A Health Technology Assessment Report on The Usage of Direct Composite Veneer Restorations Versus Porcelain Veneers in Restoring Defective Anterior Teeth

by

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ABBREVIATIONS

HTA → Health Technology Assessment

AAJ → Areej Abdel Jabbar

RFS → Raphael de Souza

PICO → Population/Participants – Intervention – Comparator/Control - Outcome

VRs → Veneer restorations

RevMan → Review Manager Software

ICER → Incremental Cost Effectiveness Ratio

PRISMA → Preferred Reporting Items for Systematic reviews and Meta-Analyses

RCT → Randomized Controlled Trail

CI → Confidence Interval

Sr → Survival of original restoration

Sf → Functional Survival of restoration

So → Overall Survival of restoration

RR → Risk Ratio

µm → Micrometre

ACDQ → Association des chirurgiens dentistes du Québec.

CAD → Canadian Dollars
GLOSSARY

- **Veneer restorations - Laminate veneers - Veneers**: Terms used interchangeably in the literature and this report (having the same meaning).
- **Direct veneer restorations**: Veneer Restorations done in the same visit, directly in the patient’s mouth.
- **Indirect veneer restorations**: Veneer restorations fabricated outside the oral cavity, the procedure can take multiple visits.
- **Bruxism**: Abnormal activity of the jaw, typically with excessive clenching.
- **Attrition**: Loss of tooth structure/wear of teeth from tooth to tooth contact (grinding).
- **Abrasions**: Loss of teeth structure from excessive external forces (e.g. brushing wrongly).
- **Erosion**: Loss of teeth structure mainly from acids.
- **Congenital**: Present since birth.
- **Diastema**: Spacing in between two teeth, most commonly in the midline.
- **Porcelain**: Ceramic material formed of infusible elements joined by lower-fusing materials.
- **Composite**: Tooth colored type of filling used to restore decayed or aesthetically defective teeth.
- **Luting agent**: A material/cement used to fuse and attach two structures together.
- **Veneer complex**: The adhesion complex composing of; Porcelain veneer <> luting cement <> Enamel/dentine surface (tooth surface).
• **Rubber dam**: A sheet that acts like a shield helps maintaining the best moisture control, and isolate the teeth being operated on from the rest of the oral cavity.

• **Cohort study**: Mostly prospective, linking the risk factors to the outcomes in order to examine the causes of the disease of participants followed over a period of time.

• **Systematic review**: A method of summarizing all the evidence and studies in the literature chosen depending on some specific criteria in order to solve a research question.

• **Absolute failure**: The complete failure (e.g. fracture) of restoration that will need full replacement

• **Relative failure**: A failure of the restoration that would only need repair not replacement

• **Confounders**: It is a factor that can affect the outcome and is interlinked with the intervention.
Conventional Porcelain Veneers Versus Direct Composite Resin Veneers in Restoring Anterior Permanent Teeth

I. INTRODUCTION:

I.1 GENERAL OVERVIEW

Aesthetic dentistry has become one of the most popular and important fields in dentistry. Restoring aesthetically compromised dental problems have arisen as a significant topic in the last couple of decades, majorly due to the increase in patient’s awareness along with the accessibility to reinforced material and modalities improving outcomes of treatment\(^{(1, 2)}\). The repair of loss in color, shape or any structural problem of teeth helps in the improvement of patient’s psychosocial state as well. Although full coverage crowns were conventionally used to re-establish the aesthetic loss in anterior teeth, the need for less invasive methods resulted in the introduction of veneers\(^{(2, 3)}\).

Veneers can be categorized into; full veneers needed for extensive abnormalities or partial veneers that repair small deformities. The grouping mentioned relies on the preparation approach\(^{(3)}\). However, depending on the method of construction, veneers were grouped into being direct and indirect\(^{(2, 3)}\).
• **Indications for the placement of veneer restorations**\(^{(2, 4)}\):

1- Restorations of teeth discolorations which can’t be reversed by bleaching.

   ![Photo showing tetracycline discoloration on teeth, taken from: https://www.oralanswers.com](https://www.oralanswers.com)

2- Minimally rotated, crowded or misaligned teeth.

   ![Photo showing a mild crowded and rotated tooth, taken from: http://www.sfjdentistry.com](http://www.sfjdentistry.com)

3- Congenital or obtained abnormalities in the shape or size of teeth. E.g. Peg laterals.

   ![Photo showing a peg lateral, taken from: https://www.juliegillisdds.com](https://www.juliegillisdds.com)
4- Closure of diastema or mild spacings.

Photo showing a diastema, taken from: http://www.shahdentalclinic.com

5- Attrition, abrasions, erosions or non-extensive fractures.

Photo showing mild attrition, taken from: http://cosmeticdentistryofsj.com/

6- Enamel malformations. E.g. Fluorosis.

Photo showing enamel fluorosis taken from: http://gangwisch.com

• **Contradictions for the placement of veneer restorations**\(^{3,4,6}\):

1- The presence of extensive restorations or fractures on teeth.
2- Severe parafunctional activity (e.g. bruxism).
3- Severely misaligned or crowded teeth.
4- Soft tissue lesions.
5- Deep vertical overbite.
6- Mixed dentition or young permanent teeth.
7- Active dental disease (periodontally or caries).

- Generally speaking, failures of veneers mostly happened due to; wear, fractures or discolorations\(^{(3)}\).

### I.2 OVERVIEW OF THE TECHNOLOGIES DISCUSSED IN THIS HTA REPORT

#### I.2.1 DIRECT COMPOSITE RESIN VENEER RESTORATIONS (INTERVENTION)

- **Brief history**

  In the 1940’s the invention of composite resin was done in the intention of replacing acrylic resin\(^{(7)}\). The concept of acid etching known for aiding to the restoration-tooth bond was introduced back in the 1950s, subsequently leading to the initiation of composite resin as an aesthetic restorative material by the early 1960s\(^{(3, 7)}\). Later in the 1960s, self-cured composite restorations were officially traded and used by clinicians\(^{(8)}\). Light cured composite resins were invented in the 1970s, enforcing superior properties and overcoming the limitations of self/chemical cured composite resins (e.g. short working time). Therefore, light-cured composites have been approved to be used in veneer restorations\(^{(3)}\).
• **Composition of composite resin:**

  Composite resins consist of; [a] resin matrix (polymer). [b] Initiator that starts the polymerization process. [c] Stabilizer to prevent unformed polymerization, [d] inorganic filler (e.g. silica, quartz) that improves the color and other physical properties of the restoration (e.g. strength and wear). [e] coupling agent (e.g. organofunctional saline), aiding to the resin matrix-filler bond. (3, 6, 8)

  ➢ Composite resin with higher filler contents potentially showed improved performance(9).

• **Composite resin classification depending on filler particles:**

  The categories of different sizes of fillers in composite resins has evolved giving different physical and mechanical properties. **Macrofill** composite resins with a size of particles that ranges approximately from 10 to 50 µm, have shown to have superior physical features such as being strong(6, 10, 11). However, they are not usually used as an aesthetic restoration because their surfaces are incapable of being polished or smoothened properly(6, 11). **Microfill** composite resins were developed to overcome the limitations of low polishable macrofilled composites. Their particle size is around 0.04-0.05 µm. Since microfilled composites have less filler loading, they are expected to be relatively weak. Moreover, they have been associated with increased water resorption and thermal expansion(6, 10, 11). Afterwards, **hybrid** composites came to combine particles of different sizes (0.04-5 µm) which as well tackled the advantageous properties of both the macrofilled and microfilled composites. Newer forms of hybrid composites contain a mix of
particle sizes that are smaller which along with a proper distribution will allow for a higher filler content. Resulting in; higher polishing ability and lower polymerization shrinkage. Therefore, being used in restoring teeth in aesthetic zone\(^5, 9\).

- **Preparation of teeth for direct composite veneers:**

  It is always favorable; to be as conservative as possible while preparing, try to maintain non-sharp angles all over the preparation\(^{11, 12}\), and to follow/keep the convexity of the tooth. The extension of teeth preparation depends mainly on the extent of the problem (i.e. caries, discoloration, fracture).

  For the **cervical part**, it’s preferable to keep it supragingival. Some studies reported cases of anterior teeth being prepared with a range of 0.1 to 0.3 mm in depth cervically, approximately 0.5 mm supragingival and with a chamfer finish line\(^{12, 13}\). Theoretically about 0.5 – 1 mm can be removed from the **labial surface** depending on the case. Regarding the **incisal ridge**, an incisel or no incisel reduction can be preformed. Some studies suggested that an incisel overlap can be done to give an adequate seating and color for restoration\(^4, 12\).

  ➢ The prepared surface is etched with 35% phosphoric acid\(^{13}\), rinsed and then a bonding agent is applied afterwards to ensure the full adhesion of the composite resin veneer restoration.
• **Characteristics of direct composite veneers:**

**Table 1. Advantages & Disadvantages of Composite Resin Veneer Restorations**\(^{(2-4, 6, 9, 14)}\):

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Conservative (minimal tooth structure removal)</td>
<td>- Inclined to be discolored/stained</td>
</tr>
<tr>
<td>- Defects can be repaired easily</td>
<td>- Highly dependent on the clinician’s technique.</td>
</tr>
<tr>
<td>- Little cost</td>
<td>- Hard to restore the optimum shape and occlusion of teeth</td>
</tr>
<tr>
<td>- Easily finished &amp; polished inside the oral cavity</td>
<td>- Prone to wear, cracks or fractures</td>
</tr>
<tr>
<td>- Good marginal adaptation</td>
<td>- Does not give the natural translucency of teeth</td>
</tr>
</tbody>
</table>

Composite resin restorations have been widely considered the primary choice of treatment for carious lesions\(^{(9)}\). This is mainly as a result of their aesthetic features, along with the other advantages mentioned earlier. The durability of these restorations is debatable, majorly because of having a high possibility for staining and retention loss, thus, potentially making it less aesthetic\(^{(2-4, 9, 14)}\). However, there is no enough evidence to confirm the span life of composite restorations. One review showed a minimal annual failure rate of 0 to 4% in a follow up of three years or more\(^{(9)}\).
1.2.2 INDIRECT CONVENTIONAL FELDSPATHIC PORCELAIN VENEER RESTORATIONS (COMPARATOR)

- **Brief history**

Advancements in the characteristics of dental porcelain were risen in the early 1960’s. Back then, the most prominent development has been done by the “Dentsply” company. Where this company included smaller sizes of particles and opacifying factors (e.g. SiO₂, aluminum or zirconium silicates, zirconium) into the conventional dental porcelain. Therefore, leveraging the esthe
tical properties of this material to closely mimic the appearance of natural teeth\(^{15, 16}\). The emergence of the silane coupling agent in the 1970s enhanced the spurt of porcelain laminate veneers\(^3\). Porcelain laminate veneers have gained higher recognition in the beginning of the 1980s, specifically in being the material of choice for restoring and fixing defective and aesthetically compromised anterior teeth\(^3, 4, 17\). The improvement in etching and bonding agents, along with them being considered a conservative modality of intervention, is the reason behind the increased popularity of porcelain laminate veneer restorations\(^3, 17\).

- **Composition of feldspathic dental porcelain:**

  \[\text{Feldspar glass matrix}^* + \text{Fluorapatite crystals}^{**} = \text{Feldspathic Porcelain Veneers}\]

  *Figure 1. Composition of Feldspathic Dental Porcelain.  
  * Feldspars: 60-64% silicon oxide, 20-23% aluminium oxide\(^d\). ** Fluorapatite crystals: Opacifying factor\(^d, s\).
Ceramic veneers are mostly made of conventional low fusing feldspathic porcelain\(^{(14)}\). The conventional Feldspathic porcelain is composed of feldspars, which are known to be originally found as aluminum silicates that contain different loads of potassium and sodium\(^{(3-5)}\). When these aluminum silicates are adjusted, they can make up the glass component used in restorations of teeth\(^{(4)}\). They contain dyes and crystals that have a role in controlling the appearance (i.e. shade, opacity and translucency) of the porcelain veneer\(^{(4, 5)}\).

**Preparation of teeth for porcelain laminate veneers**

To achieve an optimum tooth-porcelain veneer bond, a preparation limited in the enamel with well defined edges is usually favoured\(^{(4, 6, 18, 19)}\). The *cervical third* of anterior teeth is preferably prepared in a way where it aligns with the gingival margin or a bit subgingivally protecting the periodontal health, with a depth of approximately 0.3 mm into the enamel\(^{(4, 17, 20)}\). The preparation of the teeth *proximally* will be extended following the papilla, preferably in a right angle, mid-way through the contacts (embrasures) interproximally\(^{(4, 17)}\). For the *middle third* (labial) preparation, at least a 0.5 to 0.8 mm (average 0.7 mm) reduction should be made in order to ensure fitting the layers needed to achieve an optimum porcelain veneer, with natural tooth appearance and lower the chance of fracture\(^{(4, 17, 19, 20)}\). Regarding the *incisal third*, which is a part of high importance when considering the success of these veneer restoration, four possible preparations are looked at;
1) **Window (intra-enamel) preparation - Figure (a):** Where the preparation is confined to the labial surface of the tooth without extending it to the incisal edge, making it the most conservative design\(^4, 14, 18-20\).

2) **Feather preparation - Figure (b):** The preparation is extended to the full length of the incisal edge without compromising the ridge itself (no incisal reduction)\(^4, 14, 20\).

3) **Bevel preparation - Figure (c):** The preparation involves some minimal reduction of the incisal edge with a 0.5-1 mm bevel buccally towards the incisal edge, where the palatal/lingual side is maintained\(^17, 18\).

4) **Overlapped (palatal/lingual wrap) preparation - Figure (d):** The incisal third is prepared in a way where a full reduction of the incisal edge is performed, involving the palatal aspect on a depth of 1.5 – 2 mm. This depth compensates for the thickness of porcelain needed in that area in order to resist fracture, as well as, ensure a natural color of the veneer restoration\(^4, 14, 17-20\).

* Figures a, b, c & d were taken from: intranet.tdmu.edu.ua
There has been a high confusion and controversy in the literature regarding the favoured preparation for a porcelain veneer restoration. Some studies preferred the overlapped incisal preparation for having superior properties such as; (a) making the veneer more resistant to fractures since the occlusal forces and stresses on the restorations are dispersed on a wider area\(^{14, 17-19}\), (b) helping ensure the finest aesthetical appearance desired for the porcelain veneer\(^{4, 14, 19}\), (c) better periodontal health\(^{19}\). However, other studies (majorly in vitro) declared the opposite, stating that the most conservative preparation - the window incisal preparation - is preferred\(^{14}\). Despite all that, several studies with long term follow ups, showed that there were no significant differences in the design chosen for the preparation. Moreover, it does not affect the survival rate of the porcelain veneer restoration\(^{14, 20}\).

- **Impression of prepared teeth**

  An accurate impression is needed for the prepared teeth. The most commonly impression material of choice is the *polyvinylsiloxane- regular body* - impression material\(^{6, 21-23}\).

- **Surface treatment of the veneer system (tooth - luting cement- porcelain veneer)**

  When considering the success of the porcelain veneer restoration, a strong and well-established bond between the three elements in the *veneer system (tooth surface-luting agent-porcelain veneer)* is essential\(^{4}\).
**Tooth Surface**

**Enamel surface:**

Etching prepared enamel surface with 32-37% phosphoric acid for an average of 30 seconds\(^4, 5, 21-23\).

Etched surface is rinsed with an air-water/water spray for 30 seconds \(^5, 21, 22\).

Rinsed surface is air dried\(^21, 22\).

*Figure 2. Enamel Surface Treatment*

**Dentine Surface**

In some cases, preparations can be extended to the dentine. Dentine exposed is advised to be handled as soon as it is prepared, where it can be protected with a primer (dentine-bonding agent/adhesive) before taking the final impression\(^4, 6, 14, 23\). The reason behind this is to ensure a contamination free environment, as well as, lowering the chances for possible sensitivity\(^14\).

To guarantee the optimal results, it is necessary to carry out perfect moisture control while treating the tooth surface. A rubber dam can be placed in order to help achieve that. However, even with optimum moisture control, dentine is harder to deal with, this is due to bonding agents being very technique sensitive\(^4\). Therefore, a preparation constricted within the enamel is favoured whenever applicable.
(2) Porcelain Veneer Restoration Surface:

**Etching**
- **Lab:** Etching the inner surface of the porcelain veneer with 5-9% hydrofluoric acid for 2 to 2.5 min \((3-5, 13, 22)\).
- **Chairside (during cementation):** The inner porcelain veneer surface is conditioned using an enamel acidic etchant (e.g., 37% phosphoric acid) for 20-30 seconds \((5, 21, 22)\).

**Rinsing & Drying**
- **Lab:** The etched inner surface of the porcelain veneer is rinsed with water for one minute, then dried. Afterwards, Silane (coupling) agent is placed \((3-5, 13, 22)\).
- **Chairside (during cementation):** The etched inner porcelain veneer surface is rinsed with water for around 20-30 seconds and dried \((5, 21, 22)\).

**Figure 3.** Porcelain Veneer Inner Surface Treatment in Lab and Chairside.

The surface conditioning of porcelain veneers before cementation is considered a fundamental step for achieving superior results in bonding the veneer system components altogether \((4, 6)\). The usage of a hydrofluoric acid, along with applying a silane coupling agent afterwards on the conditioned porcelain veneer surface, has shown to improve the resin-porcelain link \((3, 4, 6, 14)\). Thus, lowering the possible failure of the veneer restoration \((4, 6)\). Contamination with water, saliva, the latex gloves, try-in paste and die stone used for casting are some of the elements that have shown to compromise the porcelain-resin bond \((14)\).
(3)Luting cement/agent:

Luting cements make up the middle component in the veneer complex, it is placed in between the prepared tooth and the porcelain veneer inner surface. These adhesive cements; (a) ensure the proper bonding of the tooth structure to the porcelain surface. Thus, making it invulnerable. (b) positively contribute to the veneer’s aesthetical appearance\textsuperscript{(4, 24)}

<table>
<thead>
<tr>
<th>Table 2. Characteristics considered in an ideal luting agent\textsuperscript{(4, 24)}:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Biocompatible; no pulp irritation, lowest chance of allergies.</td>
</tr>
<tr>
<td>• Resistant to microleakage and able to bond the veneer and tooth firmly.</td>
</tr>
<tr>
<td>• Does not undergo color changes.</td>
</tr>
<tr>
<td>• Enough viscosity to ensure the proper thickness.</td>
</tr>
<tr>
<td>• Good strength.</td>
</tr>
<tr>
<td>• Low solubility.</td>
</tr>
<tr>
<td>• Resistant to fracture, compression or displacement.</td>
</tr>
</tbody>
</table>

For the cementation of porcelain veneer restorations, light cured resin composite luting cement is favoured\textsuperscript{(4, 14)}. The first reason behind that is the possible longer working time span offered by the light cured composite. Therefore, being easier to handle and remove the excess luting cements before curing, and subsequently lowering the efforts needed in the finishing process\textsuperscript{(4, 14, 24)}. The second reason for this preference is that light cured composite is relatively more color stable. However, dual-cured composite luting cement is indicated if the porcelain was of a thickness that hinders the full polymerization. Therefore, dual cured composite can help achieve the desired hardness\textsuperscript{(4, 14)}.  

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• **Cementation (bonding the porcelain-luting cement- tooth complex)**

It is advisable to make the composite thickness as minimal as possible in the complex in order to maximize the proximity of the porcelain veneer and tooth surface. While luting the porcelain to the tooth surface, the edges might show some excess cement. This excess needs to be removed during finishing the veneer margin. It is preferred to remove the excess composite with a brush emerged with bonding resin since it will assure the status of the margins being smooth and resin not be pulled out from the spaces. Finishing of veneers can decrease the smoothness of the surface, which might lead to complications as plaque retention. Therefore, polishing the veneer surface might be in the favour if applicable\(^{(14)}\).

• **Characteristics of conventional porcelain veneers**

**Table 3. Advantages & disadvantages of porcelain veneer restorations\(^{(2-4, 6, 14, 23)}\):**

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Durable</td>
<td>- High cost (extra lab fees)</td>
</tr>
<tr>
<td>- Color stability- resist staining (good aesthetics)</td>
<td>- More than one appointment</td>
</tr>
<tr>
<td>- Biocompatible</td>
<td>- Hard to repair</td>
</tr>
<tr>
<td>- Resistant against abrasion, attrition and fracture</td>
<td>- Expected increase plaque accumulation on cervical end, most probably due to the slightly higher roughness of porcelain.</td>
</tr>
<tr>
<td>- No effect on the periodontal health</td>
<td>- Poor marginal adaptation</td>
</tr>
<tr>
<td>- Relatively lower technique sensitivity</td>
<td>- The texture of the surface could fail to give a natural feeling</td>
</tr>
<tr>
<td>- Coefficient of thermal expansion equivalent to structure of tooth</td>
<td></td>
</tr>
</tbody>
</table>

24
Previous studies showed a 96%–98% survival rate on a long term follow up, and failure rate of 0%–7% requiring full replacement. However, failures up to 36% were reported for only needing a repair$^{(3, 4, 25)}$. Most failures reported were due to either fracture, microleakage leading to discolorations, or debonding$^{(25)}$. Predisposing factors for such failures have been summarized below:

<table>
<thead>
<tr>
<th>Fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Poor adhesion to tooth surface (especially if bonded to large area of dentine exposed)</td>
</tr>
<tr>
<td>• Large restoration</td>
</tr>
<tr>
<td>• Defective endodontic treated teeth</td>
</tr>
<tr>
<td>• Occlusion and articulation problems</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Microleakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Preparations involving dentine</td>
</tr>
<tr>
<td>• Wrong choice of luting cements</td>
</tr>
<tr>
<td>• Patients with previous restorations and high risks for carious lesions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Debonding</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Excessive dental loss</td>
</tr>
</tbody>
</table>

Figure 4. Predisposing Factors for Types of Failures; Fracture, Microleakage and Debonding.

II. OBJECTIVES:

II.1 AIM

The aim is to examine the effectiveness of using direct composite resin veneer restoration as an intervention in comparison to the indirect conventional porcelain veneer restoration (i.e. the comparator) while restoring aesthetically compromised anterior teeth.
II.2 OUTCOMES MEASURED

II.2.1 Primary Outcome

The primary outcome will be the success of the restoration linked to one of the following parameters:

1. The absence of events leading to a change in the restoration(s), including:
   (a) non-repairable fractures; (b) restorable secondary caries; (c) poor esthetic as judged by the patient and/or clinician.

2. The absence of any event that might lead directly to the extraction of the restored tooth or more complex treatment modalities, including (a) dental fracture/loss; (b) endodontic treatment; (c) non-restorable secondary caries; (d) crowns combined or not with posts/core buildup.

II.2.2 Secondary Outcomes

1. Patient’s based outcomes; patient’s satisfaction with the treatment.
2. Economic variables; the difference in the cost-effectiveness between the two treatment modalities.

III. METHODS:

III.1 LITERATURE SEARCH

III.1.1 OVERVIEW

An electronic search was conducted thoroughly on three databases; Ovid (MEDLINE), Ovid (EMBASE) and SCOPUS. The search was not restricted to any
language, and it included publications from 30 years ago up until February the 6th, 2018. Another search was carried out manually in order to explore other references which were not included in the databases mentioned above.

**III.1.2 SEARCH STRATEGY**

**Table 4. Search Strategies for Different Databases:**

<table>
<thead>
<tr>
<th>Ovid MEDLINE &amp; EMBASE</th>
<th>SCOPUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. exp dental veneer/</td>
<td>#4: #1 AND #2 AND #3</td>
</tr>
<tr>
<td>2. (dental adj5 (veneer? or laminate?)).tw,kw.</td>
<td>#3: INDEXTERMS(Dental Veneers) OR TITLE-ABS-KEY(veneer*)</td>
</tr>
<tr>
<td>3. veneer?.tw,kw.</td>
<td>#2: INDEXTERMS(Composite Resins) OR TITLE-ABS-KEY(composite resin*)</td>
</tr>
<tr>
<td>4. or/1-3</td>
<td>OR TITLE-ABS-KEY((dental or direct) W/5 (resin* or composite*))</td>
</tr>
<tr>
<td>5. exp dental porcelain/</td>
<td>#1: INDEXTERMS(Dental Porcelain) OR TITLE-ABS-KEY((porcelain or ceramic) W/5 (dental or veneer* or indirect))</td>
</tr>
<tr>
<td>6. ((porcelain or ceramic) adj5 veneer?).tw,kw.</td>
<td>...limited to last 30 years, subject = Dentistry only</td>
</tr>
<tr>
<td>7. (dental adj5 (ceramic or porcelain)).tw,kw.</td>
<td></td>
</tr>
<tr>
<td>8. (indirect adj5 (porcelain or ceramic)).tw,kw.</td>
<td></td>
</tr>
<tr>
<td>9. or/5-8</td>
<td></td>
</tr>
<tr>
<td>10. composite resin?.tw,kw.</td>
<td></td>
</tr>
<tr>
<td>11. ((dental or direct) adj5 (resin? or composite?)).tw,kw.</td>
<td></td>
</tr>
<tr>
<td>12. or/10-11</td>
<td></td>
</tr>
<tr>
<td>14. 4 and 9 and 12</td>
<td></td>
</tr>
<tr>
<td>15. limit 13 to last 30 year</td>
<td></td>
</tr>
</tbody>
</table>
### III.1.3 STUDY DESIGN

Clinical trials comparing the comparator to the intervention

- Systematic reviews
- Cohort studies (prospective)
- Randomized or non-randomized controlled clinical trials

![Figure 5. Types of Studies Considered in The Literature Search.](image)

### III.1.4 SELECTION CRITERIA

#### Table 5. Eligibility Criteria:

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Human beings</td>
<td>- Studies that don’t involve living human beings (e.g. extracted teeth)</td>
</tr>
<tr>
<td>- Permanent teeth</td>
<td>- Studies that don’t show any control of age (could involve children with primary or mixed dentition).</td>
</tr>
<tr>
<td>- Anterior teeth</td>
<td>- Studies that don’t provide a distinct difference between anterior teeth and molars.</td>
</tr>
<tr>
<td>- Direct composite resin veneer restorations (intervention)</td>
<td>- Studies that don’t compare the intervention to the comparator</td>
</tr>
<tr>
<td>- Indirect Porcelain veneers (comparator)</td>
<td>- Non-prospective studies</td>
</tr>
<tr>
<td>- Timeline of study: Anytime (no specific timeline, a study that can be anytime after placement of restoration)</td>
<td></td>
</tr>
</tbody>
</table>
The titles and abstracts of the 537 articles which we got from the literature search were initially screened. Afterwards, the articles approved from the initial screening who showed possibility of inclusion went through full text screening to confirm their eligibility. Full texts were tracked down and downloaded for assessment. Two reviewers (AAJ and RFS) evaluated the validity of the articles chosen for eligibility assessment through the Cochrane tool.

**III.2 DATA EXTRACTION**

The details of the included studies were extracted. The following data was extracted depending on the PICO system:

1) **Study design:**
   - Randomization
   - Allocation of participants
   - Number of participants included
   - Number of participants lost during follow up
   - Number of veneer restorations and how many are lost during follow up

2) **Population/Participants**
   - The size of the sample
   - Number of lost participants
   - Origin (e.g. country)
   - Age
   - Gender
   - Former dentition status (symptoms and reason for placement of veneer restorations)
- The setting; where the participants were recruited from
- If the study matches our inclusion & exclusion criteria (e.g. the position of teeth)

3) **Intervention**
- Type of preparation
- Type or location of tooth restored
- Number of intervention restorations made
- Number of restorations lost at different follow up times
- Duration of follow-up

4) **Comparator**
- Type of preparation
- Type or location of tooth restored
- Number of comparator restorations made
- Number of restorations lost at different follow up times
- Duration of follow-up

5) **Outcomes**
- Primary and secondary outcomes mentioned earlier in section (II.2 OUTCOMES MEASURED).
III.3 DATA ANALYSIS STRATEGY

Two reviewers (AAJ and RFS) conducted the analysis of the outcomes and the data extracted from the included studies. This was done through the Cochrane Collaboration statistical guidelines on the software RevMan5 (Review Manager 5.3). Risk ratios along with their corresponding 95% confidence intervals will be measured in order to assess the effect of the intervention versus the comparator.

III.4 COST ANALYSIS STRATEGY

In this HTA report the cost analysis was performed through measuring the incremental cost-effectiveness ratio (ICER). This is done in order to somehow guide the clinicians and patients throughout the treatment process. The direct costs (chairside and lab fees) will only be considered in this cost analysis. The direct costs weren’t found in any of the studies. Therefore, they were estimated through taking the average cost of the intervention and comparator from a fee guide and contacting several labs to get the average lab costs for indirect veneer restorations.

IV. RESULTS:

IV.1 QUANTITY AND CHARACTERISTICS OF STUDIES SELECTED

The electronic search resulted in a total of 965 articles, where 488 articles were from MEDLINE, 161 from EMBASE and 316 found in SCOPUS. An additional manual search was carried out giving another 14 articles. After the removal of duplicates, the total number of articles came down to 537 articles. Title and abstract based screening was done on the 537 articles in order to remove the
studies that don’t have the potential of being included. After this initial screening, 517 articles were excluded for being irrelevant. The remaining 19 articles were assessed for eligibility through examining their full texts. this process resulted in the exclusion of an extra 16 articles. The reasons for their exclusion is listed in (Table 6). The 3 articles included in this report’s analysis and their characteristics are shown in (Table 7). Where these 3 articles with different outcomes are all related to the same study by Meijering. The PRISMA flowchart is shown in (Figure 6).

Figure 6. PRISMA Flow Diagram Showing the Articles Selection Process
**Table 6. Analysis of Reasons for excluding studies after a full text assessment:**

<table>
<thead>
<tr>
<th>Number of excluded Studies</th>
<th>Reason for Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>• Case reports</td>
</tr>
<tr>
<td>2</td>
<td>• Studies that don’t involve the intervention (direct composite veneer restoration)</td>
</tr>
<tr>
<td>1</td>
<td>• Narrative review</td>
</tr>
<tr>
<td>1</td>
<td>• Study involving full coverage teeth restorations</td>
</tr>
<tr>
<td>1</td>
<td>• Study that doesn’t show a distinct difference between teeth in the aesthetic zone and molars</td>
</tr>
<tr>
<td>1</td>
<td>• Study that does not show the age range. (could involve primary teeth)</td>
</tr>
<tr>
<td>1</td>
<td>• Systematic review that included the study which we already included (duplicate)</td>
</tr>
<tr>
<td>2</td>
<td>• Studies that compares only Indirect porcelain and Indirect composite (ceromer- not direct composite)</td>
</tr>
<tr>
<td>2</td>
<td>• A meta analysis and a systematic review with outcomes that don’t match our criteria</td>
</tr>
<tr>
<td>2</td>
<td>• Articles in the Meijering study that studies outcomes not of our interest.</td>
</tr>
</tbody>
</table>
**Table 7. Table Showing the Characteristics of the Single Study Included:**

| Study ID | (Meijering, Creugers et al. 1995)\(^{26}\).
| Study Design | Parallel-group RCT
| Setting | Patients recruited through staff, dentists and students at the Dental School, University of Nijmegen, The Netherlands.
| Patient drop-out before trial | 43 patients out of the 155 patients originally recruited
| Sample Size (Number of patients & veneer restorations (VRs)) | • Total of 111 patients (31 males, 80 females) & 178 veneer restorations (VRs):
  1. 38 patients (received 60 direct composite resin VRs in total).
  2. 36 patients (received 61 porcelain VRs in total)
  3. 37 patients (received 58 indirect composite VRs)
| Age of Participants | Mean of age 30 y (range 14-74 years old)
| Interventions | I1. Direct composite VRs.
| | I2. Porcelain VRs.
| | I3. Indirect composite VRs.
| Type/location of Tooth Restored | • Maxillary anterior region; two different site frequencies provided:
  (I) 88 VRs on central incisors, and 92 VRs on lateral incisors (Meijering, Creugers et al. 1998);
  (II) 108 VRs on central incisors, and 71 VRs on lateral incisors (Meijering, Roeters et al. 1997).
VRs: Veneer Restorations.

- **Description of the included study:**

  The single study that met our inclusion criteria was done by Meijering et al. This randomized clinical trial was conducted in the Netherlands. The study tackled five outcomes, namely; Treatment times for the VRs (26), Patient’ Satisfaction related to the different types of VRs (27), Recognition of VRs by dentists and beautician
students\textsuperscript{(29)}, Dimensional change during veneering process on discoloured teeth\textsuperscript{(30)} and Survival of types of VRs (2.5 years interim follow-up)\textsuperscript{(28)}. However, only three of the mentioned outcomes were considered in this report; the survival of VR, treatment times and patients satisfaction with the VRs. All outcomes were addressed in different publications from the year of 1995 till the 1998. Although three types of interventions were considered in the study (direct composite resin VRs., porcelain VRs., indirect composite VRs.), only direct composite and porcelain VRs were used in the analysis to meet our research question. The data extracted along with the detailed description of the included topics for the study is listed in Table 7.

\textbf{IV.2 SUMMARY OF FINDINGS}

\textbf{IV.2.1 TREATMENT TIMES}

The total treatment time for the direct composite resin and porcelain veneer restorations was considered in this trial. As well as, comparing the overall needed time for both treatments in the case of placing a single or multiple veneer restorations. Firstly, direct composite veneer restorations were all done in one session for all 38 patients. Determining the shade, preparation, restoration, finishing and polishing was done all at the same time, with an average treatment time of 46 minutes (95\% CI: 40 – 54) for a single veneer restoration placement. Whereas for a single porcelain VR.; shade selection, impression and temporary restorations was done in one session. In the second session, removal of the temporary restoration, cementation and finishing was done. The first session took around 35 minutes, and on average of 29 minutes was needed for the second session, giving a total of 62 minutes (95\% CI: 53-71) for the whole procedure (two
The mean treatment times for the single and multiple VRs are summarized in Table 8.

### Table 8. Mean treatment times of the two types of veneer restorations (single & multiple restoration)

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Type of Veneer Restoration</th>
<th>Sample size</th>
<th>Single VRs.</th>
<th>Multiple VRs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Treatment Times</td>
<td>95% CI</td>
</tr>
<tr>
<td>I1.</td>
<td>Direct resin composite</td>
<td>38</td>
<td>46 minutes</td>
<td>(40 - 54)</td>
</tr>
<tr>
<td>I2.</td>
<td>Porcelain</td>
<td>36</td>
<td>62 minutes</td>
<td>(53 - 71)</td>
</tr>
</tbody>
</table>

(Meijering, Creugers et al. 1995).

### IV.2.2 PATIENT SATISFACTION

Patients satisfaction was assessed in this clinical study through questionnaires. The questionnaires were giving to the patients receiving treatment at baseline (one month after receiving treatment), at a follow up after one year and at two years. The percentage of satisfaction for patients who received direct composite VRs went significantly lower from the 1-year follow up (95%) going to the two-year follow up (67%). However, for patients who got the porcelain VRs the percentage of satisfaction pretty much stayed the same with a (94%) satisfaction after the 1	extsuperscript{st} year and (93%) for the 2	extsuperscript{nd} year recall. For the observations of patient’s satisfaction through these recall times are listed in Table 9.
IV.2.3 SURVIVAL & SUCCESS/FAILURE OF THE VRs

The failures of the veneer restorations were classified into two types; (1) *Absolute failure*: which is the complete failure (e.g. fracture) of restoration that will need full replacement. (2) *Relative failure*: a failure of the restoration that would only need repair not replacement. The success of the restorations was calculated through subtracting the number of failures out of the total number of veneer restorations. Regarding the survival of the VRs, three terms have been defined in relation to the type of failure stated;

1- *Survival of origin* (Sr) → it is considered a “Sr” if there was no absolute failure (relative failures not taken into consideration).

2- *Functional survival* (Sf) → when the restoration undergoes a “relative failure” and was repaired successfully to full function (absolute failures aren’t included).

3- *Overall survival* (So) → Where absolute and relative failures are taken into account. However, maintenance is not.

### Table 9. Participants satisfaction levels at different recall times for the Two types of VRs

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Type of Veneer Restoration</th>
<th>Sample size</th>
<th>Frequency of satisfied patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>(Meijering, Roeters et al. 1997)</td>
<td>I1. Direct resin composite</td>
<td>38</td>
<td>28 (74%)</td>
</tr>
<tr>
<td></td>
<td>12. Porcelain</td>
<td>36</td>
<td>25 (72%)</td>
</tr>
</tbody>
</table>
The summary for the failure, successful and survival of veneers are listed in Table 10. Possible confounders such as; vitality of teeth, type/location of restoration and type of preparation that were considered to have a potential effect of the survival rate are listed in Table 11. Where the only effect that showed a significant effect is the “vitality of the teeth”.

Table 10: The Failure, Success & Survival of the Veneer Restorations at the end of the Follow-up According to the Two Different Types of VRs

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Type of Veneer Restoration</th>
<th>Sample size (# of patients / VRs)</th>
<th>Number of failures</th>
<th>Number of successful VRs**</th>
<th>Number &amp; percentage of the survival of VRs**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Absolute failure</td>
<td>Relative failure</td>
<td>Survival of original (Sr)</td>
</tr>
<tr>
<td>(Meijering, Creugers et al. 1998)</td>
<td>Direct resin composite</td>
<td>38 patients / 69 VRs</td>
<td>4</td>
<td>14</td>
<td>51</td>
</tr>
<tr>
<td>12. Porcelain</td>
<td>36 patients / 56 VRs</td>
<td>0</td>
<td>3</td>
<td>53</td>
<td>56 (100%)</td>
</tr>
</tbody>
</table>

* The type of VRs significant influence on the two survival levels (Sr & So).
** Affected by confounders such as: vitality of teeth, type of preparation and tooth type. (findings shown in Table 11)
***Number of successful VRs = Total number of VRs - Total number of failures

Table 11: Potential Confounders affecting the survival of the Veneer Restorations at the end of the follow-up (Type of preparation, Location of VRs & Tooth vitality)

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Type of preparation</th>
<th>Sample size (# of VRs)</th>
<th>Number &amp; percentage of the survival of VRs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Survival of original</td>
</tr>
<tr>
<td>(Meijering, Creugers et al. 1998)</td>
<td>No incisal reduction (Design 1)</td>
<td>132 VRs</td>
<td>98% (129 VRs)</td>
</tr>
<tr>
<td></td>
<td>incisal reduction by 1.5 mm (Design 2)</td>
<td>47 VRs</td>
<td>95% (45 VRs)</td>
</tr>
<tr>
<td></td>
<td>location of VRs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central incisor</td>
<td>108 VRs</td>
<td>96% (104 VRs)</td>
</tr>
<tr>
<td></td>
<td>Lateral incisor</td>
<td>71 VRs</td>
<td>92% (65 VRs)</td>
</tr>
<tr>
<td></td>
<td>Tooth vitality*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vital</td>
<td>115 VRs</td>
<td>97% (111 VRs)</td>
</tr>
<tr>
<td></td>
<td>Non-Vital</td>
<td>64 VRs</td>
<td>88% (56 VRs)</td>
</tr>
</tbody>
</table>

* The only factor that showed a significant effect on the survival of the VR is the tooth vitality.
IV.2.4 COST ESTIMATION

The costs for the clinical chairside procedures were required from the ACDQ pricing guide booklet giving as estimation for the costs locally. Whereas the average cost for the lab fees in CAD was obtained from several sources. The estimated costs for two types of veneer restorations are shown in Table 12.

Table 12. Estimated Average Costs for different types of VRs

<table>
<thead>
<tr>
<th>Type of veneer</th>
<th>Chairside cost</th>
<th>Laboratory cost</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1. Direct resin composite</td>
<td>364 CAD*</td>
<td>0</td>
<td>364 CAD</td>
</tr>
<tr>
<td>I2. Porcelain</td>
<td>820 CAD*</td>
<td>289 CAD</td>
<td>1109 CAD</td>
</tr>
</tbody>
</table>

* CAD : Canadian Dollars

IV.3 DATA AND FINDINGS ANALYSIS

The effect estimates of the intervention (direct composite VRs.) was obtained by measuring the relative risk/risk ratio (RR) and their corresponding 95% confidence interval (CI) through the RevMan5 (Review Manager 5.3) software.

IV.3.1 PRIMARY OUTCOME

IV.3.1.1 ANALYSIS ON THE SUCCESS OF VRs.

The failures of the restoration are provided in the data/findings extracted, therefore we were able to calculate the success as the following to be used in the analysis:
Success of VRs = [Total number of VRs – (complete failures + salvageable failures)]

- The analysis gave the following results (shown in Figure 7. snapshot from RevMan):

  Risk ratio (RR) = 0.78, 95% CI= (0.67, 0.91), p-value = 0.002

**Figure 7. Analysis of the Success of the Direct Composite Vs. Porcelain Veneer Restorations (VRs.) at the 2-year follow-up:**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Direct composite</th>
<th>Feldspathic porcelain</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meijering et al. 1995</td>
<td>51 Events, 69 Total</td>
<td>53 Events, 56 Total</td>
<td>0.78 [0.67, 0.91]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>69 Total</td>
<td>53 Total</td>
<td>0.78 [0.67, 0.91]</td>
</tr>
</tbody>
</table>

Total events: 51, 53
Heterogeneity: Not applicable
Test for overall effect: Z = 3.16 (P = 0.002)

- Interpretation of the results:

  Since the **RR is 0.78** this means that the chance of the direct composite restoration to be successful is 0.78 of the control group (Porcelain) or 22% lower the chance for direct composite resin veneer restorations to be successful. The **95% CI (0.67, 0.91)** shows a range that doesn’t cross 1. Therefore, the difference in the success of both types of veneer restoration is statistically significant. Additionally, the **p-value of 0.002 (<0.05)** shows that the difference is significant at the 2-year follow-up.
IV.3.1.2 ANALYSIS ON THE SURVIVAL OF VRs.

For the data analysis, the estimated effect for the interventions on the survival of the VRs was calculated through considering the total number of VRs minus the number of VRs who underwent complete failure (absolute failure) at the second recall (2-year follow up) shown in this formula:

Survival of VRs = Total number of VRs – Complete failures of VRs

- The analysis gave the following results as shown in (Figure 8):

Risk ratio (RR) = 0.94, 95% CI = (0.88, 1.01), p-value = 0.09

Figure 8. Analysis of the Survival of the Direct Composite Vs. Porcelain Veneer Restorations (VRs.) at the 2-year follow-up:

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Direct composite</th>
<th>Feldspathic porcelain</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meijering et al. 1995</td>
<td>65</td>
<td>56</td>
<td>0.94 [0.88, 1.01]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>65</strong></td>
<td><strong>56</strong></td>
<td><strong>0.94 [0.88, 1.01]</strong></td>
</tr>
<tr>
<td><strong>Total events</strong></td>
<td><strong>69</strong></td>
<td><strong>56</strong></td>
<td><strong>0.94 [0.88, 1.01]</strong></td>
</tr>
</tbody>
</table>

- Interpretation of the results:
  
  Since the RR is very close to 1 (0.094), it reflects mainly a minimal or no difference in the survival of both types of veneers at the 2-year follow-up. A 95% CI of (0.88, 1.01) that includes the null value 1, along with a 0.09 p-value that is larger than 0.05 confirms that there is no statistical significant difference in between the survival of direct composite and porcelain veneer restorations at the 2-year follow-up.
IV.3.2 SECONDARY OUTCOMES

IV.3.2.1 ANALYSIS OF THE PATIENT’S SATISFACTION

1. Patient’s Satisfaction after 1-year follow-up:

- The screenshot from RevMan (Figure 9) shows the risk ratio (RR) and the 95% CI calculated; where the RR = 1 and the 95% CI = (0.09, 1.12).

- The interpretation for the mentioned RR & 95% CI:

Since the RR = 1, this reflects that there is no difference in the patient’s satisfaction between participants treated with direct composite and porcelain VRs. Moreover, since the 95% confidence interval crosses 1, this confirms that there is no statistically significant difference in the patient’s satisfaction between participants treated with the two different types of VRs after the 1-year follow-up. P-value is more than 0.05; no significance difference.

Figure 9. Analysis of Patients satisfaction at the 1-year Follow-up for patients receiving Direct Composite Vs. Porcelain VRs:

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Direct composite</th>
<th>Feldspathic porcelain</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events</td>
<td>Total</td>
<td>Events</td>
</tr>
<tr>
<td>Meijering et al. 1995</td>
<td>36</td>
<td>38</td>
<td>34</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>36</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Not applicable
Test for overall effect: Z = 0.06 (P = 0.96)
2. Patient’s Satisfaction after 2-year follow-up:

- The snapshot (Figure 10) shows the following results;
  Risk ratio (RR) = 0.72, 95% CI = (0.56, 0.92)

- The interpretation for the RR & 95% CI results:
  \( RR = 0.72 \) → this can be interpreted in two ways: (1) Participants treated with direct composite VRs. (intervention) are at 0.72 reduced possibility (risk) of being satisfied. Or (2) Participants treated with direct composite VRs. (intervention) are at 28% \((1 - 0.72 = 0.28)\) lower possibility of being satisfied.
  \( 95\% \ CI = (0.56, 0.92) \) → Since the confidence interval doesn’t cross 1, then the difference is statistically significant. \( P\text{-value} = 0.009 \) which is less than 0.05 then the difference in patient’s satisfaction was significantly different in the two types of VRs at the 2-year follow up.

**Figure 10.** Analysis of Patients satisfaction at the 2-year Follow-up for Participants receiving Direct Composite Vs. Porcelain VRs:
SUMMARY OF ALL ANALYSIS:

Table 13. Summary of the Analysis of Both Primary and Secondary Outcomes (Direct Composite versus Feldspathic Porcelain):

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Participants/Number of VRs</th>
<th>Risk Ratios*</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success Rate, 2 YEARS [Total - (Complete failure of Restorations + Salvageable Failure)]</td>
<td>125 VRs</td>
<td>0.78</td>
<td>[0.67, 0.91]</td>
<td>0.002**</td>
</tr>
<tr>
<td>Survival Rate, 2 YEARS (Total - Complete failure of restorations)</td>
<td>125 VRs</td>
<td>0.94</td>
<td>[0.88, 1.01]</td>
<td>0.09</td>
</tr>
<tr>
<td>Participants Satisfaction (n satisfied), 1 YEAR</td>
<td>74</td>
<td>1</td>
<td>[0.90, 1.12]</td>
<td>0.96</td>
</tr>
<tr>
<td>Participants Satisfaction (n satisfied), 2 YEARS</td>
<td>74</td>
<td>0.72</td>
<td>[0.56, 0.92]</td>
<td>0.009**</td>
</tr>
</tbody>
</table>

* Statistical method used: Risk Ratio (M-H, Fixed, 95% CI).
** Significant value.

IV.3.2.1 ANALYSIS OF THE COST-EFFECTIVENESS

To estimate the cost-effectiveness of both technologies considered in this report, we have used the following formula:

\[
\text{Incremental cost-effectiveness ratio (ICER)} = \frac{\text{Difference In The Cost For Both VRs}}{\text{Difference In The Effect For Both VRs}}
\]

- ICER for success, survival of the veneer restoration and the patient’s satisfaction:

The ICER for success is 0.028 %, which is interpreted as; the patient would need to pay 100 CAD extra just to increase the success rate by only 2.8% (2.8% per 100
CAD). For the **survival rate**, the ICER is 0.008%; which means that the patient would need to pay 100 CAD extra just to increase the survival rate by only 0.8%. Regarding the patient’s satisfaction, the patient would need to pay 100 CAD to increase the satisfaction by 3.5 % (ICER= 0.035%). Therefore, the direct composite veneer restorations are more cost-effective than porcelain veneers. A summary of the findings and ICER results are listed in Table 14, 15 and 16.

| Table 14. Summary of the Cost, Effect as Success and the Calculated ICER for the interventions |
|---------------------------------------------------|---------|---------|-----------|----------|---------|----------|-------------|
| Intervention                                      | Cost    | Effect  | ICER (rate improvement per CAD) |
| I1. Direct Composite                              | Clinical from ACDQ* 364 | Lab fee 0 | Total (CAD**) 364 | Success 51 | Total sample 69 | Success rate 73.9% | 0.028% |
| I2. Porcelain Veneer                              | Clinical from ACDQ* 820 | Lab fee 289 | Total (CAD**) 1109 | Success 53 | Total sample 56 | Success rate 94.6% | * ACDQ: Association des chirurgiens dentistes du Québec. **CAD: Canadian dollars |

| Table 15. Summary of the Cost, Effect as Survival and the Calculated ICER for the interventions |
|---------------------------------------------------|---------|---------|-----------|----------|---------|----------|-------------|
| Intervention                                      | Cost    | Effect  | ICER (rate improvement per CAD) |
| I1. Direct Composite                              | Clinical from ACDQ* 364 | Lab fee 0 | Total (CAD**) 364 | Survival 65 | Total sample 69 | Survival rate 94.2% | 0.008% |
| I2. Porcelain Veneer                              | Clinical from ACDQ* 820 | Lab fee 289 | Total (CAD**) 1109 | Survival 56 | Total sample 56 | Survival rate 100.0% | * ACDQ: Association des chirurgiens dentistes du Québec. **CAD: Canadian dollars |
V. DISCUSSION:

The reason behind conducting this HTA report is to resolve the dilemma of whether we should be choosing an indirect porcelain veneer restoration or a direct composite resin veneer restoration, when restoring defective anterior teeth. Moreover, it can serve as an evidence-based guidance for clinicians and patients, in hope of providing the best treatment care to people with aesthetically compromised anterior teeth.

This HTA report tackles two technologies showing; the direct composite veneer restoration as the intervention, the porcelain veneer as the comparator and conventional treatment for aesthetically restoring anterior teeth. The failures/success of the veneers, survival of the veneers, patient’s satisfaction and economical aspects were all assessed as primary and secondary outcomes through this report. No previous HTA reports have been published covering the intended aim and research question mentioned in this report.
V.1 SUMMARY OF FINDINGS & EVIDENCE

From the literature search conducted, only one study has shown to match our inclusion criteria. The study had five published papers with different outcomes assessed. However, only three of the papers evaluated the outcomes we’re interested in.

Regarding the primary outcome; the study evaluated the failures/success and associated survival of the different types of veneer restorations. Two kinds of failures were identified in the study; an absolute/complete failures and relative/salvageable failures. Most failures mentioned in the study were shown to be mostly as a result of cracks and fractures of the VRs, and less frequently due to color mismatch\(^\text{28}\). The failures reported were used in the data analysis in order to evaluate the success and survival of the two types of anterior veneer restorations, mainly at their 2-year interim follow-up. Risk ratios and their 95 % CI were calculated through the Cochrane Collaboration statistical guidelines on the software RevMan5 (Review Manager 5.3). The mentioned analysis showed that direct composite veneer restorations have a slightly lower chance to be successful in comparison to porcelain veneers. In regards to the survival of the restoration, our analysis showed that there is no significant difference in the survival rate of both types of veneer restorations. Several factors were assessed in the study for potentially and indirectly affecting the survival of the veneer restoration, namely; (a) The type of preparation: whether there is an incisal reduction or no incisal reduction, (b) tooth type or location of VR: Central or lateral incisor, and (c) the tooth vitality: whether it the tooth restored was vital or non-vital. (Meijering, Creugers et al. 1998) reported that the vitality of teeth was the only factor
significantly affecting the survival of the veneer restorations, where 72% of the complete failures were seen in relation to non-vital teeth and 50% of the “relative failures” – salvageable failures- include non-vital teeth.

As for the secondary outcomes; the patient satisfaction and the economical aspects has been assessed. Regarding the patient’s satisfaction, it was evaluated in the study through questionnaires through three different recall times; baseline, 1-year recall and 2-year recall. The treatment demand and need were aimed for a 100%. There was an agreement by both the dentist and patient while assessing the aesthetic faults for the existing teeth to be repaired, which will subsequently affect the satisfaction later on. The reason behind not considering each opinion alone is to ensure reliable results. The change of the shape, position or color of the tooth with the agreement of dentists and patients were shown to be the most common types of faults that indicated the treatment. The clinical trial showed that the patient’s satisfaction wasn’t different between the baseline and the 2nd recall. However, showed a difference between the baseline and 1st recall(27). The analysis conducted in this HTA showed that there was no significant difference in the patient’s satisfaction at the first recall for both the direct composite and porcelain veneer restoration. Whereas, at the 2-year follow up, there was a significant difference in patient’s satisfaction between both types of VRs, with the direct composite having a 28% lower chance.

The economic aspect was analyzed in this report depending on estimated average costs. The reason behind this is that the study included mentioned no costs or any type of cost analysis needed for this report. Therefore, standard average costs were estimated through approaching several references, such as;
ACDQ and contacting a couple of dental labs. The incremental cost effectiveness ratio (ICER) was used to measure the cost effectiveness of both veneer restorations. The results for the analysis showed that a patient would need to pay a lot more in order to increase the satisfaction, success, and survival by very low percentages. Therefore, Direct composite resin veneer restorations are more cost effective in comparison to the porcelain veneers.

**V.2 ETHICAL AND LEGAL ASPECTS**

In regards to the technologies considered in this report, no legal, ethical, social or political issues were identified in the literature or the study included in the analysis. Thus, no risks related to these aspects were stated anywhere in this report. Both interventions have been used in the clinical field, mainly being case-dependent.

**V.3 LIMITATIONS**

**V.3.1 LIMITATIONS OF THE INCLUDED STUDY**\(^{27, 28}\).

The randomized controlled trial included in this report has clarified the method of randomization through the published reviews, where computer codes were generated on a programme showing an allocation depending on the type of veneer, operator and preparation. However, the number of patients allocated to each group of the veneer restorations tested were not precise. Since the multiple published papers for the same study reported the data differently each time, a lot of confusion and loss of reliability have resulted. It was not mentioned whether the allocation was sealed or not. Moreover, it wasn’t clear if the person in charge
of evaluating or analysing the outcomes was blinded or came into contact with the process of allocation/treatment through this trial.

As shown in (Table 7) describing the characteristics of the included study, nine patients were not examined at the recall time due to their non-surviving veneers. Ten direct resin composite VRs and six porcelain veneers were lost and subsequently not examined at the final follow-up. At the end of the 2-year recall, a total of 9 patients (13 VRs) were lost. Throughout the trial, some of the indirect veneer restorations which were not installed, mainly because of their unpleasant aesthetics properties, were not taken onto account as failures. We have to understand that being able to replace these undesired veneer restorations doesn’t justify their exclusion which will subsequently increase the risk of bias in the study and results. Other sources of bias; knowing that the cervical preparation is highly dependent on the extension of the defect, shows that it is wrong to classify it depending on the type of the material used in the veneer. Reporting the patient’s satisfaction through the different recall times mentioned, might as well increase the risk of bias. This is due to the fact that patient might adapt to the new veneer restoration and therefore report better satisfaction with time, but at the same time the follow-up period is not long enough to detect most of the major faults (e.g. discolorations).

The evaluation of the outcomes after a follow up of a short period of time has its upsides, specifically; ensuring that the interventions and the associated clinical plan will not be outdated, which is a problem we often witness in longitudinal studies. However, this 2-year follow-up might lead to a compromise in the
relatability of the analysis, in a way where the difference of the outcomes between the interventions might go unseen in this short follow-up time.

**V.3.2 LIMITATIONS OF THIS HTA REPORT**

In the literature search conducted, only one study was included in this review. Moreover, this included study’s limitations mentioned earlier in section V.2.1 are considered legitimate factors that can weaken the integrity, and reliability of the evidence concluded from this report. Another aspect to consider is that the analysis in this report was done although some of the outcome’s data in the study included was reported in relation to the number of participant’s (patient’s satisfaction), while other times associated with the number of veneer (survival of the restorations). We have mentioned that the exclusion of the indirect veneers in the study which weren’t installed and not taking them into consideration as failures might result in a bias. This bias can cause some kind of shift in the effect measures of the intervention considered, in a way where the effect might be overestimated when conducting the analysis\(^{31}\).

Regarding the cost analysis, the costs were only estimated as average costs in the province of Quebec, not representing the average cost elsewhere which can vary considerably. As no study showing the costs was identified through the literature search. Moreover, the indirect costs were not taken into consideration. Where some of the patient’s-based costs were not evaluated, such as; the transportation, since for the indirect veneer procedures, two visits are required.

Finally, the lack of evidence and the methodological weakness in the study included along with the other limitations encountered in this report, resulted in
the following; (1) being unable to confirm or recommend the best choice to restore defective anterior teeth, (2) questioning the reliability of the results of the analysis because of the faults in reporting the data in the study included. Therefore, patients should be offered both choices of treatment, with a full description of each. Moreover, they should be informed that no enough evidence shows if one veneer restoration is preferred over the other, instead a decision should be made with the agreement of the patient desires and dentist’s expertise ensuring the best quality of treatment.

VI. CONCLUSION:

This HTA report aims to show the effectiveness of using direct composite veneer restoration (intervention) versus the usage of porcelain veneers in anterior teeth. The patient’s satisfaction, success, survival and cost effectiveness of the interventions outcomes were assessed. The analysis showed the following; (a) the difference in the success rate was statistically significant difference between direct composite VRs and porcelain VRs, showing a 22% lower chance for direct composite VRs being successful. (b) no difference in the survival of both types of veneers at the 2-year follow-up, (c) no difference in the patient’s satisfaction between participants treated with direct composite and porcelain VRs at the 1-year follow-up. However, (d) the difference in patient’s satisfaction was significantly different in the two types of VRs at the 2-year follow up, with a 28% lower chance of satisfaction with direct composite VRs. (e) Direct composite resin veneer restorations are relatively a more cost-effective option.
The lack of enough evidence, along with the significant limitations in this report, shows that no type of intervention should be favoured over the other. When considering the treatment for defective anterior teeth, both types of veneer restorations should be offered to patients. Thus, the conduct of further studies that compare the two types of veneer restorations with a robust design method is essential.
REFERENCES:


