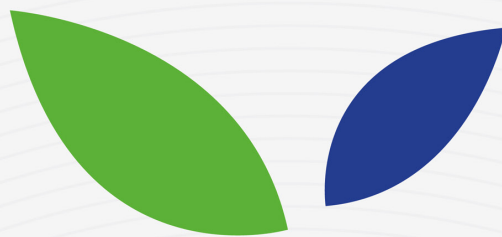


SPIDENT

Symposium

EsCem[®]

Self-Adhesive Resin Cement





"A Comprehensive Review of Last 20 Years of Self-Adhesive Resin Cement"

[Prof. Park] Hello, today I am here with Professor KyungMo Cho and Professor KyungHo Ko to discuss self-adhesive resin cement. As most dentists may already know, various restorative materials requiring bonding have been used in the field of dentistry for a long time.

In the past, most restorations were made of metal materials such as cast gold inlays, cast gold crowns, and porcelain-fused-to-metal crowns.

Recently, with the advancement of adhesive technology for both tooth structure and restorative materials,

complete ceramic crowns, laminate veneers, ceramic or composite resin inlays have become more common.

In recent years, reinforced fiber posts, implants, and zirconia have become popular in the field of dentistry. These materials are commonly used for various types of restorations, which require cementation.

As you may know, all of these restorations can be attached to the abutment only when cementation material, that is, dental cement (hereafter referred to as cement), is used. This can prevent restorations from falling off. By sealing the margins,

it can prevent hypersensitivity and pulp damages caused by the exposure to oral fluids.

Professor Ko, there have been various types of dental cements used in the field of dentistry for a long time, haven't there?

[Prof. Ko] Yes, that's right.

Traditionally, zinc phosphate cement (ZPC) and polycarboxylate cement were used in almost all cases, but nowadays they are rarely used. Glass ionomer (GI) cement has been developed, taking advantage of the adhesive properties of fluoride glass and dentin.

With the development of composite resin adhesion to dentin, resin-modified glass ionomer (RMGI) cement has been developed, which adds composite resin

components to GI and can be cured by light. RMGI cement is still widely used today due to its many advantages.

Of course, many resin-based cements with high adhesion and good physical properties have been developed and are being used in various restorations.

[Prof. Park] Yes, that's right. Cement materials are evolving to have better mechanical and physical properties. However, although resin-based cements offer superior adhesion and properties, there are still some challenges associated with their use.

[Prof. Cho] That's correct. While it is true that resin-based materials offer excellent adhesion, achieving adhesion to dental enamel and dentin is not as simple as it may seem. The basic

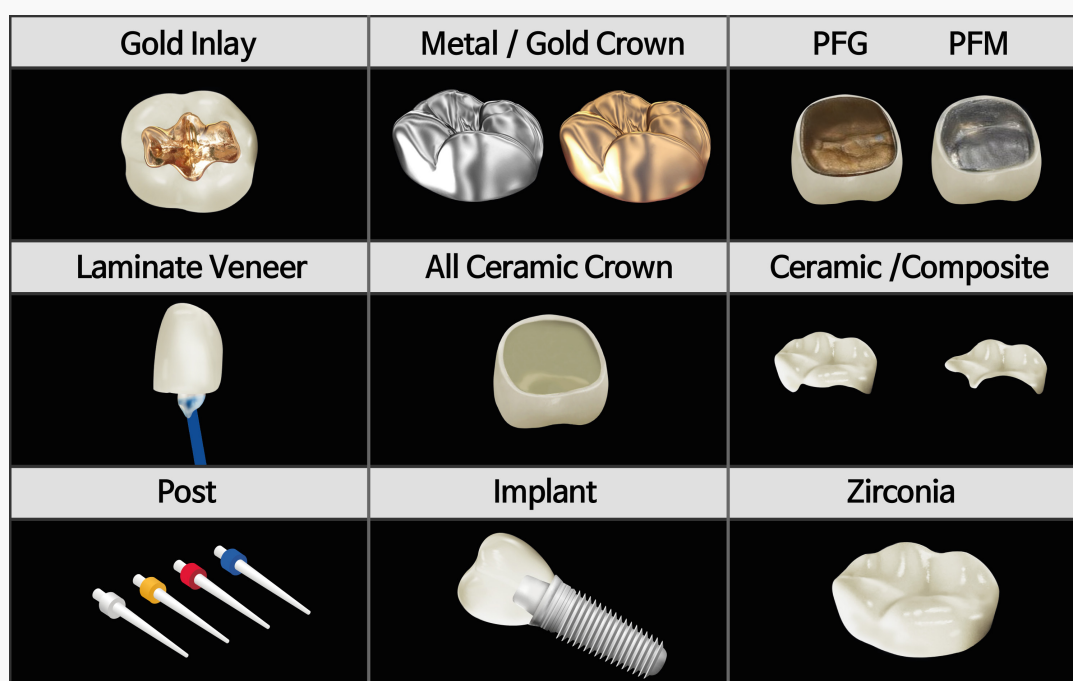


Figure 1. Types of dental prosthetics

SPIDENT SYMPOSIUM

Material	Ideal material	ZPC	Poly	GI	RMGI	Resin
Film thickness (μm)	Low	< 25	< 25	< 25	< 25	< 25
Working time (min)	Long	1.5~5	1.75~2.5	2~3.5	2~4	0.5~5
Setting time (min)	Short	5~14	6~9	6~9	2	1~15
Compressive strength (MPa)	High	62~101	67~91	122~162	40~141	179~255
Solubility	Very low	High	High	Low	Very low	Very low
Pulp irritation	Low	Moderate	Low	High	High	High
Microleakage	Very low	High	High to very high	Low to very high	Very low	Very low to low
Excess removal	Easy	Easy	Medium	Medium	Medium	Difficult
Retention	High	Moderate	Low to moderate	Moderate to high	Moderate to high	High
Mixing sensitivity	Low	Medium	Medium	Medium	Low	Low
Surface conditioning	Easy & simple	No need	No need	No need	No need	Multi step

Figure 2. Characteristics of luting cements

Property	Film thickness (μm)	Working time (min)	Setting time (min)	Compressive strength (MPa)	Solubility	Microleakage	Excess removal	Retention	Mixing sensitivity	Surface conditioning
Resin Cement	< 25μm	Long	1~15	Very high	Very low	Very low	Difficult	High	Low	Multi step
Self-Adhesive Resin Cement	< 25μm	Moderate	Moderate	Very high	Very low	Very low	Difficult	High	Low	Easy

Figure 3. Characteristics of resin cement

principles of adhesion to enamel and dentin are somewhat different, and as a result, various methods and materials for treating tooth surfaces have been developed and evolved.

While acid etching is a primary method for increasing adhesion to dentin, it is not quite correct for enamel to be etched as same as dentin. Ultimately, achieving good adhesion requires precise treatment of the tooth surface, and several meticulous steps must be taken to achieve optimal results.

Although self-etching adhesives that

don't need the acid-etching process have become more prevalent in recent years, and universal adhesives have been developed, achieving optimal adhesion with resin-based cements still requires great care. In addition to the surface of the tooth, various surface treatments of the restoration material itself are necessary to achieve adhesion with resin-based cements, depending on the type of restorative material used. Thus, achieving strong adhesion with resin-based cements can be challenging.

[Prof. Ko] Another challenge with resin-based cement is that it has good mechanical properties. If excess cement is not properly removed during the initial cementation process, it can be difficult to remove after the cementation is complete. In particular, when excess cement flows into subgingival areas of loose gingiva, such as in implant restorations, it can cause damage to the surrounding soft tissue. This can result in periodontal damage.

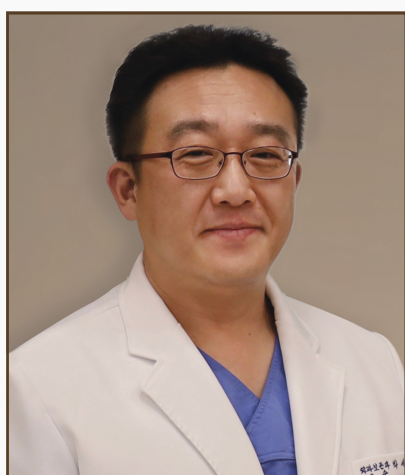
[Prof. Park] Although material is great, the complexity of processes required for adhesion and the difficulty in removing excess cement led to development of today's topic, self-adhesive resin cement.

[Prof. Cho] Yes, human nature tends to seek for things that are easy and simple, and a product that fits that tendency is the self-adhesive resin cement. The first product was released

in 2002, and it has been exactly 20 years since then. In the early days of its release, it was expected that it could be used as a universal product for almost all cases like zinc phosphate cement from the past, as it could achieve bonding and adhesion without any special treatment of the tooth surface while having similar properties to resin-based cements.

[Prof. Park] Is self-adhesive resin cement really a universal material that can be used in all cases?

[Prof. Cho] After actively using the initial product and conducting numerous experiments and reviews, I find it difficult to say that self-adhesive resin cement is superior to traditional resin-based cements in terms of adhesion. Adhesion to enamel is achieved by opening the collagen fiber network of enamel by acid etching



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and then allowing resin components to penetrate and harden, creating a hybrid layer that tightly adheres. However, as some of the components of self-adhesive resin cement must produce an acid-etching effect while others must penetrate, there may not be enough capacity or time to accomplish both tasks, so the adhesive strength cannot be better than that of traditional resin-based cements. Nonetheless, adhesion is achieved.

[Prof. Park] Then self-adhesive resin cement is not that good?

[Prof. Cho] Well, it would be difficult to say that it's not good just based on the adhesive strength alone. Initially, when the product was introduced, it was naturally researched and compared

with traditional zinc phosphate or glass ionomer cements in terms of properties and bonding strength, showing better results. Clinical studies published this year have also reported high success rates in bonding PFM for 106 months and maintaining ceramic inlays for 14 years, which are comparable to traditional resin cements. It seems to be obvious as self-adhesive resin cement is also a kind of resin-based cement. It has advantages such as better properties than ZPC, Poly, GI, RMGI, lower solubility and mixing sensitivity, and is easy to use without surface treatment. However, the bonding strength to dentin is low, and the bonding strength to enamel is similar to or slightly lower than traditional resin cements.

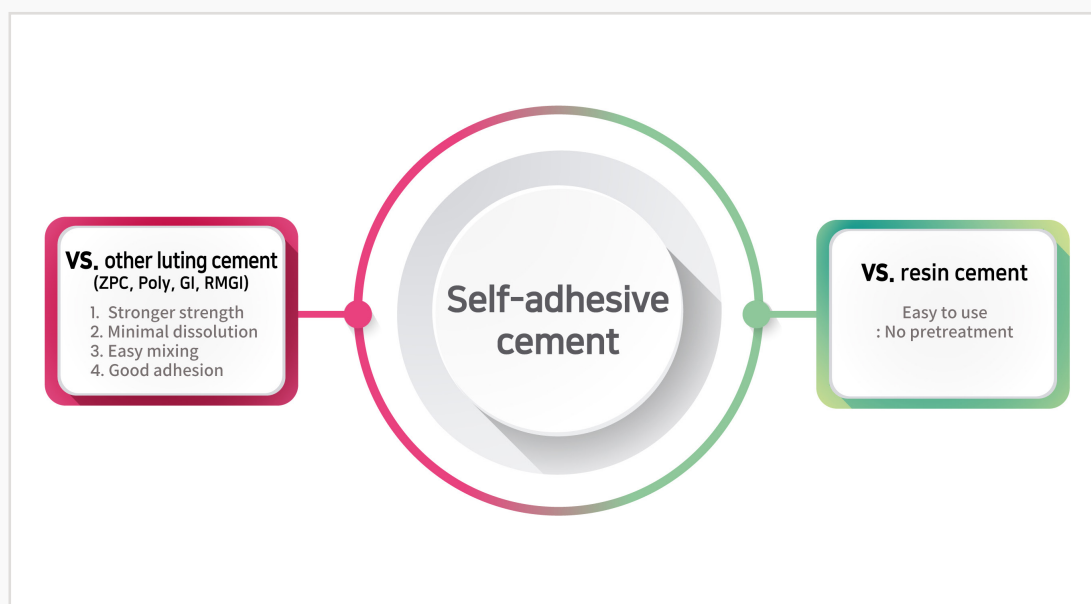


Figure 4. Characteristics of self-adhesive cement

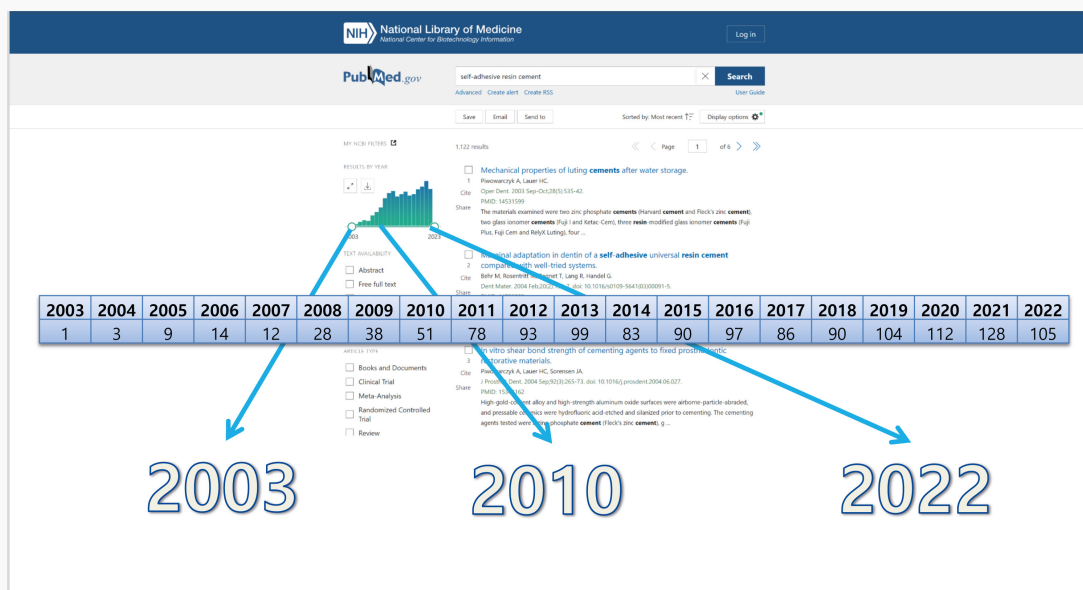


Figure 5. The statistics from Pubmed website

[Prof. Park] It seems that there are both advantages and limitations to self-adhesive resin cements. Then what do you think of the changes of the perception of the material over 20 years?

[Prof. Cho] According to statistics from Pubmed, a widely used medical paper search site, the first paper on self-adhesive resin cement was published in 2003, and the number of related papers has steadily increased every year. Since 2019, over 100 research results are reported annually, with over 1,100 papers published to date. If it were not a useful material, there would be no reason for such research to be conducted. Despite the limitations, it is considered to have sufficient value for practical use, particularly

due to its ease of use. Based on major manufacturers have developed such products, and the enamel bonding is gradually simplified, self-adhesive resin cement has sufficient utility value.

[Prof. Park] Professor Ko, as zirconia restorations are becoming increasingly popular not only in Korea but also worldwide, what factors should be considered when choosing a cement for these restorations?

[Prof. Ko] When we talk about zirconia restorations, it generally refers to CAD-CAM restorations. Although there have been significant advancements in CAD-CAM precision, the milling fabrication process inherently results in greater gap between the margin and inside, compared to traditional cast restorations. Additionally, zirconia

restorations have high strength and hardness, and when occlusal forces are applied, the stress is transferred to the underlying structure, requiring a strong bonding strength of cement for durability. However, as with all restorations, adhesive retention is ideal for maintenance, and as you may know, bonding to zirconia is a challenging process.

[Prof. Park] That's right, zirconia is a material that is difficult to bond to. Regarding what you mentioned, how about self-adhesive resin cement for zirconia restorations?

[Prof. Ko] As mentioned earlier, considering various factors related to zirconia, a resin-based cement with

good properties would be suitable for zirconia restorations, and within resin-based cements, a product that can induce adhesion to zirconia would be even better.

[Prof. Park] Then are you saying if using a self-adhesive resin cement would achieve adhesion to zirconia?

[Prof. Ko] Simply using a self-adhesive resin cement does not guarantee complete adhesion to zirconia. Various attempts have been made and being made to achieve adhesion to zirconia. However, the current knowledge is that zirconia restorations need to be tried-in and adjusted in the patient's mouth, and the interior of the restoration should be cleaned to remove any saliva, debris, or

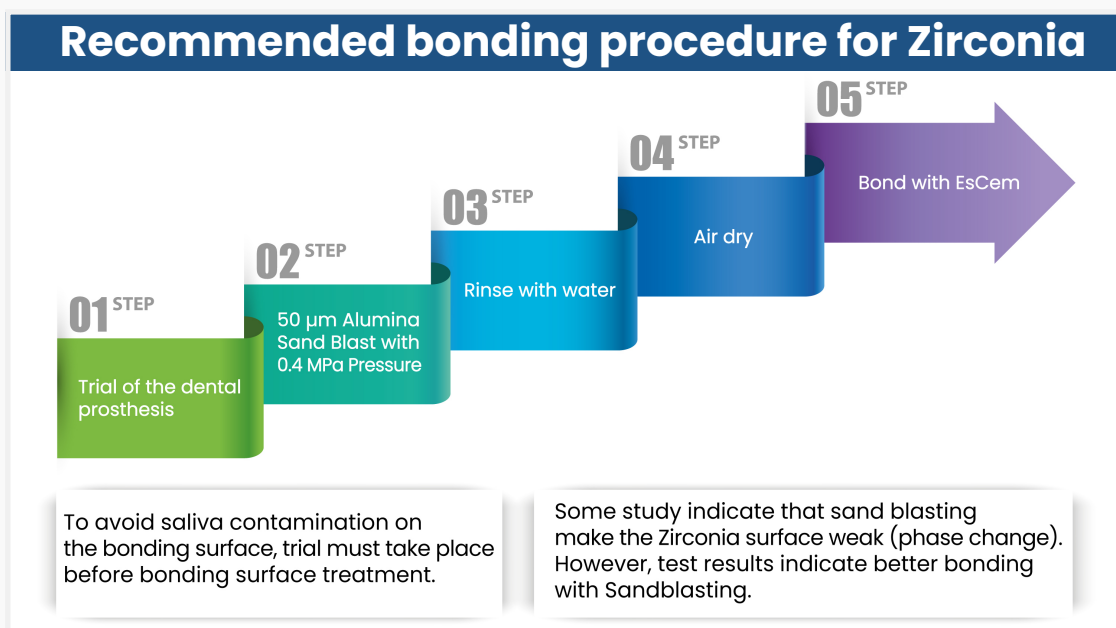


Figure 6. Recommended bonding procedure for Zirconia

contaminants that may interfere with adhesion. While there are products available that can clean the interior of the restoration, the most effective method is to perform sandblasting and NaOCl soaking.

There has been controversy regarding sandblasting, which has been introduced in several papers, as it can weaken the strength of zirconia. However, appropriate sandblasting (50 μ m particle size, 0.25 MPa, 10mm distance, 10 seconds of spraying (Yang et al.)) has the advantage of creating a mechanical form that increases adhesion. For objects that have been sandblasted after production, it is recommended to soak them in a 10-15% NaOCl solution for 1 minute, as described in papers such as Yoshida et al. from 2019. After cleaning the inside of the zirconia prosthesis, a surface treatment agent containing MDP, including phosphate group that induces adhesion of resin-based materials, can be applied. Although there is still some controversy regarding this, it seems that MDP primer is helpful, as evidenced by the fact that MDP primers are sold as a set with many resin cements containing MDP in the market.

Recent research has shown that cement

with phosphate groups can improve adhesion. Therefore, I believe that using resin cements containing MDP and primer together can lead to better adhesion. Some self-adhesive resin cements contain MDP, a particularly emphasized in phosphate group, and using such products can induce better adhesion. Thus, self-adhesive resin cements that are resin cement and contain an adhesion-promoting component are considered to have sufficient value for use. However, the adhesive strength to zirconia restorations is still lower compared to ceramic restorations or to composite resins.

[Prof. Park] Professor Cho, you mentioned that self-adhesive resin cement has significant utility value. Are there any other aspects in which the utility of self-adhesive resin cement is even greater?

[Prof. Cho] Yes, I think the utility of self-adhesive resin cement is particularly high in situations where surface treatment for adhesion is difficult. For example, when bonding fiber-reinforced composite posts, the root canal is a very challenging environment for proper surface treatment. It is difficult to ensure

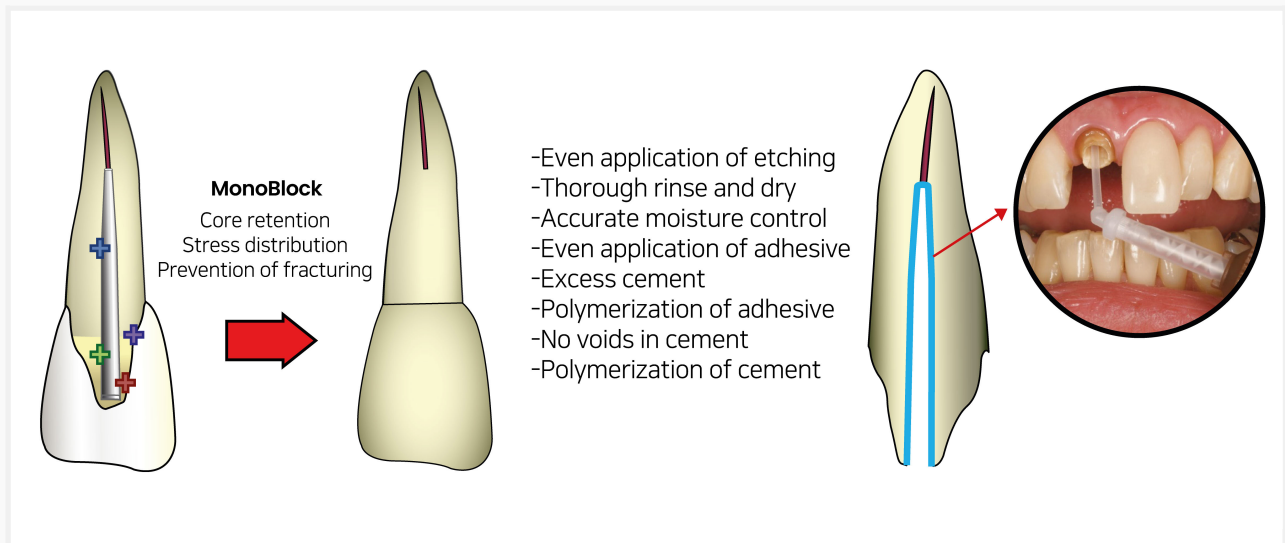


Figure 7. It is worth considering the use of self-adhesive resin cement as a solution for the challenging aspect of achieving perfect adhesion in the space where the post is inserted, in order to create a single unit called a Monoblock, composed of the crown, core, and root.

that the etchant is uniformly applied and thoroughly rinsed in the narrow canal, or to control moisture properly, to apply dentin adhesive thoroughly without the excess material stuck together, and make sure curing light has reached in the deep canal. These factors can make it challenging to achieve a reliable bonding. However, using a self-adhesive resin cement without the need for additional surface treatment could potentially improve the bonding of fiber-reinforced composite posts. It is essential to use a thin and long tip to fill the cement well inside the canal for optimal bonding.

[Prof. Park] Sure, both professors, do you have any additional thoughts on self-adhesive resin cement that you would like to share?

[Prof. Ko] Earlier, I mentioned that removing excess resin cement can be difficult and requires careful removal. As a clinical tip, I suggest applying the self-adhesive resin cement to the prosthesis, pressing it, then polymerizing from the buccal side first and removing any excess. Most resin cements are dual-cure and can be tack-cured to facilitate initial removal. The reason why resin cement is often difficult to remove is that some materials are distributed from adjacent area to buccal or lingual side, making them harder to access later. Remove the buccal side first, breaking the connection to adjacent area. Then polymerize the lingual side, remove the excess material, and clean up the adjacent area with a dental floss. When the polymerization process is complete, there will be little

excess resin cement material. Properly utilizing tack-cure will make the removal process easier without any difficulty once everything is fully set.

[Prof. Cho] I have something to add regarding the dual-curing feature of resin cement, as Professor Ko mentioned. As most resin cements are dual-cured, they can be cured by both light and self-curing mechanisms. Nevertheless, when resin cements are light cured, it shows higher degree of polymerization, resulting in more suitable properties. However, we must consider whether the restorative materials we use can transmit light effectively. Not only metal restoration, but also tooth-colored restoration, when the material gets thick, it may not allow light to pass through effectively. Additionally, monomers in the acidic category, which are used in self-adhesive resin cements, can interfere with the redox reaction that is the basis of self-curing. Therefore, good self-curing ability is essential for self-adhesive resin cement to create long-lasting restorations.

[Prof. Park] You mentioned various things about self-adhesive resin cements. Do Korean companies also produce self-adhesive resin cement products?

[Prof. Ko] Yes, in Korea, SPIDENT has developed and sells a product called EsCem. It possesses the characteristics of a self-adhesive resin cement, bonding to tooth surfaces and restorations without any special treatment and dual-curing capability. Thanks to dual-curing capability, excess material is easy to remove by 1-second tack cure. In addition, EsCem contains 10-MDP, making it useful for bonding to zirconia restorations. It also shows very high bonding strength to not only zirconia but also glass ceramics after silane application.

[Prof. Cho] EsCem comes with various types of mixing tips, especially including an endo tip which is great for post bonding. I have been using EsCem since 2021, which I received from SPIDENT. After applying it to numerous restorative cases, I have not felt much of a difference compared to the previous products I used. Its handling is excellent, and the prognosis for patients is also good. EsCem accelerates radical reactions through the use of multi-catalysts, so it has sufficient self-polymerization ability. As I mentioned earlier, this eliminates concerns about incomplete polymerization in various types of restorations, making it another

advantage. Its color stability is also comparable to other well-known foreign products on the market. In fact, only major dental companies produce such self-adhesive resin cement, so the fact that SPIDENT produces EsCem shows that SPIDENT has excellent manufacturing technology.

[Prof. Park] Oh, I see. I hope EsCem will continue to be active worldwide in the future. Thank you both for talking about self-adhesive resin cements for a long time. I think that self-adhesive resin cements are easy to use and have many advantages compared to past cements, but they cannot replace

all cements due to their specific characteristics. However, I think that they can be used in many clinical aspects if their advantages are utilized. However, if a high degree of adhesion is required, there are still some limitations, and product improvements are needed. Looking at EsCem, we can expect a good product to be supplied to us more affordably, and we can have quick and diverse opinions exchanged, so I hope that self-adhesive resin cements will continue to develop and become more convenient and stable for us to use. Thank you for today's discussion.



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EsCem®



EsCem® is dual-cured self-adhesive resin cement. It contains MDP, an adhesive monomer, to improve chemical interaction and durability with the tissue. EsCem® shows strong adhesion to tissues as well as various indirect restorations, such as zirconia and all-ceramic. It does not require pre-treatment. It is easy to handle and has radiopacity.

Indication

- ① All-ceramic, Composite, Zirconia Crowns & bridges
- ② Metal inlays, Crowns & bridges
- ③ Final cementation of posts and screws

-Dual-cure system

>> With dual-cure system of EsCem, you can remove excess cement through 1-second tack cure, reducing chair time.

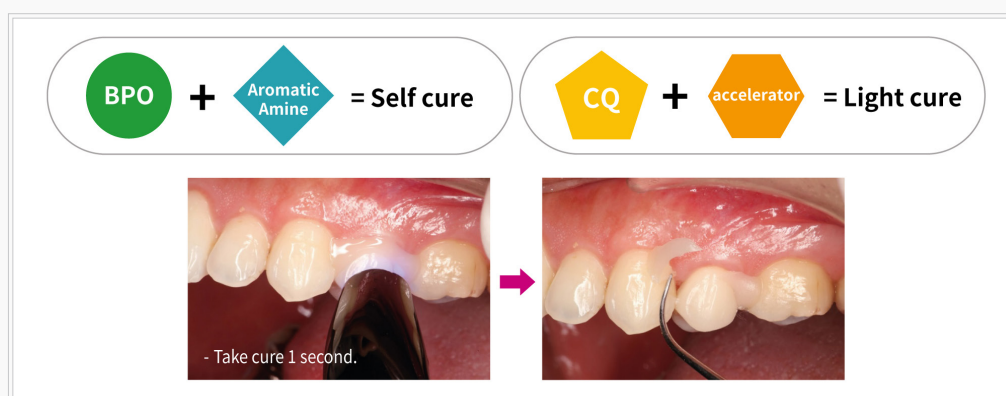


Figure 8. Dual-cure system

-Esthetics

>> Excellent color stability

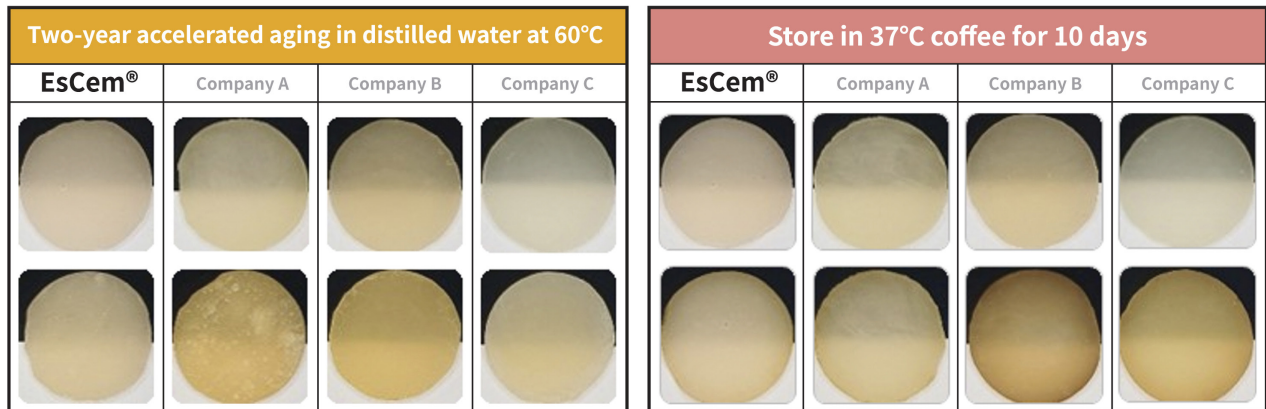


Figure 9. Excellent color stability

-Powerful adhesive strength

>> High bond strength to all indirect restoration without treatment

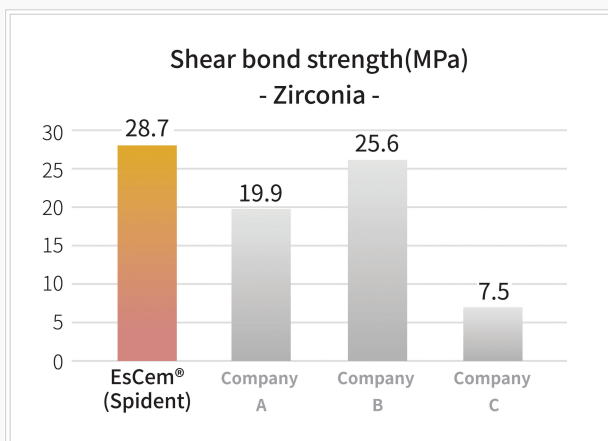


Figure 10. Shear bond strength_Zirconia

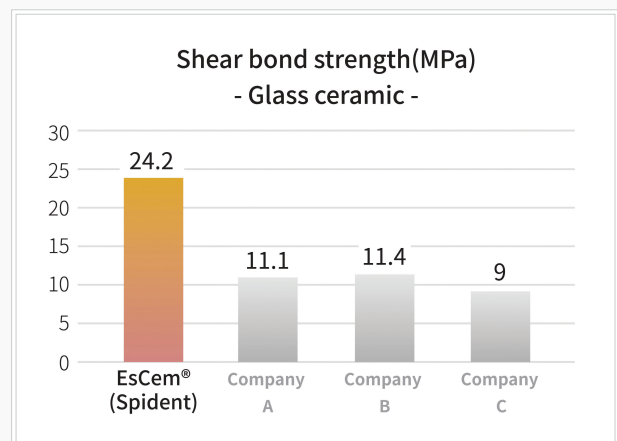


Figure 11. Shear bond strength_Glass ceramic

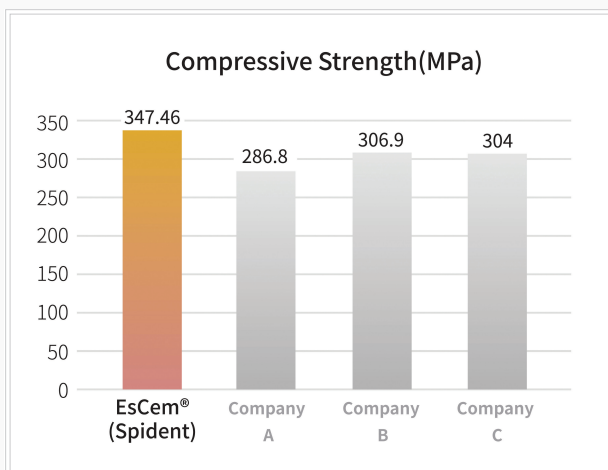


Figure 12. Compressive strength

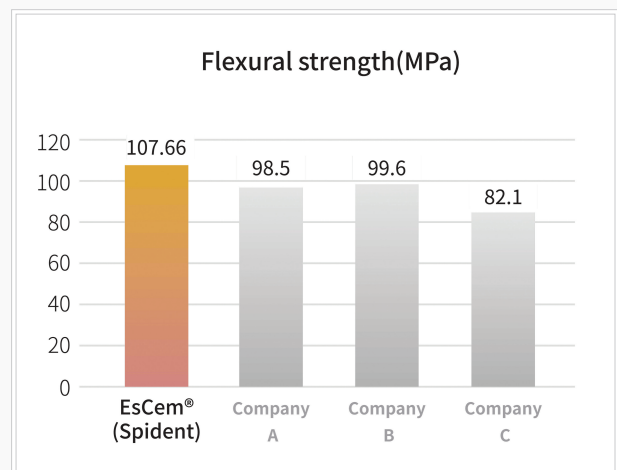


Figure 13. Flexural strength

-Easy removal of excess

>> Excellently easy to remove excess material with tack curing

*Self Cure : Wait 1' to 1' 30"



1. Tack cure for 1 second.



2. Remove excess cement.



3. End Result.

-Clinical case "Resin Core Cementaion"



1. Making post space with drill.



2. Thoroughly dry post space using paper point.



3. Apply adhesive and light cure to the outside of root canal.



4. Prepare EsCem assembled with Endo tip.



5. Apply EsCem directly into the post space. Endo tip can fill post space easily without bubble.



6. Insert post immediate after apply EsCem and remove excess of cement.



7. Light cure for 20 second by pressing post.



8. Build-up core using light-cure or dual-cure composite material.



9. Prepare tooth for impression.



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