

INDIRECT PULP CAPPING WITH CALCIUM HYDROXIDE IN PERMANENT MOLARS

Perawatan Indirect Pulp Capping dengan Kalsium Hidroksida pada Gigi Molar Permanen

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ABSTRAK

Berbagai bahan dan protokol klinis pulp capping telah digunakan selama bertahun-tahun untuk menjaga kesehatan dan vitalitas kompleks pulpa dan menginduksi sel pulpa untuk membentuk jaringan keras (dentin reparatif/tersier). Pulpa dapat diselamatkan dengan perawatan pulp capping. Perawatan ini melibatkan penempatan semacam bahan di atas pulpa untuk melindunginya dan mempertahankan viabilitasnya. Bahan yang paling umum digunakan dalam indirect pulp capping adalah kalsium hidroksida. Laporan kasus ini membahas mengenai perawatan gigi 47 dengan diagnosis pulpitis reversibel dengan menggunakan kalsium hidroksida sebagai bahan indirect pulp capping yang selanjutnya dilakukan perawatan restorasi kelas I komposit. Kalsium hidroksida memiliki beberapa kelemahan, yaitu tingkat kelarutan yang tinggi, kurangnya adhesi dan sifat fisiko-mekanis yang buruk. Tetapi kalsium hidroksida masih menjadi 'gold standard'. Hal ini karena kemampuannya untuk berdisosiasi menjadi ion kalsium dan hidroksil, memiliki pH tinggi, sifat antibakteri, serta kemampuan untuk merangsang odontoblas dan sel pulpa lainnya untuk membentuk dentin reparatif melalui respon inflamasi. Selain itu, kalsium hidroksida merupakan bahan yang ekonomis dan mudah didapat sehingga menjadi bahan yang paling umum digunakan.

Kata kunci: *indirect pulp capping, kalsium hidroksida, restorasi komposit*

ABSTRACT

Various clinical pulp capping materials and protocols have been used for many years to maintain the health and vitality of the pulp complex and induce pulp cells to form hard tissue (reparative/tertiary dentine). The pulp can be saved by pulp capping treatment. This treatment involves placing material over the pulp to protect it and maintain its viability. The most common ingredient used in indirect pulp capping is calcium hydroxide. This case report discusses the treatment of tooth 47 with a diagnosis of reversible pulpitis using calcium hydroxide as an indirect pulp capping material which is then treated with composite class I restorations. Calcium hydroxide has several disadvantages, namely high solubility, lack of adhesion, and poor physico-mechanical properties. But calcium hydroxide is still the 'gold standard'. This is due to its ability to dissociate into calcium and hydroxyl ions, has a high pH, antibacterial properties, as well as the ability to stimulate odontoblasts and other pulp cells to form reparative dentin through an inflammatory response. In addition, calcium hydroxide is an economical and easy-to-obtain material, making it the most commonly used material.

Keywords: calcium hydroxide, composite restoration, indirect pulp capping

INTRODUCTION

Dental caries is a multifactorial chronic disease in the oral cavity, mainly caused by complex interactions between cariogenic bacteria in biofilms that ferment carbohydrates on the tooth surface from time to time. Based on the Keyes-Jordan diagram, caries etiology are more complex than the three tooth-biofilm and carbohydrate interactions because not all individuals with teeth, biofilm, and carbohydrate consumption will develop caries over time. Several modifying factors and protective factors also affect the caries process.¹

According to Riset Kesehatan Dasar (RISKESDAS) in 2018, the prevalence of dental health problems are 57,6% with 88,8% of them suffer from caries.² Untreated caries will have an impact on pulp vitality.³ The pulp can be saved by doing pulp capping treatment. This treatment involves placing some kind of material over the pulp to protect it and maintain its viability so that more invasive treatments (extraction or endodontic therapy) can be avoided. Two approaches are available, direct pulp capping, in which the bioactive material is placed directly over the exposed pulp, and indirect pulp capping, in which a cavity liner or sealant is placed over the remaining thin layer of dentine.⁴

Various Clinical pulp capping materials and protocols have been used for many years to maintain the health and vitality of the pulp complex and induce pulp cells to form hard tissue (reparative/tertiary dentine). Conventionally the most commonly used ingredient in indirect pulp capping is calcium hydroxide. This is due to the alkaline pH of calcium hydroxide and its biocompatible nature which indicates remineralization at the pulp-dentin junction. However, calcium hydroxide has several disadvantages, namely high solubility, lack of adhesion and poor physico-mechanical properties.⁵⁻⁷ In particular, the effectiveness of the seal

they can provide against ingress of bacteria during the repair period is questionable. So it is usually used with glass ionomer cement. This cement acts to provide a reliable seal against entry of bacteria, calcium hydroxide alone does not provide an adequate seal.⁴ This case report discusses the treatment of reversible pulpitis in permanent molars using calcium hydroxide as an indirect pulp capping material with composite class I restorations follow-up.

CASE REPORT

First Visit

A 19-year-old female patient came to Padjajaran University Hospital with complaints of aching pain in her right lower posterior tooth when she eats and drinks. Patients also complain that there is often impacted food. Complaints felt approximately since 1 year ago. Systemic, family history and allergic history was denied. The pain comes and go and are only felt when eating and drinking something cold or when the tooth was expose to air. Patients brush their teeth 2-3 times a day while bathing and before going to bed. The patient has a habit of chewing on one side. There are no factors that alleviate the patient's complaints and the patient has not taken medication to relieve complaints. The patient wants his teeth examined and treated. Examination of the patient's general condition was good, and extra oral examination found no abnormalities. On intra oral clinical examination found occlusal caries media covering all fissures of tooth 47 (Figure 1). Examination of pulp sensitivity with a cold test using chlorethyl was carried out and the results obtained were positive, namely the patient felt pain and disappeared when the stimulus was removed. This finding indicates that the pulp is still in a vital condition. On percussion, palpation, and mobility examination, negative results were obtained.



Figure 1. Clinical appearance on 1st visit

Based on the history taking and examination performed on the patient, the diagnosis obtained reversible pulpitis of tooth 47. The treatment plan for the patient is to carry out a class I composite restoration on tooth 47 accompanied by the administration of calcium hydroxide as indirect pulp capping material.

Second Visit

Operator conducted a subjective and objective examination of the patient. Next, operator isolates the patient's teeth using a cotton roll. The first step was to excavate the caries on tooth 47 with the aim of removing all carious tissue using an excavator and a bur. Furthermore, the enamel surface that is not supported by healthy dentin is removed. The caries tissue at the base of the cavity is cleaned using an excavator slowly until all the caries tissue is removed. After that, the cavity was cleaned with cotton pellets and 0.1% chlorhexidine. Furthermore, pulp protection was applied with calcium hydroxide medicament. Apply a thin layer of Ca(OH)₂ (Dycal™) to the bottom of the cavity using a cement stopper. Then glass ionomer cement (GIC) was applied. Ca(OH)₂ is left in the cavity to stimulate reparative dentin formation. The cavity was closed with a temporary restoration and the patient was asked to return for control after 6 weeks.



Figure 2. Caries excavation



Figure 3. Application of calcium hydroxide

Third Visit

Six weeks later, on August 26 2022 patient came back for control. From the results of history taking, the patient had no complaints. Intra-oral examination showed sensibility test (+), percussion (-), and surrounding tissue showed no abnormalities. Operator isolates patient's teeth using a cotton roll. The temporary restoration was removed and the GIC base cement, Ca(OH)₂, was left in the cavity. The work is continued by carrying out preparations in accordance with the fundamental principles of tooth preparation which are, initial depth and forming an outline, primary resistance, primary retention, convenience form; and the final steps are removal of damaged restorative material and/or weak dentin, pulp protection if indicated, secondary resistance and retention, external wall finishing, and final debridement and inspection procedures. In this case, after removing the carious tissue, a class I cavity was obtained according to G.V. Black. Retention in composites is obtained from the chemical bond

between the restorative material and the tooth structure using an adhesive material. Furthermore, the convenience form stage ensures that restoration tools and materials are easy to insert and help the operator's visibility. After that, secondary retention was given in the form of a 45° bevel on the external wall of the cavosurface margin 2 mm wide using a diamond flame-shaped bur.



Figure 4. Clinical appearance after six weeks

Next, a class I composite restoration was carried out. The choice of composite color was carried out by covering patient's clothes with a neutral colored polybib. Composite color selection using button shade technique, the colors chosen for this patient are A2 enamel and A3 dentin. Next, isolate the work area using a cotton roll. Apply etching agent (37% phosphoric acid) for 30 seconds on the enamel and 15 seconds on the dentin, clean the etch using water syringe and dry it until the surface of the cavity looks moist/frosty appearance. Then apply, bonding using a microbrush on the entire surface of the cavity, then cured using light cured for 20 seconds. Place the dentin shade A3 composite using the composite filling instrument to form the cusp slope and cured for 20 seconds. This procedure is performed cusp by cusp. Followed by placing the shade A2 enamel composite to form the occlusal part and cured for 20 seconds. Smoothing and shaping the anatomy is done using superfine burs. After checking the occlusion with articulating paper, finishing the part with the thick impression until all the thickness of the

impression is uniform. Re-examine the occlusal using a half moon probe, the entire cavity must be ensured that the composite is properly filled, not overfilled or underfilled. Patients were instructed to come back after 1 week for polishing and control of the restoration.



Figure 5. Calcium hydroxide left in the cavity



Figure 6. Button shade composite technique



Figure 7. Class I composite restoration

Fourth Visit

At the next visit on September 12, 2022, after one week, the patient came back for control. From the results of the anamnesis, the patient had no complaints with his teeth, nothing stuck, nothing involved food, and no pain. On intra-oral examination showed sensibility tests (+), percussion (-), and the surrounding tissue showed no

abnormalities. During this visit, finishing and polishing of class I composite restorations was carried out.



Figure 8. Finishing and Polishing

DISCUSSION

Patients come with complaints of toothache when eating and drinking. Based on the results of history taking and objective examination, diagnosis of reversible pulpitis was made for first lower right molar. Caries preparation and excavation was carried out on tooth 47. The infected dentine was excavated with a bur with minimal pressure and the affected dentin was left in the cavity to prevent pulpal exposure. In this case, the indirect pulp capping procedure was carried out. Indirect pulp capping is indicated in cases where a thin layer of dentine remains after caries excavation, the tooth is vital without spontaneous pain or a diagnosis of reversible pulpitis, no periradicular pathology or swelling or fistula, no mobility and no root resorption, as occurs in patients in this case.^{1,7}

The ideal pulp capping material should bond with the tooth substrate; maintains adequate seal, does not dissolve in tissue fluids; dimensionally stable, non-resorbable, non-toxic, non-carcinogenic, non-genotoxic, radiopaque, and have good biocompatibility and bioactivity.⁸ Along with the development in dentistry, various materials have been used for indirect pulp capping treatment. Some materials that can be used for pulp capping include calcium hydroxide,

mineral trioxide aggregate (MTA), calcium-silicate based cement, calcium-phosphate based cement, zinc oxide eugenol, and resin-modified glass ionomer cement (RMGIC).⁵

In this case, operator used calcium hydroxide for indirect pulp capping treatment. Based on the literature, until now, calcium hydroxide is still the gold standard for pulp capping materials. Hard-setting calcium hydroxide is used because it partially dissolves, releasing Ca^{2+} and OH^- ions, produces an alkaline environment, provides an antibacterial effect, and can stimulate reparative dentin formation. Calcium hydroxide has a fast setting time, the price is also affordable compared to other pulp capping materials, so it is cost effective.^{4,9,10} However, calcium hydroxide also has several drawbacks, including poor marginal seal, risk of microleakage, and can cause pulpal irritation.^{5,8} Due to the deficiency of calcium hydroxide, an additional base is needed. In this case the base material used is type III glass ionomer. Glass ionomer was chosen because it is biocompatible, prevents dissolution of calcium hydroxide, releases fluoride, is adhesive to tooth structure, and provides mechanical, chemical and thermal protection.^{1,10}

IPC has high clinical and radiographic success rates. This high success rate can be attributed to a number of factors: (I) correct diagnosis of pulpal status, (II) removal of infected carious tissue, and (III) adequate marginal seal by permanent restorative material selected to prevent microleakage.¹¹ The success of IPC treatment can also be seen clinically, from the anamnesis there are no complaints of pain and from an objective cold test examination the teeth are vital and no periodontal abnormalities when the percussion test

is carried out.¹² After 6 weeks the patient came for control and the patient showed good clinical signs, there was no pain in the teeth and the objective examination results were good, which indicated the success of the IPC treatment for the patient. This is in accordance with research by Sofiani and Fajriyani which stated that the success of IPC treatment with calcium hydroxide in 1-4 week control showed results with good criteria of 93.6%, 5-8 week control with good criteria of 94.4%. The results of this study are also in accordance with the research by Murray and Godoy, that teeth with deep carious lesions after IPC treatment had a success rate of 86% for more than 10 years.¹³ In this case the patient was ask to control after 6 weeks. At the time of control there were no signs of pulpal degeneration and periapical abnormalities, there for the treatment was continued by replacing temporary fillings with class I composite restorations. Composite restorations were chosen because they have the ability to bond with the tooth structure both to the enamel and dentin so as to provide a good seal.^{14,15} Calcium hydroxide and base glass ionomer are left in the cavity. This is because strong scientific evidence shows that calcium hydroxide and base disassembly in asymptomatic vital teeth can increase the likelihood of pulpal exposure without a favorable increase in treatment success.¹⁵ The risk of pulpal exposure occurs because the tertiary dentine formed within 6 weeks is not thick enough, approximately 182.3 μm .¹⁶

CONCLUSION

The diagnosis of reversible pulpitis is inflammation of the pulp where the pulp can return to normal if treated immediately. Indirect pulp capping is a procedure for placing pulp capping material on a thin layer of dentine after caries excavation. In addition to the accuracy of diagnosis, caries excavation and selection of restorations with good seals, the success of IPC also depends

on the selection of materials. Calcium hydroxide is still the 'gold standard'. It is due to its ability to dissociate into calcium and hydroxyl ions, has a high pH, antibacterial properties, as well as the ability to stimulate odontoblasts and other pulp cells to form reparative dentin through an inflammatory response. In addition, calcium hydroxide is an economical and easy-to-obtain material, making it the most commonly used material.

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