A systematic review of the survival and complication rates of resin-bonded bridges after an observation period of at least 5 years

Resin-bonded bridges (RBBs) were first developed as a conservative fixed reconstruction for missing anterior teeth, before dental implants became available. Early RBBs with perforated cast retainers, as described briefly by Rochette (1973) and in greater detail by Howe & Denelay (1977), were considered temporary restorations, with approximately 2 years of service. These early prostheses were placed with minimal or no tooth preparation. The technique had also been further extended to the posterior region (Livaditis 1980). Since the development of the first RBBs in the 1970s, there have been significant changes in the design, the materials used, and the
tooth preparation, to improve the longevity of the prostheses.

Contrary to initial beliefs, the use of RBBs is not an easy clinical procedure; careful treatment planning and clinical skills are required. The tooth preparation has to be designed to minimize tensile forces. Case selection also plays a great role in the longevity of the prostheses. Short clinical crown height with limited interocclusal distance may be considered as relative contraindications. The various retainer and tooth surface treatments together with the cement (bonding) used also have some bearings on the success. Owing to these variables, the survival rates of RBBs vary widely between studies. Various factors included the observation periods, retainer designs, abutment preparations, surface treatment and bonding techniques applied, the type of luting agent used, the mobility of the abutments, the interocclusal relationship and the location of the prostheses.

In a meta-analysis on RBBs, the authors reported a 74% survival rate at 4 years (Creugers & van’t Hof 1991). However, the majority of the included studies had maximum follow-ups of 5 years or less. The type of retention and location of the RBBs did not seem to affect the survival rate. Survival rates of 5 years and more were not analyzed due to the limited number of RBBs that were followed for these periods of time. Thus, in view of more recent follow-up of the studies, with better clinical techniques and materials, a systematic review with more recent and updated data would be beneficial. In addition, a mean follow-up period of at least 5 years would provide a more meaningful interpretation of the survival rate (Pjetursson et al. 2004a). In order to compare the results of survival and complication rates for tooth-supported fixed dental prostheses (FDPs) and implant-supported single crowns (SCs) with optional treatments like RBBs, it would be of importance to perform systematic reviews based on the same level of evidence and accomplished with exactly the same methodology.

This systematic review is part of a series of six systematic reviews based on the same methodology that have evaluated the survival of tooth- and implant-supported fixed reconstructions of different designs and described the incidence of biological and technical complications after an observation period of at least 5 years (Lang et al. 2004; Pjetursson et al. 2004a, 2004b; Tan et al. 2004; Jung et al. 2008).

It has been demonstrated that after 5 years of service, the survival of FDPs with different designs was 91.4% for tooth-supported cantilever FDPs (Pjetursson et al. 2007), 93.8% for conventional tooth-supported FDPs (Pjetursson et al. 2007) and 94.5% for implant-supported SCs (Jung et al. 2008).

The main objectives of this systematic review were to obtain the long-term survival rate of RBBs and to evaluate the incidence of specific technical and biological complications over an observation period of at least 5 years.

**Material and methods**

**Search strategy and study selection**

A Medline (PubMed) search from 1965 up to and including January 2007 was conducted for articles published in the dental literature, and limited to human trials, using the search terms 'resin-bonded bridges,' 'fixed partial dentures OR bridges,' 'adhesive bridges,' 'acid-etched bridges,' 'maryland bridges,' 'resin-bonded bridges survival rate,' 'denture, partial, fixed, resin-bonded,' and 'resin-bonded fixed partial dentures.'

Manual searches of the bibliographies of all full-text articles and related reviews, selected from the electronic search, were also performed.

From this extensive search, there were no randomized-controlled clinical trials (RCTs) available comparing RBBs with the conventional FDPs.

**Inclusion criteria**

In the absence of RCTs, this systematic review was based on prospective and retrospective cohort studies. The additional inclusion criteria for study selection were that:

- the studies had a mean follow-up time of 5 years or more;
- the publications were reported in the dental literature, with no language restriction;
- the patients included had been examined clinically at the follow-up visit, i.e., publications based on patient records only, on questionnaires or interviews were excluded and
- the studies reported details on the characteristics of the suprastructures.

**Selection of studies**

Titles and abstracts of the searches were initially screened by independent reviewers (B.E.P., W.C.T., K.T. and U.B.) for possible inclusion in the review. The full text of all studies of possible relevance was then obtained for independent assessment by two reviewers. Any disagreement was resolved via discussion.

Figure 1 describes the process of identifying the 17 studies selected from an initial yield of 6110 titles. Data were extracted independently by two reviewers using a data extraction form. Disagreement regarding data extraction was resolved by consensus.

**Excluded studies**

Of the 93 full-text articles examined, 76 were excluded from the final analysis (see reference list).

The main reasons for exclusion were a mean observation period of <5 years, multiple publications on the same patient cohorts with the same observation period and publications based on questionnaires, interviews or patient records, without clinical examination (Fig. 1).

**Data extraction**

Of the 17 studies included, information on the survival of the reconstructions and on biological and technical complications was retrieved. Survival was defined as the RBBs remaining in situ at the examination without multiple debonding, but irrespective of its condition. Failure was defined as the RBBs that were lost and required refabrication, or multiple recementations.

Biological complications included caries on abutment teeth, and periodontal disease progression.

Technical complications analyzed included loss of retention, with or without loss of the reconstruction, and fractures of veneers, with or without loss of the reconstruction. From the studies included, the number of events for all these categories were extracted and the corresponding total exposure time of the reconstruction was calculated.
Exposure time up to the end of observation time.

Exposure time up to a failure of the RBBs/abutments.

Exposure time of RBBs/abutments, the sum of:

- Total exposure time was calculated by taking the sum of:
  
  1. Exposure time of RBBs/abutments, that could be followed for the whole observation time.
  
  2. Exposure time up to a failure of the RBBs/abutments that were lost due to failure during the observation time.
  
  3. Exposure time up to the end of observation time for RBBs/abutments that did not complete the observation period due to reasons such as death, change of address, refusal to participate, non-response, chronic illnesses, missed appointments and work commitments.

For each study, event rates for RBBs and/or abutments were calculated by dividing the total number of events by the total RBBs or abutments’ exposure time in years. For further analysis, the total number of events was considered to be Poisson distributed for a given sum of RBBs exposure years, and Poisson regression with a logarithmic link function and total exposure time per study as an offset variable were used [Kirkwood & Sterne 2003a].

Robust standard errors were calculated to obtain 95% confidence intervals (CIs) of the summary estimates of the event rates. In order to assess the heterogeneity of the study-specific event rates, the Spearman goodness-of-fit statistics and associated P-value were calculated. If the goodness-of-fit P-value was below 0.05, indicating heterogeneity, random-effects Poisson’s regression with γ-distributed random effects was used to obtain a summary estimate of the event rates. Five- and 10-year survival proportions were calculated via the survival function S, S(T) = exp(-T × event rate), by assuming constant event rates [Kirkwood & Sterne 2003b]. The 95% CIs for the survival proportions were calculated using the 95% confidence limits of the event rates.

Multivariable Poisson regression was used to investigate formally whether event rates varied by position of the reconstruction, namely, maxilla vs. mandible or anterior vs. posterior.

All analyses were performed using Stata®, version 8.2 (StataCorp, College Station, TX, USA).

Results

Included studies

A total of 17 studies on RBBs were included in the analysis. The characteristics of the selected studies are shown in Table 1.

The studies included around 1500 patients between the age of 13 and 78 years. The proportion of patients with RBBs who could not be followed for the complete study period was available for 11 of the 17 studies and ranged from 0% to 48% (Table 1).

Although one of the most important advantages of RBBs is the requirement of minimal tooth preparation, the studies included used various techniques. These ranged from conservative minimal preparations to extensive preparations with grooves, guide planes and wrap-around design to improve the retention of the prostheses. In the same way, in order to enhance the resin-to-metal bond, a variety of metal treatments were used. These included micromechanical retention with sandblasting, chemical etching or electroetching, or macromechanical retention with perforations, or surface treatment with silica coating. A number of different luting cements were used in the studies included, of which dual-cured resin cements were most frequently used (Table 1).

The studies were mainly conducted in an institutional environment such as in universities or specialists’ clinics (Table 1).

In one of the studies, the survival of conventional two-retainer design RBBs was compared with single-retainer cantilever RBBs [Kern 2005]. Another research group randomly assigned the reconstructions to groups examining the effect of retainer designs, like perforated vs. etched.
Table 1. Study and patient characteristics of the studies reviewed for resin-bonded bridges

<table>
<thead>
<tr>
<th>Study</th>
<th>Year of publication</th>
<th>Study design</th>
<th>Manufacturing procedure</th>
<th>No. of patients</th>
<th>Age range</th>
<th>Mean age</th>
<th>Setting</th>
<th>Drop-out (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garnett et al.</td>
<td>2006</td>
<td>Retrospective</td>
<td>Various techniques</td>
<td>45</td>
<td>13–44</td>
<td>17.6</td>
<td>University</td>
<td>47%</td>
</tr>
<tr>
<td>Kern</td>
<td>2005</td>
<td>Prospective</td>
<td>Conservative, grooves and proximal boxes</td>
<td>30</td>
<td>NR</td>
<td>NR</td>
<td>University</td>
<td>0%</td>
</tr>
<tr>
<td>Zalkind et al.</td>
<td>2003</td>
<td>Retrospective</td>
<td>Wrap-around design with grooves, rests and guide planes</td>
<td>51</td>
<td>15–55</td>
<td>NR</td>
<td>Specialist</td>
<td>0%</td>
</tr>
<tr>
<td>Hikage et al.</td>
<td>2003</td>
<td>Prospective</td>
<td>Deep occlusal rests and inlays</td>
<td>24</td>
<td>NR</td>
<td>NR</td>
<td>University</td>
<td>NR</td>
</tr>
<tr>
<td>Corrente et al.</td>
<td>2000</td>
<td>Retrospective</td>
<td>Extended guide planes</td>
<td>67</td>
<td>32–58</td>
<td>42.1</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>de Kanter et al.</td>
<td>1998</td>
<td>Prospective</td>
<td>Approximal grooves, guide planes and occlusal stops</td>
<td>175</td>
<td>16–72</td>
<td>39</td>
<td>University</td>
<td>NR</td>
</tr>
<tr>
<td>Pröbster &amp; Henrich</td>
<td>1997</td>
<td>Prospective</td>
<td>Various techniques</td>
<td>264</td>
<td>NR</td>
<td>29</td>
<td>University</td>
<td>17%</td>
</tr>
<tr>
<td>Hansson &amp; Bergström</td>
<td>1996</td>
<td>Retrospective</td>
<td>Wrap-around design with vertical grooves</td>
<td>32</td>
<td>18–70</td>
<td>34.4</td>
<td>University</td>
<td>9%</td>
</tr>
<tr>
<td>Bergbreiter et al.</td>
<td>1996</td>
<td>Prospective</td>
<td>Grooves and rests</td>
<td>32</td>
<td>NR</td>
<td>NR</td>
<td>University</td>
<td>48%</td>
</tr>
<tr>
<td>Samama et al.</td>
<td>1996</td>
<td>Retrospective</td>
<td>NA.</td>
<td>121</td>
<td>NR</td>
<td>NR</td>
<td>Private practice</td>
<td>NR</td>
</tr>
<tr>
<td>de Rijk et al.</td>
<td>1995</td>
<td>Prospective</td>
<td>Various techniques</td>
<td>146</td>
<td>NR</td>
<td>NR</td>
<td>University</td>
<td>5%</td>
</tr>
<tr>
<td>Priest</td>
<td>1995</td>
<td>Prospective</td>
<td>Wrap-around design, with guide planes and occlusal stops</td>
<td>83</td>
<td>NR</td>
<td>NR</td>
<td>Specialist</td>
<td>20%</td>
</tr>
<tr>
<td>Hosseini</td>
<td>1994</td>
<td>Retrospective</td>
<td>Extended guide planes</td>
<td>90</td>
<td>20–59</td>
<td>37.3</td>
<td>Specialist</td>
<td>NR</td>
</tr>
<tr>
<td>Barrack &amp; Bretz</td>
<td>1993</td>
<td>Prospective</td>
<td>Wrap-around design with grooves and rests</td>
<td>109</td>
<td>14–69</td>
<td>45</td>
<td>Specialist</td>
<td>22%</td>
</tr>
<tr>
<td>Thayer et al.</td>
<td>1993</td>
<td>Retrospective</td>
<td>NA.</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>University</td>
<td>NR</td>
</tr>
<tr>
<td>Creugers &amp; Käyser</td>
<td>1992</td>
<td>Prospective</td>
<td>Various techniques</td>
<td>183</td>
<td>13–78</td>
<td>30</td>
<td>University</td>
<td>8%</td>
</tr>
<tr>
<td>Creugers et al.</td>
<td>1990</td>
<td>Prospective</td>
<td>Various techniques</td>
<td>183</td>
<td>13–78</td>
<td>30</td>
<td>University</td>
<td>0%</td>
</tr>
</tbody>
</table>

NA, not available; NR, not reported.
metal and groups comparing different cements [Creugers et al. 1990; Creugers & Käyser 1992]. The remaining studies reported on survival and complication rates without comparing different treatment modalities.

Two of the studies [Creugers et al. 1990; Creugers & Käyser 1992] reported on the same patient cohort. The older study [Creugers et al. 1990] was included because it gave additional information on technical complications, but was not used for survival analysis.

Survival
RBB survival was defined as the RBB remaining in situ with or without modification for the observation period. Twelve of the 17 studies reported on survival and complication rates without comparing different treatment modalities. Twelve of the 17 studies reported on survival and complication rates without comparing different treatment modalities. The remaining studies 

Table 2. Annual failure rates and survival of resin-bonded bridges (RBBs)

<table>
<thead>
<tr>
<th>Study</th>
<th>Year of publication</th>
<th>Total no. of RBBs</th>
<th>Mean follow-up time</th>
<th>No. of failure</th>
<th>Total RBB exposure time</th>
<th>Estimated failure rate (per 100 RBB years)</th>
<th>Estimated survival after 5 years (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kern</td>
<td>2005</td>
<td>37</td>
<td>5.2</td>
<td>5</td>
<td>192</td>
<td>2.60</td>
<td>87.8</td>
</tr>
<tr>
<td>Zalkind et al.</td>
<td>2003</td>
<td>51</td>
<td>9.1</td>
<td>20</td>
<td>464</td>
<td>4.31</td>
<td>80.6</td>
</tr>
<tr>
<td>Corrente et al.</td>
<td>2000</td>
<td>61</td>
<td>6.7</td>
<td>1</td>
<td>422</td>
<td>0.24</td>
<td>98.8</td>
</tr>
<tr>
<td>de Kanter et al.</td>
<td>1998</td>
<td>201</td>
<td>5.0</td>
<td>42</td>
<td>1005</td>
<td>4.18</td>
<td>81.1</td>
</tr>
<tr>
<td>Pröbster &amp; Henrich</td>
<td>1997</td>
<td>325</td>
<td>5.0</td>
<td>29</td>
<td>1625</td>
<td>1.78</td>
<td>91.5</td>
</tr>
<tr>
<td>Hansson &amp; Bergström</td>
<td>1996</td>
<td>34</td>
<td>6.1</td>
<td>6</td>
<td>207</td>
<td>2.90</td>
<td>86.5</td>
</tr>
<tr>
<td>Bergbreiter et al.</td>
<td>1996</td>
<td>74</td>
<td>6.5</td>
<td>8</td>
<td>481</td>
<td>1.66</td>
<td>92.0</td>
</tr>
<tr>
<td>Samama</td>
<td>1996</td>
<td>145</td>
<td>5.8</td>
<td>4</td>
<td>835</td>
<td>0.48</td>
<td>97.6</td>
</tr>
<tr>
<td>Priest</td>
<td>1995</td>
<td>31</td>
<td>5.3</td>
<td>15</td>
<td>164</td>
<td>9.15</td>
<td>63.3</td>
</tr>
<tr>
<td>Barrack &amp; Bretz</td>
<td>1993</td>
<td>127</td>
<td>5.8</td>
<td>9</td>
<td>737</td>
<td>1.22</td>
<td>94.1</td>
</tr>
<tr>
<td>Thayer et al.</td>
<td>1993</td>
<td>85</td>
<td>7.3</td>
<td>13</td>
<td>621</td>
<td>2.09</td>
<td>90.1</td>
</tr>
<tr>
<td>Creugers &amp; Käyser</td>
<td>1992</td>
<td>203</td>
<td>7.5</td>
<td>35</td>
<td>1488</td>
<td>2.35</td>
<td>88.9</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1374</td>
<td>6.0</td>
<td>187</td>
<td>8241</td>
<td>2.61 (1.68–4.06)</td>
<td>87.7% (81.6–91.9%)</td>
</tr>
</tbody>
</table>

*Based on random-effects Poisson regression, test for heterogeneity $P<0.0001$.
Cl, confidence interval.

Fig. 2. Annual failure rates [per 100 years] of RBBs.

was reported by Zalkind et al. [2003]. For this study, the estimated annual failure rate was 4.31 per 100 RBB years, translating into a 10-year survival of 65%.

Upon further investigation utilizing multivariable Poisson regression, the annual failure rate of RBBs placed in the maxilla was lower compared with that for RBBs placed in the mandible (1.07% vs. 2.36%). This difference, however, did not reach statistical significance ($P = 0.370$) [Table 3].

The survival of RBBs could not be analyzed separately with regard to the position in the dental arch (anterior vs. posterior), but two of the studies included reconstructions placed in the same region of the jaw. Kern [2005], solely evaluating RBBs placed in the anterior, reported a 5-year survival rate of 87.8%, and de Kanter et al. [1998] reported survival rates after 5 years of 81.1%.

Success
Success was defined as an RBB being free of all complications over the entire observation period. This information could not be extracted from any of the 17 studies included in this systematic review.

Biological complications
Information on two kinds of biological complications, caries and RBBs lost due to periodontitis, could be extracted from the included studies.

Dental caries
Four studies with a total of 1254 abutments gave information on caries occurring
at the abutments. In random-effects Poisson model analysis, the estimated cumulative rate of caries occurring at abutments over an observation period of 5 years was 1.5% [95% CI: 0.3–7.1%] (Table 4).

Recurrent periodontitis

Four studies provided information on periodontal disease progression resulting in loss of the entire reconstruction, and seven out of 253 RBBs were lost due to recurrent periodontitis in these studies. In standard Poisson model analysis, the estimated cumulative rate of RBBs lost due to recurrent periodontitis over a 5-year observation period was 2.1% [95% CI: 0.9–4.8%] (Table 4).

Technical complications

Debonding (loss of retention)

Debonding was the most frequent technical complication of RBBs. Debonding of the reconstruction was addressed in all included studies, and affected 436 out of the 1693 RBBs. The annual RBB complication rate ranged between 1.22 and 12.8.

In random-effects Poisson model analysis, the estimated annual rate was 4.26%, translating into a cumulative rate of debonding over a 5-year observation period of 19.2% [95% CI: 13.8–26.3%] (Table 4). The incidence of debonding was also analyzed according to the jaw position: a group of eight studies with a total of 519 RBBs placed in the maxilla and a group of seven studies with a total of 611 RBBs placed in the mandible. For the group of RBBs placed in the maxilla, the annual complication rate was estimated at 4.08%, translating into a 5-year rate of debonding of 18.4% [95% CI: 12.6–26.5%]. Similar results were obtained for the group of RBBs placed in the mandible. The annual complication rate was estimated at 3.93%, giving a 5-year rate of debonding of 17.8% [95% CI: 9.5–32.2%] (Table 3).

The studies were also divided according to the position in the mouth: a group of eight studies with a total of 674 RBBs placed on anterior teeth and a group of seven studies with a total of 461 RBBs placed on posterior teeth. The group with posterior RBBs demonstrated a higher, 22.8% [95% CI: 14.4–35%] 5-year rate of debonding, compared with the debonding rate of 14.1% (95% CI: 8.6–22.7%) for the anterior RBBs. This difference, however, did not reach statistical significance (P = 0.157) (Table 3).

Seven studies reported on the rate of RBBs lost after multiple debonding, resulting in an annual failure rate of 1.61%, translating into a 5-year failure rate of 7.7% (Table 4).

Material complications: framework and veneer fractures

Six studies reported on the loss of reconstructions due to material fractures. These included fractures of the framework or the veneer material. Thirteen out of 451 RBBs were lost due to material fractures.

The annual RBB failure rate ranged between 0% and 2.08% (Table 4). The highest annual rate of material failures was reported for all-ceramic resin-bonded reconstructions (Kern 2005).

In a random-effect Poisson model analysis, the estimated cumulative rate of RBBs lost due to material fractures over a 5-year observation period was 2.5% (95% CI: 1.3–4.7%) (Table 4).

Five studies reported on the rate of minor veneer fractures [ceramic chipping] that could be repaired without losing the reconstruction. For ceramic chipping, the annual complication rate was estimated at 1.17%, translating into a 5-year rate of 5.7% (Table 4).

Discussion

This systematic review is part of a series of six systematic reviews addressing the survival and complication rates of FDPs of different designs. In the absence of RCTs, a lower level of evidence with prospective and retrospective cohort studies was used in this as well as in the previous systematic reviews to summarize the available information about the survival and complication rates of RBBs after a period of at least 5 years.

The results of longitudinal cohort studies with a mean follow-up time of at least 5 years regarding the survival and success of RBBs and their biological and technical complications were reviewed systematically. Survival was defined as RBB remaining in situ without multiple debonding.

Multiple debonding (two or more) was considered a failure because the failure rate has been shown to increase with each rebonding. Creugers & Käyser [1992] reported a significantly lower survival rate for RBBs that were rebonded when compared with the original RBBs. Similar observations on RBBs with multiple debonding were also reported by other authors [Marinello et al. 1990].

In several of the studies included, only debonding was reported. There was a mixture of definitions for survival, ranging from ‘complete’ survival with no debonding to ‘functional’ survival, with previous loss of retention, but functional after reattachment. Biological complications and technical complications were not routinely reported.

<table>
<thead>
<tr>
<th>Table 3. Annual failure and debonding rates analyzed according to the position of the resin-bonded bridges (RBBs) in the mouth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Survival Maxilla</td>
</tr>
<tr>
<td>Debonding Maxilla</td>
</tr>
<tr>
<td>Survival Mandible</td>
</tr>
<tr>
<td>Debonding Mandible</td>
</tr>
</tbody>
</table>

*Based on multivariable random-effect Poisson regression.  †Based on random-effects Poisson regression. CI, confidence interval; NA, not available.
It must be acknowledged that information on long-term survival is still scarce, and the results of the present review should not be extrapolated to follow-up times measured in decades. The present review, although there was no language restriction in the present systematic review, the inclusion of studies published in languages other than English (Egger et al. 2003), did not yield additional studies for final inclusion. This concurred with an empirical study, which found little effect on the combined effect estimates in meta-analyses of RCTs, with the inclusion or exclusion of studies published in languages other than English (Egger et al. 2003).

Instead of performing a formal quality assessment of the included studies and sensitivity analysis, this review used stringent inclusion criteria. For example, only studies with clinical follow-up examinations were included to avoid the potential inaccuracies in event description in studies that based their analysis on patient self-reports.

The present systematic review reported a cumulative failure rate for RBBs of 12.3% after 5 years. Clearly, a limitation of the present review is the assumption of a constant annual event rate. Nevertheless, the results of the present analysis should be robust as only information of studies with a mean follow-up of 5 years or more was included. The survival rate of this study was higher when compared with another meta-analysis on RBBs with a shorter follow-up period (Creugers & Van’t Hof 1991). In that study, the survival rate at 4 years was 71%. The higher survival rate at 4 years was 71% in the present systematic review was possibly due to improvements in the technique utilized in newer studies.

It is important to note that the cumulative failure rate for RBBs of 12.3% after 5 years would be lower if a more conservative method was used in the technical selection of teeth used in RBBs. For example, the use of minimal tooth preparation is considered sufficient by most authors. The extension of the tooth preparations with a wrap-around design, grooves, and rest involved in the tooth design, grooves, and rests, which have been used in recent years to increase retention for RBBs placed on posterior teeth, cannot qualify as a conservative method.

Table 4. Biological and technical complications

<table>
<thead>
<tr>
<th>Study</th>
<th>Year of publication</th>
<th>Total no. of abutments</th>
<th>Total no. of RBBs</th>
<th>Estimated rate of RBBs lost due to periodontitis (per 100 RBB years)</th>
<th>Estimated rate of RBBs lost due to veneer or framework fractures (per 100 RBB years)</th>
<th>Estimated rate of RBBs lost due to multiple debonding (per 100 RBB years)</th>
<th>Estimated rate of debonding (per 100 RBB years)</th>
<th>Estimated rate of minor veneer fractures (repairs) (per 100 RBB years)</th>
</tr>
</thead>
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<td>0.50 (0.26–0.97)</td>
<td>1.61 (0.32–1.30)</td>
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<tr>
<td>Summary estimate event rates (95% CI)</td>
<td>0.30 (0.06–1.47)</td>
<td>0.41 (0.18–0.97)</td>
<td>0.50 (0.26–0.97)</td>
<td>1.61 (0.32–1.30)</td>
<td>4.26 (2.97–6.12)</td>
<td>1.71 (0.57–2.41)</td>
<td>5.71 (2.8%–11.4%)</td>
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<tr>
<td>Cumulative 5-year complication rates (95% CI)</td>
<td>1.5% (0.3–7.1%)</td>
<td>2.1% (0.9–4.8%)</td>
<td>2.5% (1.3–4.7%)</td>
<td>7.7% (4.2–14.1%)</td>
<td>19.2% (13.8–26.3%)</td>
<td>5.7% (2.8%–11.4%)</td>
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*Based on random-effects Poisson regression.
†Based on standard Poisson regression.
CI, confidence interval; NA, not available; RBB, resin-bonded bridge.
Creugers et al. [1989a] reported better retention with micromechanical retention when compared with macromechanical retention, and cements like Clearfil F® and Panavia Ex® (Carex/Kurary, Haarlem, the Netherlands) were better than Conclude® (3M Dental Products, St Paul, MN, USA) when used with micromechanical retainers.

The present systematic review reported lower failure rates for RBBs placed in the maxilla compared with RBBs placed in the mandible. Moreover, the rate of debonding was lower for RBBs placed on anterior teeth compared with those placed on posterior teeth. This is in agreement with the results from Creugers et al. [1980b], who reported the highest survival rate for anterior RBBs and that the mandibular posterior RBBs had the highest debonding rates.

The studies included were mainly conducted in an institutional environment, such as universities or specialists’ clinics. Therefore, the long-term outcomes observed here could not be generalized to dental services provided in private practice. In a study based on annual reports of government agencies administering dentistry in the regions of England, Wales and Scotland, a high failure rate of RBBs was reported in the General Dental Services of the National Health Service [Hussey & Wilson 1999]. Although RBBs were more inexpensive when compared with conventional FDPs, the cost of managing complications, like rebonding the RBBs, was very high over the 10-year observation period.

When considering the fact that RBBs were initially developed as an interim restoration, they have a good survival rate of 87.7% after 5 years. However, when comparisons were made with conventional FDPs [Pjetursson et al. 2007], and implants [Jung et al. 2008], RBBs had lower survival rates.

It is of interest to compare the evidence available for RBBs and implant-supported SCs, where several parallels and differences can be drawn. In a recent systematic review on implant-supported SCs, 26 studies were included [Jung et al. 2008]. However, only 15% or 50% of those studies gave information on the survival of the reconstructions. The remaining 13 studies only reported on the survival of the implants, but gave no detailed information on the suprastructure. In the present systematic review, 17 studies were included, but as for the implant-supported SCs, only 12% or 70% of those studies reported on the survival of the reconstructions. The remaining studies gave detailed information on debonding of the reconstructions without mentioning their survival.

It seems that studies in the dental literature often concentrated on one aspect of the reconstruction without reporting on the functional survival of the reconstruction. Functional survival of the reconstruction is of great importance from the clinical point of view, as it presents the reconstructions that are functional in the patients’ oral cavity, which is perceived by the patients as a surrogate for ‘success.’

The implant-supported SCs showed a lower annual failure rate, 1.14% (95% CI: 0.85–1.56%) [Jung et al. 2008], compared with an annual failure rate of 2.61% (95% CI: 1.68–4.06%) for RBBs. This translates into 5-year survival rates of 94.5% and 87.7%, respectively. Thus, it should be cautioned that on the basis of the annual failure rate, there may be more failures per year for RBBs when compared with implant-supported SCs.

From the literature, few 10-year follow-up studies were available. For implant-supported SCs, the longest mean observation period was 10 years [Brägger et al. 2005], while that for RBBs was 9.1 years, as reported by Zalkind et al. [2003]. From these studies, the annual failure rate was 1.2% and 4.3% for implant-supported SCs and RBBs, respectively. This translates into a 10-year survival rate of 89.4% for implant-supported SCs compared with a 10-year survival rate of 65% for RBBs.

Therefore, more long-term studies with a follow-up period of 10 years or more, would provide a better insight into the longevity of RBBs.

Literature-based systematic reviews of prognosis and survival outcomes are hampered by a variety of problems [Altman 2001]. The present systematic review revealed several shortcomings in the previous clinical studies. Hence, it appears appropriate to make the following recommendations: long-term cohort studies on RBBs should be prospective and should have complete follow-up information, preferably with a similar length of follow-up for all patients. This means that data on well-defined time periods should be reported for the entire cohort, especially for the different years after insertion.

Conclusion

Despite the high survival rate of RBBs after 5 years, technical complications such as debonding are frequent. This, in turn, means that substantial amounts of extra chair time may by needed following the incorporation of RBBs. Thus, there is an urgent need for prospective studies with a follow-up time of 10 years or more, to evaluate the long-term outcomes of RBBs.

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References


Pjetursson et al. Systematic review of resin-bonded bridges


List of excluded full-text articles and the reason for exclusion


