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Evaluation of clinical performance of self etching-self adhesive composite (Constic) ® compared with total etching composite system in primary teeth

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Abstract
Aim of the study is to evaluate the clinical performance of self-etching, self-adhesive composite (Constic ®) in comparison with conventional composite with total-etch bonding system in primary teeth.
Materials and methods: included comparing clinical performance of 2 different types of composite resins. Working time, restoration failure (recurrent caries – breakage – loss of restoration), post-treatment sensitivity, development of gingival abscess, recurrent caries visible on x-ray, radiographic abscess or periapical lesion were studied for both restorations. Clinical and radiographic observation was done every 3 months for 9 months for both restorations.
Results: Clinical results showed substantial differences between the two types of composite in favor of self- etching, self-adhesive composite (Constic®) against the conventional one when working time length was compared ($p< 0.0005$).
However, clinical results over the observation duration of both restorations showed that they have almost the same clinical performance with no statistically significant difference.

Keywords: 10/6/2020 self-etch, self-adhesive / total-etch / clinical performance / Constic ®

Introduction
Evolution of dental science has led into the interpretation of new types of composite materials used in restorations. Composite restoration materials at first started with a selfcuring resin matrix and then filling materials were added in order to improve composite's physical and mechanical properties and reduce shrinkage [1].
A few years later, light-cured composite was introduced into the dental clinic as a restoration material, which was a revolution in composite resins because it was easy to use [2].
Later on, companies manufacturing composite resin started to add a few adjustments to resin matrix, filling materials, coloring agents and primers in order to produce a composite that has the best clinical performance and most of the physical and mechanical properties required in addition to reducing dental tissue preparation while removing carious lesions, which was highly accepted amongst practitioners [3].

Dental Caries
Dental caries are bacterial, infectious diseases that causes topical dissolution of calcified dental tissue that goes through multiple stages of de-mineralization and re- mineralization [4].

Main causes of dental caries are
- Increased number of bacteria causing dental caries.
- Increased amounts and frequency of consuming sugar.
- Insufficient flow of saliva in mouth.
- Insufficient dental tissue exposure to fluoride. e- Low oral hygiene.
- Poverty [5].

Classification of dental caries
Position of the lesion – progression speed – lesion extension [6].

Methods of dental caries detection
- Conventional methods
- Visual examination and using a probe.
- Bitewing radiographs.
- Chemical detection materials.
- Modern methods: 1- CBCT.
- Lasers.
- Electrical conductance.
- Temporary separation of teeth adjacent to lesion [7].

2- Composite Resin:

Esthetic restoration materials were introduced early in this century with the discovery of Silicates which led to the invention of Acrylic Resin [8].

In 1959, the first filled resin (Bis-GMA) was invented, which marked the start of composite resin development because of its ability to merge with filling materials' particles [9].

These particles are what sets composite resin apart from acrylic resin. in the mid- 1970s, light curing appeared and thus we started using a single paste instead of two [10].

Light curing was done using UV and was later on replaced by blue light [11].

Composite Resin composition

Composite resin consists of hard, non-organic filling materials connected by a bonding agent to a soft, organic resin matrix [12].

Additive materials were also used in relatively small amounts in order to make composite resin usable clinically [13].

Composite Resin is composed of

Resin matrix – filling materials – bonding agents – primers – coloring agents [14].

Composite Resin specifications
- Good physical and mechanical properties.
- Radio-opacity.
- Color stability.
- Can be used in all teeth.
- Larger color variety.
- Viscosity.
- Elasticity factor.
- Longevity.
- Curing duration.
- Polymerization shrinkage [15, 17].

Composite Resin classification

Composite Resins have multiple classifications, which depends on:
- Filling materials' particles size.
- Amounts of filling materials. c- Resin matrix materials.
- Filling method.
- Curing method [18].

Dental Bonding

The main purpose of using an adhesive restoration is to achieve a perfect fit between the used material and the preparation cavity in order to prevent marginal micro-leakage, which causes tooth sensitivity and recurrent caries [19].

Bonding types
- Physical.
- Chemical.
- Mechanical [20].

Bonding Systems Classification

Bonding systems are classified based on its generation and etching system.
- Etching systems: Total etching – Self-etching.
- Generations: 1st Generation, 2nd Generation, 3rd Generation, 4th Generation, 5th Generation, 6th Generation, 7th Generation, 8th Generation [21].
- Self-Etching, Self-Adhesive Composite Resin (Constic ®):

Introduction

This composite
- Is classified as a Flow-able composite.
- Is considered to be using the 8th Generation of Bonding Agents.
- Is considered a self-etching system.
- Has its resin matrix is made of Bis-GMA.
- Uses (Barium Glass) as a filling material with a filling percentage of 65%, and
- 0.02 – 2.3 microns sized particles.
- Uses Light Curing.
- Used widely in dental clinics.
- Etching and bonding phases happen simultaneously.
- Helps reduce technical errors and save time.
- Has a high bonding strength [22].

Features
1. Self-etching and self-adhesive.
2. Faster, easier and more efficient treatment process.
3. Radiopacity and tooth-like fluorescence.
4. Prevents postoperative sensitivities.
5. Minimizes potential sources of mistakes [22].

Main areas of application for Constic
1. Small restorations of class I and III.
2. Primary tooth cavities.
3. Fissure sealings.
4. Base lining of class I and II restorations.
5. Blocking out and filling of undercuts [22].

Materials and Methods

Determining the samples size:
- Sample size was 26 children / 58 teeth.
- Children chosen must be within 6-10 years old.
- Children must be co-operative, with good to medium oral health.
- Each child must have 2 parallel teeth with class II carious lesion.
- Buccal and lingual surfaces of teeth must be intact (not affected by caries).
- Teeth must be vital (no pulpetomy or endodontic treatment).
- 23 primary teeth where selected to apply Self-etching, Self-adhesive Composite Resin on them.
- 23 primary teeth were selected to apply conventional Composite resin with Total-etching system in parallel with the 1st group.
- Only 2nd primary molars were used in this study because of the thickness of enamel layer compared to 1st primary molars.
- When a carious lesion was diagnosed in both 2nd primary molars (teeth must parallel to each other in the same arch), an x-ray was taken to confirm diagnosis (using a digital sensor) and determine the extent of the carious lesion in order to make sure it hadn't reached the pulp.

Local Anesthesia was administered to child in selected working area.

Then, teeth preparation was performed using high-speed handpiece with a cylindrical bur (0.6mm) and sufficient water flow. Suction was used when needed.

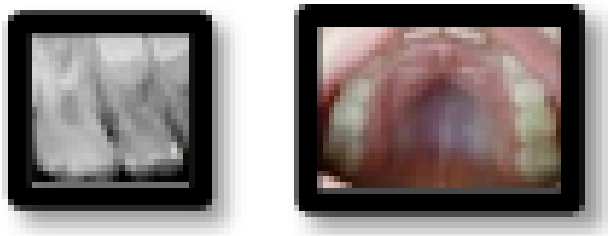
Depth of preparation in teeth was determined depending on the extent of carious lesion in accordance with the preparation standards of cavities with composite restoration.

After that, teeth were filled, one with self-etching, self-adhesive composite resin, and the other one with composite resin using Total- etching. - later, restorations were finished using Composite finishing burs.

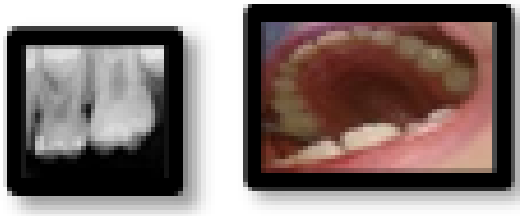
An X-ray was taken in the end to confirm perfect fit of filling material in preparation cavity using a digital sensor.

Clinical observation was done every 3 months, for 9 months.

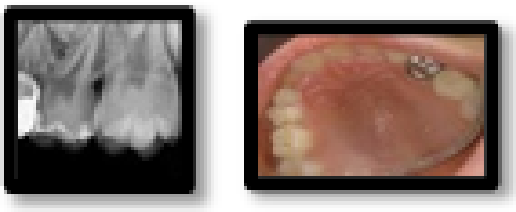
1st clinical observation



2nd clinical observation



- **3rd clinical observation**



Clinical observation evaluated the clinical performance and success / failure of both restorations. Criteria of restoration failure included recurrent caries, breaking of restoration and pulp necrosis. - Results comparison.

Results: 10/6/2020

Constic®		**Conventional Composite**				**Class II Restorations**
Percentage	Reps.	Percentage	Reps.			
75%	9	75%	9	Success	3 Months	
25%	3	25%	3	Failure		
100%	12	100%	12	Sum		
66.7%	8	75%	9	Success	6 months	Clinical success
33.3%	4	25%	3	Failure		
100%	12	100%	12	Sum		
50%	6	58.3%	7	Success	9 months	
50%	6	41.7%	5	Failure		
100%	12	100%	12	Sum		
83.3%	5	85.7%	6	Negative	9 months	Recurrent caries detected
16.7%	1	14.3%	1	Positive		
100%	6	100%	7	Sum		

Discussion

Clinical performance was done in order to detect restoration failure (breakage loss – attrition), recurrent caries, post-treatment pain, pulp necrosis, gingival abscess and radiographic failures(recurrent caries– periapical lesions).

Results of both restorations were relatively close; 9 restorations were clinically successful, whereas 3 restorations failed clinically during the 1st observation period. restorations done using Constic® were lost, whereas 1 restoration was broken and 2 were lost when conventional composite was used.

In the 2nd observation period, results were also close. It showed 1 breakage in Constic® restoration, whereas conventional composite was completely successful
in the rest of the teeth.

In the 3rd observation period, results of both restoration materials were kind of close. 2 restorations of each material were lost and showed recurrent caries.

All results showed no sign of (after-treatment pain – gingival abscess – pulp necrosis
periapical lesions) in all observation periods. This result was due to the perfect application of restoration materials within the internationally recommended standards and materials' biocompatibility.

Failures shown in 1st observation period were due to child's lack of cooperation in
the past 3 months after restoration because he intentionally removed the filling due to psychological problems confirmed by his parents.
Breakage of restoration done using Constic® composite was due to an unusual occlusal trauma that happened while child was chewing on a hard material contained in food, as child claimed.
In the 2nd observation period, breakage of restoration done using Constic® composite was due to biting on a foreign object, as patient claimed.
In the 3rd observation period, restoration done using conventional composite was lost due to extraction of tooth because of trauma.
Results of this study agree with results of research done by (Puppin-Rotani et al., 2006), in which they evaluated clinical performance of resin composite restorations used in 41 primary molars after 18 months of application on children between 4-9 years old.
Results of this study agree with results of research done by (Kurokawa *et al.*, 2007), in which they evaluated clinical performance of 5 types of self-etching dentin bonding systems and monitored them for a year. Their results showed no post-restoration hypersensitivity or pain.
Results of this study contradicts results of research done by (Swift A., 2010), in which he evaluated the clinical performance of bonding systems in permanent teeth. His results showed that single-stage bonding systems had less efficiency than etch and rinse systems, which contradicts results of this study. Differences between the two studies were statistically irrelevant and unsubstantial. They could be resulted from the researcher's use of permanent teeth instead of primary teeth. Forces applied on restorations in children are less than adults.

Conclusion

Self-etching, Self-adhesive composite resin provides clinical and radio-graphical performance close to what total-etch system provides. However, Self-etching, Self- adhesive composite resin is much easier to apply in children.

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