerization shrinkage of resin composites during the polymerization process persists, and is the consequence of the reaction of monomer transformation into polymers, with the change from the viscous to the solid state. During this transformation, the resin develops forces that may cause rupture of the bond between the adhesive system and cavity walls, reducing the useful life of restorations because of the existence of microscopic gaps at the tooth/restoration interface. These gaps allow entry of bacteria, and may lead to the
formation of caries, staining and post-operative sensitivity.

Various recommendations have been made to reduce the effects caused by polymerization shrinkage of resin composites. The use of gradual and careful light activation techniques and care with maintaining the wavelength emitted by the light source, inserting the resin in small increments and the use of a base of materials with a low modulus of elasticity are some of the suggestions (62–65).

Incomplete resin composite polymerization is also responsible for post-operative sensitivity (4). Problems associated with inadequate polymerization include inferior physical properties, diminished retention, greater degradation in the oral environment and adverse pulp responses. In clinical practice, only one appliance is bought and used to polymerize all the materials available in the dental office, as it is not possible for dentists to suit their appliances to the different materials. Inadequate power due to degradation of the components (bulbs, reflectors, filters and light conducting tips), which occurs with use over time, contributes to difficulties in polymerizing these materials (65).

It is impossible for the naked eye to identify differences between the types of light sources, variations in wavelength and changes in pulse and intensity. The light intensity is directly proportional to the number of photons that stimulate the photoinitiator, which is responsible for initiating the resin polymerization reaction (66,67). Therefore, frequent evaluation of the light intensity and care in the maintenance of light sources used for polymerization are among the ways of preventing post-operative sensitivity (65).

Many light polymerizing appliances used in dental offices are operating at a light intensity below the recommended level, and this means that insufficient resin composite polymerization is occurring and a larger quantity of substances harmful to the pulp, such as unreacted resin monomers and camphorquinone, may be released (16,65). Moreover, the bond and sealing present failures that may trigger pain and reduce the useful life of restorations (16).

The contraction stress that occurs during polymerization has received considerable attention. A recommendation for reducing the stress caused by polymerization shrinkage is to activate the resin composite in small increments within the cavity (65), observing the size of the increment to be polymerized (up to 2 mm) and the number of walls with which the resin comes into contact (4). The smaller the number of bonded faces, the greater will be the resin’s capacity to flow and release stress, favouring the resin bond to the tooth (4,65).

In addition to resin composite insertion in small increments and gradual light activation, the use of materials with a low modulus of elasticity, such as resin flow or ionomer materials has been proposed in an attempt to minimize the effects of shrinkage and increase the longevity of the restoration, especially of the Class II type (68–71).

In cavities that present margins limited to coronal enamel, the beveled and etched enamel helps to contain the contraction forces. In Class II cavities that present the cervical margin located apically to the cement/enamel line, in an area with no enamel where the material bond to dentin is weaker, rupture of the bond between the material and cavity wall may occur due to the polymerization shrinkage forces of the resin composite. This rupture of the bond causes the formation of spaces, which serve as a port of entry to bacteria and their products, leading to secondary caries, marginal stains, pulp inflammation and hypersensitivity to cold (72,73). Due to the deficient seal at the tooth/restoration interface, the free extremities of the tubules are exposed, generating a flow of fluids due to differences in gradient when they come into contact with the external medium (16). The sensitivity to cold that is present in this situation may be explained by a small change in the fluid volume present at the gap. When it receives the cold thermal stimulus, contraction of the fluid within the gap occurs, which causes rapid movement within the dentinal tubules, leading to stimulation of the pulp nerve fibers, causing the painful sensation (26). This occurs mainly in the presence of infection, as in cases in which there is communication with the oral cavity. With elimination of the gap and any existing infection, the sensitivity rarely persists unless the pulp has been irreversibly compromised (74). Very severe pulp inflammation may present even in the presence of small gaps, therefore the size of the gap may be of less importance than the other factors, such as bacterial invasion and their toxic products, and the effects these could have on the pulp.

Recent studies have shown that patients with resin composite restorations with low polymerization shrinkage have not presented post-operative sensitivity (75). It is possible to eliminate post-operative sensitivity, even in restorations with
cavities that have a high C factor value, when they are restored using small increments and gradual light activation (76).

Therefore, to perform a resin composite restoration, all the clinical stages must be strictly followed. Among these, knowledge, skill and professional organization must be included. It is essential for professionals to have full understanding of how complex the adhesive restorative technique is, so that they obtain adequate aesthetics and seal the cavity, thereby guaranteeing the success of the restorative treatment, without complaints of pain from their patients.

Post-operative causes

Restoration finishing and polishing

Finishing and polishing are commonly performed by dentists. Restorations must be done in such a way that the finishing and polishing stages are restricted to small adjustments in the shape and superficial smoothness of the restoration. Purposely inserting a large excess of material and then performing finishing is extremely unfavourable to the tooth and the restoration (4). Immediate and excessive superficial wear of a recently placed resin composite generates alterations in the resin matrix by the heat produced, disturbs the post-irradiation phase of polymerization, and removes the superficial layer, which theoretically obtains the highest degree of conversion. The possibility of pulp injury due to the exaggerated frictional heat generated by the high speed bur is increased. The careful use of burs and abrasive instruments at this stage avoids possible damage to the restoration margins and adjacent dental tissue, avoiding failures at the tooth/restoration interface.

Occlusal interference

During mastication of solid foods, or when the restoration is in occlusion with the antagonist tooth, deformation of the margins and interfaces occurs, and this may lead to a dimensional change that could cause fluid movement within the dentinal tubules and cause pain (4,16).

Cervical dentin exposure

The restorative procedure may trigger or increase pain coming from areas of exposed dentin in the cervical region of the tooth. Inadequate use of clips may result in traumatic gingival displacement and consequent cervical dentinal exposure. Similarly, the inadvertent permanence of acid in this region can lead to pain and can be avoided by paying attention to all stages of the restorative procedure.

Final considerations

The clinical performance of resin composite restorations in posterior teeth can be maintained at satisfactory levels, and post-operative sensitivity can be avoided or maintained at minimal levels when restorations are inserted strictly in accordance with the technical recommendations (18). Several causes of sensitivity result from errors in technique before, during and after placement of the restoration. The dynamics of a poorly conducted restoration may also trigger post-operative dentinal sensitivity.

Dentistry demands complicity between professionals and the material they use. The material must offer properties that justify their choice and it is the responsibility of professionals to be familiar with these properties, understand their indications, and know how to apply them with the necessary skill (4). Many procedures performed using the same restorative materials, applied with the same technique and under similar clinical conditions generate sensitivity in some cases and not in others. Only by alling knowledge and command of the technique and the material applied is it possible to ensure the placement of adequate restorations, and the patient’s physical and psychological well-being in return.

Briefly, the causes of post-operative sensitivity in direct resin composite restorations are diverse, and comprise failures in the diagnosis and indication for the procedure, cavity preparation and/or stages of insertion of the material, finishing and polishing the restoration, through to occlusal adjustment of the restoration.

The recommendations for avoiding or minimizing post-operative sensitivity involve all the principles for attaining excellence in restorative dentistry; that is, making a good diagnosis before performing the restoration; analysing the initial health of the pulp and periapical region; the use of new burs with abundant cooling; use of adequate isolation to prevent contamination; not dehydrating dentin with excessive drying; strictly following all the criteria indicated in the stages of hybridization, insertion, finishing, polishing and occlusal adjustment of the restoration.

References


