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Research Report

# Indirect pulp capping in primary molar using glass ionomer cements

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***ABSTRACT***

***Background:*** *Indirect pulp capping in primary teeth, however, is more rarely conducted than permanent teeth, since it thought to have low impact and most suggestion is for taking caries lesion aggressively on primary teeth.* ***Purpose:*** *The study was aimed to evaluate the subjective complaint, clinical symptom, and radiographic appearance of indirect pulp capping treatment using glass ionomers cements in primary molar.* ***Methods:*** *Sixteen children in range of age 6 to 8 years old, who visited Clinic of Pediatric Dentistry Universitas Airlangga Dental Hospital, Surabaya Indonesia, were the subject of study. They had one occlusal dental caries on one side of maxillary or mandibular primary molar with the diagnose of pulpitis reversible. The experimental group, had indirect pulp capping treatment with glass ionomer cements (GC Fuji VII®), while the control group, had indirect pulp capping treatment with calcium hydroxide (Metapaste). Each group was filled with GC Fuji IX® as permanent restoration. After one week, one month, and three months later, the observations were made on subjective complaint, clinical symptom, and radiographic appearance.* ***Results:*** *The results showed no subjective complaint such as pain or problem on mastication; no negative clinical symptoms such as pain on palpation, gingivitis or periodontitis, and abnormal tooth mobility; no negative radiographic appearance such as pathological apical radioluscency, internal or external resorbtion, and change of ligament periodontal widthafter the treatment.* ***Conclusion:*** *The study suggested that indirect pulp capping treatment using glass ionomer cement materials on primary teeth might be considered to be the treatment choice.*

***Key words:*** *Indirect pulp capping, primary molar, glass ionomer cement, children*

***ABSTRAK***

***Latar belakang:*** *Indirect pulp capping pada gigi sulung lebih jarang dilakukan dibandingkan gigi permanen, karena dianggap memiliki dampak yang rendah dan sebagian besar menyarankan untuk mengambil lesi karies secara agresif pada gigi sulung.* ***Tujuan:*** *Penelitian ini bertujuan untuk mengevaluasi keluhan subjektif, gejala klinis, dan gambaran radiografi perawatan indirect pulp capping menggunakan glass ionomer pada gigi molar sulung.* ***Metode:*** *Enam belas anak berusia 6 sampai 8 tahun, yang mengunjungi Klinik Kedokteran Gigi Rumah Sakit Gigi dan Mulut Universitas Airlangga, Surabaya Indonesia, adalah subjek penelitian ini. Mereka punya satu karies gigi oklusal molar sulung pada satu sisi maksila atau mandibula dengan diagnosa pulpitis reversibel. Pada kelompok eksperimen dilakukan perawatan indirect pulp capping dengan glass ionomer (GC Fuji VII®), sedangkan kelompok kontrol, dilakukan perawatan indirect pulp capping dengan kalsium hidroksida (Metapaste). Setiap kelompok ditumpat dengan glassionomer untuk gigi posterior (GC Fuji IX®) sebagai restorasi permanen. Observasi dilakukan setelah satu minggu, satu bulan, dan tiga bulan kemudian, pengamatan dilakukan pada keluhan subjektif, gejala klinis, dan gambaran radiografi.* ***Hasil:*** *Hasil penelitian menunjukkan tidak ada keluhan subjektif seperti rasa sakit atau masalah pada pengunyahan; tidak ada gejala klinis negatif seperti rasa sakit pada palpasi, gingivitis atau periodontitis, dan mobilitas gigi abnormal; tidak ada gambaran radiografi negatif seperti radioluscency patologis apikal, resorbsi internal atau eksternal, dan pelebaran periodontal ligamen setelah perawatan.* ***Simpulan:*** *Penelitian ini menunjukkan bahwa perawatan indirect capping menggunakan glass ionomer pada gigi sulung dapat dipertimbangkan sebagai pilihan perawatan.*

***Kata kunci:*** *Indirect pulp capping, molar sulung, glass ionomer, anak*

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## INTRODUCTION

Treatment of dental caries and effort of maintaining oral health for each patient must be considered as the main goal for dentist. The lost of healthy dental tissue must be considered to be a serious problem. For the reason, it is important to treat each tooth accurately and carefully. One of the clinical treatments conducted in deep caries lesion is indirect pulp capping. The aim of this treatment is to recover from dental caries by taking the infected dentin and isolating the caries lesion from oral liquid by using restoration materials.[1] This treatment, moreover, is chosen more in order to maintain pulp vitality which can easily be affected by caries, trauma, or other causes. Furthermore, indirect pulp capping treatment can be conducted in teeth with dentin caries. The deepest caries lesion is left remain to prevent pulp tissue exposure. Materials considered as base like calcium hydroxide, zinc oxide eugenol, and glass ionomer cements are set in cavity base or dentin in order to stimulate the process of recovery and reparation. Indirect pulp capping in primary teeth, however, is more rarely conducted than the permanent teeth. Some dentists think that indirect pulp capping has low impact and suggests taking caries aggressively on primary teeth. Nevertheless, based on the result of the previous experiment, it was reported that the level of successfulness is very high, about 90-99%.[2]

In addition, according to Hilton and Summit, the deepest layer or soft dentin that has been demineralized is abandoned and does not need to be taken. The other clinical experiments reported that the abandoned soft dentin caries will not affect the healthy dentin, and in next ten years the progress of lesion of the caries will stop and will not grow further.[3-5]

Glass ionomers cements have been long used in Atraumatic Restorative Technique (ART). Part of infected teeth or dentin actually can be cleaned only with hand instruments. Glass ionomers cements are set in cavity in order to repair soft dentin. The reason is because the materials can improve re-mineralization process in dentin. It has been examined and published in many literatures that dentin caries which covered with glass ionomer cements generate process of remineralization.[6]

Glass ionomer cements as liner can reduce the taking of dental tissue in which lesion of caries is located, and the taking of dentin that has been demineralized. The reason is because the setting of glass ionomer cement materials as liner can cause soft dentin get remineralization.[7] Massara *et al*., reported that the use of glass ionomers cements can stimulate process of remineralization, thus, the materials recommended as liner in indirect pulp capping treatment.[8] Glass ionomers cements considered as ideal materials for covering cavity base, through the adhesion process of ion alteration in demineralized dentin, actually can prevent the formation of nutrition for bacteria and reduce colonization of bacteria which still left in cavity base. Besides that, glass ionomer cements continually secrete fluoride that consider as anti cariogenics.[9] The GIC only take short time for application in dental cavity, therefore, glass ionomer cements give more advantage relating with the duration of treatment in child patients.[10]

The in vitro experiment, moreover, has also proven that glass ionomer cements (GC Fuji VII) can secrete fluoride six times as much as glass ionomer cements.[11] According to Svanberg and Forss the materials can be considered as anti-microbe by reducing the growth of *Streptococcus mutan*s in the surface of restoration.[12] The basic component of glass ionomer cements (Fuji VII), in addition, is strontium fluoroalumino-silicate glass. Strontium producing radiopacity and fluorine formed by fluoride ion entering into matrix phase can improve the remineralization process of dental structure got caries and give effect of anti microbe when the cements are getting harder.[13]

Glass ionomer cements (GC Fuji VII), thus, are located in cavity base, demineralized dentin or infected layer. The aim is to remineralize dentin that has been demineralized. This technique actually has already been used in developing countries, especially for indirect pulp capping, but there is still not many further experiment about it.[11] The study was aimed to examine the subjective, clinical, and radiologic progression of indirect pulp capping treatment using glass ionomers cements (Fuji VII) in primary teeth.

## MATERIALS AND METHODS

There were sixteen child patients, both male and female children visiting Clinic of Pediatric Dentistry Universitas Airlangga Dental Hospital Surabaya. The criteria of subject were: male or female children in the range of age 6 to 8 years old: patients had lesion of dentin caries that was deep and closed to pulp in primary molar teeth either in upper or lower jaw with diagnose of pulpitis reversible; the successor permanent teeth had not erupted, there was only one tooth suffering with class I of caries in one quadrant, patients had positive response on thermal test, the depth of cavity was about 1 – 0.5 mm from pulp based on radiologic picture; and patients did not have any allergy with any materials contained in glass ionomer cements.

After explained the procedures of the experiment and the advantage and disadvantage of indirect pulp capping treatment with glass ionomer cements and calcium hydroxide, patients were divided into two groups, each of which consisted of ten children. The first group, as the experimental group, received indirect pulp capping treatment with glass ionomer cements, while the second

one, as the control group, received indirect pulp capping treatment with calcium hydroxide.

First, subjective examination based on anamnesis to patients together with their parents, clinical examination and radiologic examination were conducted before the treatment in order to get diagnose of the dental caries that met the criteria of sample. Then, lesion of caries was carefully cleaned with high speed bur. But, the lesion closed to pulp was abandoned in order to prevent the pulp opened, irrigated with aquadest, and then dried with cotton pellet. Afterwards, in the first group, the cavity base was covered with glass ionomer cements (GC Fuji VII®), while in the second group that was covered with calcium hydroxide (Metapaste). Then, the cavity in each group was fully filled with glass ionomer cements (GC Fuji IX®).

The progression of the treatment then was determined by three aspects observed, which were subjective, clinical, and radiologic progressions. Those aspects of consist of: subjective complaint e.g. there was no pain based on anamnesis to patients and their parents, and good chewing function; clinical condition e.g. there was no pain on percussion or pressure, no sign of periodontitis, and no abnormal teeth mobility; and there was no picture of radiolucency pathologies in periapical area, no picture of internal or external root resorption, and no abnormal periodontal ligament.[14]

## RESULTS

The observation and evaluation of the treatment result were conducted three times, which were one week, one month, and three months after indirect pulp capping treatment. All subjects (8 patients) showed the same condition at 3 recall visits. They had no complaint concerning the pain or mastication problem. On intra oral examination, there was no pain on percussion or pressure, no gingival inflammation, and no abnormal tooth mobility. From radiographic examination there was no sign of pathology radiolucency in periapical area, no internal or external root resorption, and no sign of periodontitis or abnormal periodontal ligaments.

## DISCUSSION

The subjective conditions observed and evaluated in this study involved two aspects The first aspect observed was pain, and the second aspect observed was chewing function. The control visit results showed that based on subjective observation, there was no pain suffered by either the first group - glass ionomer cements (Fuji VII®) or the second group - metapaste. The second aspect of subjective observation was chewing function. It also revealed that the chewing function of the first group (glass ionomer) and the second group (metapaste) was all had no problem. The result showed that the application of glass ionomer cements or metapaste as sub base did not cause any pulp inflammation. Moreover, the condition of pulp diagnosed as reversible pulpitis did not develop into irreversible pulpitis, but the inflammation seems to stop or disappeared. It might due to the bacteria causing inflammation had been eliminated after the infected dentin was taken and the cavity base was given liner. Glass ionomer cements and metapaste reported to have anti bakterial effect in eliminating cariogenic bacteria that made the cavity sterile.[15]

The dental materials that is used for indirect pulp capping treatment should have the ability to overcome the inflammation to reduce the bacteria by disturbing bacterial metabolism, thus, pulp can be repaired and recovered.[16] Furthermore, when calcium hydroxide is applied and connected into pulp tissue, it can maintain the pulp vitality, will not cause inflammation, and can stimulate the formation of mineralized tissue barrier.[17]

The main component of glass ionomer cements is calcium or strontium fluoroalumino-silicate glass. The fluoride enter ion into matrix phase that can improve remineralization process of dental structure. Besides that, strontium can also give effect of anti microbe after those cements are getting harder.[13] Strontium produce remineralization through *ion exchange adhesion* process in dentin, moreover, it can prevent the formation of nutrition for bacteria, and can decrease the colonization of bacteria live in cavity base.[9]

The second examination conducted during control period was clinical examination. This clinical examination involved three aspects of observation and evaluation, which were: no pain on percussion and pressure, no gingival inflammation or peridontitis, and no abnormal dental mobility. It appeared that in the first, second, and third visit controls the first group (glass ionomer as liner), and the second group (metapaste as liner) had no pain on percussion or pressure (100%). Based on the result it could be known that indirect pulp capping treatment using either glass ionomer cements or calcium hydroxide as liner, the dentin demineralization process could be inhibited. Thus, the process of pulp inflammation would not continue due to the lost of bacterial toxins.

Indirect pulp capping was conducted by taking the outer layer of dentin carries which contained microorganisms. By limited the demineralization process of the deepest dentin caused by bacterial toxins and by put restorative materials in the cavity, it can stimulate pulp to regenerate and to form reparative dentin.[18]

The result showed that based on the clinical observation in the first control, one week after the treatment, both the first group (glass ionomer cements) and the second group (metapaste) had no gingival inflamation or periodontitis. The same conditions were observed at the second and the third controls. The last aspect observed was the abnormal tooth mobility. The first group and the second group had no abnormal tooth mobility until the third recall visits. It showed that there was no inflammation either in hard or soft dental tissue. The periodontitis is marked by the abnormal

tooth mobility. If the factor causing pulpitis was eradicated, there would be small possibility that pulpits would continue to be periodontitis.

The dentin would get remineralization when the source of its infection was eradicated. In this case, glass ionomer cements as liner was used as the combination of antibacterial barrier and adhesive seal against the entrance of bacteria that can prevent the reparation and recovery of pulp.[19] Calcium hydroxide is believed as the best medicament for stimulating the formation of hard tissue and for recovering the vital pulp and periapical tissue.[20]

The last observation and evaluation for determining the progress of indirect pulp capping treatment was radiographic examination. There were three aspects examined in radiology description, e.g. no pathologic radiolucency in apical areas, no internal and external root resorption, and no the widening of periodontal ligament. The study showed that based on the radiographic examination at all recall visits, the first group had no either the pathologic radiolucency in apical areas, the internal and external root resorption, or the widening of periodontal ligament. Similar condition observed in the second group.

Ngo [6] showed that the releasing of aluminum and fluoride simultaneously from glass ionomer cements has played a role as anti bacteria. The success of calcium hydroxide as liner was related with the effect of calcium hydroxide and its effect on the tissue and bacteria. Estrela stated that calcium hydroxide passed some tests for years ago which proven that it has two enzyme characteristics, which are (1) enzyme that can restrain the formation of bacteria, through hydroxyl ion working in cytoplasmic membrane of bacteria and causing effects of anti bacteria; and (2) enzyme that can activate tissue, such as alkaline phosphates, that have effects of mineralization.[21]

The glass ionomer cements or metapaste could decrease or even eliminate the activity of cariogenic microorganism, so the pulp inflammation can be decreased or even be eliminated. Since the pulp inflammation or reversible pulpitis was decreased or eliminated, there was no sign of pulp inflammation in the radiographic, that could continue into the inflammation of periodontal tissue (periodontitis). The radiographic examination showed that there was no radiolucency in apical areas; no internal and external root resorption; and no widening periodontal ligament.

The success of indirect pulp capping treatment can be indicated by no clinical inflammation symptoms or pathologic symptoms.[22] However, the further examination must be conducted to examine the vitality of primary molar teeth after indirect pulp capping treatment. The study suggested that based on subjective, clinical and radiographic examination, indirect pulp capping treatment using glass ionomer cement materials (GC Fuji VII®) on primary teeth might be considered to be the treatment choice.

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