Resin Bonded bridges: Is it an option in Libya: Audit Study

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Abstract

Statement of the problem: Resin bonded bridges (RBBs) have been used to restore edentulous spaces for many years and offer many advantages as a conservative approach to tooth replacement over conventional full coverage fixed prosthesis. However, the use of this treatment option has been limited. Therefore, the aim of this study was to assess the knowledge and attitude of dentists in Libya, including general dental practitioners (GDPs) and prosthodontics and restorative specialists (SPs), toward RBBs.

Methods: In this study, questionnaires designed to survey knowledge of RBB performance factors were distributed to GDPs and SPs (n = 200). Specifically, opinions of GDPs and SPs regarding clinical, mechanical, technique and patient-dependent performance factors of RBBs were obtained. Average significance and tests were used to identify the frequency, pattern, and significance of the response variables identified.

Results: A majority (78%) of the subjects reported using RBBs in less than 7% of their pros- prosthodontics cases. The most common reason for the limited clinical application of RBBs was observed poor retention (33%). In addition, SPs regarded the influence of enamel structure, number of pontics, cement type, RBB design, and surface treatment as "very significant" factors with respect to RBB survival. Overall, a statistically significant difference was observed between the responses of GDPs and SPs regarding their knowledge of performance factors for RBBs.

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Conclusion: In the light of this study, the different resin-bonded bridges appear to provide acceptable option for replacing single missing tooth. In comparison to SPs, GDPs reported greater disagreement with current standards for RBB success factors. Moreover, 52% of SPs and 61% of GDPs used RBBs for less than 7% of their prosthodontics cases. Therefore, continuing education opportunities are needed for practicing den-dentists, and undergraduate students need to receive greater exposure to the clinical application of RBBs.

Keywords; resin bonded bridge, adhesive bridge, awareness, attitude, dental practioner, specialist.

1. INTRODUCTION

Resin-bonded bridges (resin-retained adhesive bridges, minimally prepared bridge) have been used to restore edentulous spaces for decades. They has advantages over conventional full-coverage fixed partial dentures, including reduced cost and high patient satisfaction.

Resin bonded bridges (RBBs) offer a conservative and cost effective approach to the restoration of space compared to conventional bridgework (Cheung et al., 2005). Specifically, RBBs allow for the preservation of tooth structure and loss of abutment, preservation of pulp vitality, minimal soft tissue interaction (Djemal et al.. 1999: 1bbetson. 2004: Pjetursson et al, 2008).

Although the failure rates of resin-bonded bridges is higher than that of the conventional bridgework, the failure of a resin-bonded bridges is often less catastrophic than the failure of a conventional bridge which usually involves caries, apical pathology and abutment loss (Pjetursson et al, 2008). Conventionally, these restorations consist of ceramic bonded to a non-precious metal substructure but recently fibre-rein forced composite resin and high-strength ceramic materials have been also used as alternatives to metal frameworks for resin-bonded bridges.

The early 'Rochette-bridges' had a high rate of failure: a study by Creugers et al., (2000) on non-perforated cast-metal resin-bonded non-perforated cast-metal resin-bonded bridges

inserted in 1983-1984 reported a survival rate after 7.5 years in the posterior regions of only 28%. Since then resin bonded bridges have evolved including developments in metal surface treatment resin cements and framework design, all of which have improved the clinical success of these bridges. Today's conventional metal framed, resin-bonded bridges are made of non-perforated, sandblasted, non-precious metal substructure cemented with a chemically active resin cement. Single-abutment cantilever design to have a significantly lower risk of failure and greater longevity than resin-bonded bridges with two abutments. One large study found that the median survival of fixed-fixed designs was 7.8 years compared to 9.8 years of cantilever designs.

In a systematic review of survival and complication rates for RBBs over a five-year period that was conducted by Pjetursson et al., (2008), an estimated survival rate of 87.7% was reported. Clinical success rates ranging from seven to nine years have also been reported, provided that vital success factors are respected (Djenal et al., 1999; Garnett et al., 2006 Pjetursson et al., 2008). Specifically, the clinical performance of RBBs has been found to depend on factors that can be classified as: patient-related (e.g., saddle span, location, remaining enamel, and parafunction), design-related (e.g., retainer type, thickness, connector height), and technique-related (e.g., cement, retainer treatment, and isolation method) (Djemal et al., 1999) Established standards (Garnett et al.. 2006: Miettinen and Millar, 2013) related to the design and retainers of RBBs for clinical success include: increased longevity for cantilever designs (van Dalen et al., 2004; Kern. 2005), maximum enamel coverage by retainers, sandblasted and non-perforated retainers, and nickel chromium alloy framework (Djemal et al., 1999). Furthermore, a minimum retainer thickness of 0.7 mm and a minimum connector height of 2 mm have been recommended (Smyd. 1961; Tbrahim et al., 1997).

The knowledge and application of vital performance factors for RBBs are key to the successful application of RBBs as a definitive treatment option .The teaching and training of undergraduates and postgraduates regarding RBBs is reflected in the clinical attitudes and clinical application of this restoration method by general dental practitioners (GDPs) and

prosthodontics and restorative specialists (SPs). It is hypothesized that RBBs are not widely performed in clinical practice due to concerns regarding the reliability of this treatment. While this uncertainty among clinicians may be multifactorial, if the reasons for this uncertainty can be identified and addressed, more effective use of RBBs may be achieved.

Correspondingly, it is important to estimate the clinical use of RBBs in Libya and to evaluate awareness of the factors needed to successfully perform RBBs. As a result, reasons for the limited application of these restorations may be ascertained.

To date, there have been no reports to evaluate the attitudes and knowledge of RBB performance factors between GDPs and SPs. Hence, the aim of this study was to assess perceptions and knowledge of essential performance factors for RBBs by GDPs and SPs in Libya.

2. Materials and methods

This study was conducted among GDPs and SPs in Libya. The former graduated as dentists and had completed at least one-year of an internship. The SPs involved in this study had completed a postgraduate specialist program in prosthodontic and restorative dentistry. Participants also had to be currently engaged as a dental practitioner and/or have a teaching position. Contact details for the enrolled clinicians were obtained from the office of the Libya Society Ministry of health. Although a sample size of 200 was considered sufficient for statistical analysis. Stratified random sampling was performed to select study particıpants, and GDPs and SPs were considered two distinct strata. The ethics committee of the College of Research Centre committee approved the study protocol.

A structured, self-administered questionnaire composed of 17 questions was attached to a study description and a consent for participation form. These packets were hand delivered (n = 200). To maximize the responses obtained, participants were reminded to return their questionnaires three weeks and six weeks after the questionnaires were distributed.

The questionnaire comprised of seventeen close-ended, multiple-choice questions which were designed to extract the opinion and understanding of the respondent regarding performance

factors for RBBs. The questions were related to clinical indications, prosthesis design, retainer type and dimensions, retainer surfaces, tooth preparation, desired cements, and clinical technique. The last part of the questionnaire contained a single table grid question that was designed to identify the participants' opinions regarding the significance level of vital factors related to the clinical success of RBB therapy. These factors included: remaining abutment enamel, area of the mouth where the RBB is placed, number of missing teeth to be replaced, RBB design, type of retainer, retainer surface treatment, connector height, retainer thickness, tooth preparation, cement type, and use of RD during cementation. The respondents could provide Scores ranging from one to five, with a score of one indicating a factor is very insignificant, and a score of five indicating a factor was very significant. Factors designated as insignificant, neutral, and significant received scores 2-4, respectively.

A single investigator analyzed all of the returned questionnaires. Average significance was determined to identify the frequency, pattern, and significance of the response variables identified (e.g. performance factors for RBBs). Using the Statistical Package for Social Sciences (SPSS) version 17 (Chi cago, Illinois, USA), Chi-square tests were used to compare the responses of GDPs and SPs for each question in regard to the response options. A p-value less than 0.05 was considered statistically significant.

Table INumerical summary or partcpant tesponses to survey questions.

Question	Question	Response options	SPs (%)	GDPs (%)	Chi-squared	p-Value
1.	For what percentage of your tooth replacement cases have RBBs employed?	<10	52%	60%	5.081	0.165
		10-20%	35%	23%		>
		21-30%	7%	10%		
		31-40%	5%	5%		

2.	How long have you been practicing dentistry?	<5 years 5-10 years >10 years	20% 57% 51%	14% 28% 56%	0.117	0.943<
3.	What type of restoration do you consider RBBs provide?	Permanent Provisional Both	75% 20% 5%	91% 9% 00%	7.094	0.0288
4.	Does the amount of remaining enamel affect the success of RBBs?	Yes No	75% 25%	92% 8%	15.073	0.0001
5.	In which area of the mouth are RBBs the most successful?	Ant Max Ant Mand Post Max Post Mand No effect	74% 22% 11% 5%	64% 16% 9% 7%	7.594	0.107
6.	How many missing teeth should be replaced for maximum longevity of a RBB?	One Two Three	65% 31% 14%	62% 19% 9%	0.484	0.9223
7.	Which RBB design provides maximum longevity?	Fixed-fixed Cantilever Does not affect	%70 %25 %5	70% 15% 2%	6.218	0.0446

8.	Which RBB retainer provides maximum longevity?	Perforated Non-perforated Both are equal	51% 57% 5%	20% 54% 22%	36.623	0.0001<
9.	Does retainer surface treatment increase RBB longevity?	Yes No	91% 9%	92% 8%	14.491	0.0001
10.	Does connector height affect longevity?	Yes No	90% 9.33%	81% 19%	0.243	0.622
11.	What is the optimum height for a connector?	2 mm 3 mm 4 mm	57% 48% 8%	31% 68% 4%	8.204	0.041
12.	Does preparing teeth for retentive features improve longevity?	Yes No	83% 17%	72% 28%	2.886	0.089
13.	Which cement type provides maximum longevity?	RBC GIC	91% 9%	71% 28%	18.916	0.001<

14.	Does the use of rubber dam improve longevity?	Yes No	80% 20%	82% 18%	16.335	0.001<
15.	Does thickness of a retainer affect longevity?	Yes No	80% 20%	45% 27%	1.831	0.176
16.	What is an optimum thickness for a retainer?	0.3 mm 0.5 mm 0.7 mm	5% 85% 22%	5% 18% 76%	6.632	0.084
17.	Which type of occlusion RBBs are the most successful?	Class I Class II Class 111 Has no effect	50% 10% 10% 28%	7% 55% 19% 17%	6.069	0.108

3. Results

Of the 200 questionnaires that were distributed, 145 were returned response rate (72%). The response rate for the SPs was 87% (35/40) and for the GDPs it was 69% (111/160). Both groups had comparable clinical experience (p =0.943) (Table 1). For 52% of the SPs and 60% of the GDPs, RBBs were performed for less than 10% of the available prosthodontics cases. In

addition, the majority of SPs (75%) considered RBBs a permanent restoration, compared with 8% of GDPs who regarded RBBs only as a provisional option (p = 0.02).

Regarding design and mechanical factors associated with RBBs (Table 1), about 70% of both the SPs and GDPs selected fixed-fixed as the most successful RBB design. However, 25%o of SPs opted for cantilevers, thereby resulting in a significant difference in opinion between the two groups (p0.04). For 50% of SPs, non-perforated retainers were associated with the clinical success of RBBs. In contrast, 54% of GDPs associated perforated retainers with better RBB performance. However, of the SPs (90%) of the GDPs agreed that retainer surface treatment improves longevity (86%.41) ($p < 0.001$).

The optimum connector height selected by SPs (50%) and GDPs (68%) was 3 mm (p = 0.04). For optimum retainer thickness, 0.5 mm choice (SPs 75 and GDPs 18%; p = 0.084), followed by 0.7 mm (76%) according to GDPs. However, for both groups (SPs 57% and GDPs 62%), preferred that only one tooth should be replaced by RBB, while 20% labored the use to two pontics (p= 0.922).

A greater percentage of the anterior maxilla was considered the most favorable location for achieving a successful RBB (both SPs and GDPs , 65%) followed by the anterior mandible (SP, 20%, GDP, 16%). Class I was also the most preferred jaw relation. A total of 34% of GDPs selected glass ionomer cement (GIC) as their first choice for RBB cementation, while majority of the SPs (80%) and a majority of GDPs (72%) preferred RBC.

4. Discussion

This study presents a unique comparison of data designed to evaluate the knowledge and perception of factors related to the successful clinical performance of RBBs between GDPs and SPs in Libya. The overall response rate for the questionnaire distributed was 72% (78% for SPs and 70% for GDPs). In comparison, the response rate for paper surveys was previously reported to be 50-55% (Baruch and Brooks, 2008). The higher than average response observed in the present study is attributed to the multiple reminders that were distributed to participants,

a method previously reported to improve response rates (Dommeyer et al., 2004). Of the respondents, 54% of the SPs and 39% of the GDPs had more than 10 years of clinical experience. Due to the statistical similarity of this clinical experience (p 0.943), an effective comparison of the available data sets was performed. A majority of the SP and GDP groups (60% and 71%, respectively) used RBBs for less than 10% of the prosthodontics cases in their clinical practice. Low levels of confidence in performing these restorations and pessimism regarding the longevity of RBBs were reasons given for the limited use of RBBs. For example, 75% of SPs and of GDPs classified RBBs as only a permanent restoration, and not as a provisional restoration.

In a recent systematic review, survival rates for RBBs were found to be 87.7% compared with 90% for conventional bridges over a period of five years (Pjetursson et al., 2008). It is accepted that adhesive bonding of a RBB warrants strict isolation and a meticulous enamel bonding technique, since these factors have been found to directly impact the prognosis of RBBs (Audenino et al., 2006).

A fixed-fixed (FF) design was the preferred choice for both groups of respondents, with only 25% of SPs opting for a cantilever design. However, many dental professionals prefer initially support the use of a cantilever due to differential abutment movement and partial retainer failure that has been associated with the FF design (Chan and Barnes, 2000: van Dalen et al., 2004: Kern, 2005). While the FF design can be used to gain surface area in cases involving short abutments and a long span, the FF choice in the present study is contrary to established facts. However, the success of a cantilever RBB is not straightforward, and informed case selection is a key to its successful application.

In the present survey, Maryland non-perforated RBBs were associated with greater success according to the opinion of the SP group (50%), which is a perspective that is consistent with many other research reports (Bastos et al., 1991; Boyer et al., 1993). In contrast, 42% of the GDP group associated Rochette (Perforated)-type retainers with better performance. This indicates that GDPs may have an inaccurate impression of design-related RBB success factors.

Regarding connector height, approximately 95% of respondents indicated that a height of 2 mm and above was optimal, and this is consistent with previously published standards (Ibrahim et al., 1997). In the present study, more than half of the respondents from each group selected less than 0.7 mm as an optimum thickness. However, it has been shown that the lesser the thickness of a retainer, the greater the chance that a framework may flex and debond (Smyd. 1961). all subjects agreed that remaining tooth enamel affects the success of a RBB.

For patients with tooth wear, hypodontia, and trauma, there tends to be less enamel available for resin bonding. As a result, the available bonding surface area is decreased, and in some cases, this can enhance debonding (Djemal et al., 1999). However, the notion the tooth preparation for RBBs improves retention remains controversial.

While most authors recommend that tooth preparation is not needed or can be minimal (Botelho, 2000: Ibbetson 2004), both SPs and GDPs respondents (a total of 82%) strongly expressed that tooth preparation increases RBB survival. Conversely, however, tooth preparation results in dentine exposure, which increases the potential for sensitivity and reduced bond strength.

Almost 74% of all respondents agreed that the anterior maxilla was the most successful site for a RBB, followed by the anterior mandible (SP, 22%; GDP. 16%). These results are consistent with those of previous studies (Boyer et al., 1993. Boening, 1996: De Rijk et al., 1996, Howard-Bowles et al. 2011). However, 34% of GDPs associated GIC with improved RBB performance compared with RBC, which is contrary to popular belief. Bonding RBBs under isolation using RD is currently considered the gold standard, as it provides the best possible chance of survival (Audenino et al., 2006, Gilbert et al., 2010). However, 29% of GDP respondents did not report the use of RD for RBB cementation.

The most important performance factors for RBB were previously reported to include: patient selection. Design, mechanical features, and clinical technique (Djemal et al., 1999). In the present study, SPs designated the following remaining enamel structure, number of pontics, cement type, design, and retainer surface factors to be very significant treatment. In contrast,

the GDPs only reported the length of a span (e.g., number of pontics) as "very significant". In addition, designs with four or less units were regarded as more successful. However, the latter is related to an increased debonding risk due to the presence of more retainers, rather than the length of the span involved (Djemal et al., 1999).

Overall, it was observed that GDPs considered most of the performance factors surveyed (e.g., design, restoration type, retainer type and thickness, occlusal classification, and cement type) to be important for RBBs. In contrast, SPs considered bridge design, retainer thickness, and occlusal classification to be important factors. However both sets of factors are inconsistent with contemporary RBB standards.

5. Conclusion

Within the limitations of the present study, the following observations were made:

- GDPs and SPs (prosthodontic and restorative) exhibit differences in their knowledge and understanding of the factors that affect the clinical performance of RBBs.
- Of the respondents for this study, 52% of SPs and 60% of GDPs used RBBs for less than 10% of the tooth replacement prosthodontics cases treated in their clinical practices. Poor retention was the most common reason given for not using RBBs.
- Regarding the successful application of RBBs, SPs regarded the following factors to be "very significant": enamel structure, number of pontics, cement type, RBB design, and retainer surface treatment.

References

1. Audenino, G.. Giannella, G., Morello, G.M.. Ceccarelli, M.. Carossa.S., Bassi, F.. 2006. Resin-bonded fixed partial dentures: ten-year follow-up. Int. J. Prosthodont. 19, 22-23.
2. Baruch, Y.. Brooks. H.. 2008. Survey response rate levels and trends in organizational research. Hum. Relations 61, 1139 1160. August.

3. Bastos, M.T.. Mondelli. J., Ishikirima. A.. Navarro, M.F.. 1991. Tensile strength of five types of retention for resin-bonded prostheses. J. Prosthet. Dent. 66. 759 762.
4. Boening. K.. 1996. Clinical pertormance or resin-bonded fixed partial dentures. J. Prosthet. Dent. 76, 39 4-4.
5. Botelho. M., 2000. Design principles for canulevercd resin- bonded fixed partial dentures. Quintessence Int. 31, 613-619.
6. Botelho. M.G., Leung, K.C.. Ng, H., Chna, K.. 2006. A retrospective clinical evaluation of two-unit cantilevered resin-bonded fixed partial dentures. J. Am. Dent. Assoc. 137 (6). 783-788.
7. Boyer, D.B., Williams, V.D.. Thaer. K.E.. Denehy. G.E., Diaz Arnold. A.M., 1993. Analysis of debond rates of resin-bonded prostheses. J. Dent. Res. 72. 1244-1248.
8. Chan, A.W., Barnes, 1.E., 2000. A prospective study of cantilever resin-bonded bridges: an initial report. Aust. Dent. J. 45, 31-36.
9. Cheung. G.S.P., Lai, S.C.N.. Ng. R.P.Y.. 2005. Fate of vital pulps beneath a metal-ceramic crown or a bridge retainer. Int. Endo J. 38.521-530.
10. Creugers, NH., De Kanter, R.J.A.M. 2000. Patients' satistaction in two long-term clinical studies on resin-bonded bridges. J. Oral Rehabil. 27, 602-607.
11. Creugers, N.H., De Kanter, R.J.A.M.. De Kanter. R.J.A.M.. Van't Hof. M.A. 1997. Long-term survival data from a clinical trial on resin-bonded bridges. J Dent. 25. 239 242.
12. De Rijk. W.G., Wood, M., Thompson. VP. 1996. Maximum likelihood estimates lor the lhletume of bonded dental prostheses J. Dent. Res. 75. 1700-1705.
13. Djemal, S., Setchell, D.. King. P.. Wickens, J.. 1999. Long-term survival characteristics of 832 resin retained bridges and splints provided in a post-graduate teaching hospital between 1978 and 1993 J. Oral Rehabil. 26. 302-320.

14. Dommeyer. C.J., Baum. P. Hanna, R.W. Chapman, K.S.. 2004.Gathering 1aculty teaching evaluations by in-class and online Surveys. their effects On response rales and evaaluations. Assess Eval. Higher Educ. 29. 611 623.
15. Garnett. M.J.. Wassell, R.W. Jepson. N.J.. Nohl. F.S., 2006. Survival of resin-bonded bridgework provided for post-orthodontic hypodontia patients with missing maxillary lateral incisors. Br. Dent. J.201, 527-534.
16. Gilbert, G.H. Litaker. MS. Pihlstron, D.J, Amundson. C.W.,Gordan, V,V., 2010. Rubber dam use during routine operative dentistry procedures: findings from the Dental PBRN. Oper. Dent.35 (5). 491 499, Sep-Oct doi 10.2341/09-287C.
17. Howard-Bowles. E. MeKenna, G.. Allen, F. 2011. An evidence based approach for the provision of resin-bonded bridgework. Eur. J.Prosthodont Restor. Dent. 19, 99-104.
18. Ibbetson, R., 2004. Clinical considerations for adhesive bridgework.Dent. Update 31, 254 265.
19. Ibrahim, AA, Byrne, D., Hussey, D.L., Claffey, N., 1997. Bond strengths ol maxillary anterior base metal resin- bonded retainerswith different thicknesses. J. Prosthet. Dent. 78. 281-285.
20. Jepson, N.J.. Nohl, F.S., Carter, N.E., et al, 2003. The interdisciplinary management of hypodontia: restorative dentistry. Br. Dent. J.194, 299 304.
21. kern, M., 2005. Clinical long-term survival of two-retainer and single retainer all-ceramic resin-bonded fixed partial dentures. Quintes-sence Int. 36, 141-147.
22. Ketabi, A.R.. Kaus. T.. Herdach, F., Groten. M.. Axmann-Kremar,D. Pröbster, L. Weber. H. 2004. Thirteen-year follow-up study of resin-bonded lixed partial dentures. Quintessence Int. 35 (5). 407410.
23. Lin. C.L. Lin, T.S., Hsu, K.W.. Wu, CH., Chang. C.H., 2003. Numerical investigation of retaner thickness affecting retention in posterior resin-bonded prOsthesis using the linite element method.Chin. Inst. Eng. 26, 781-789.
24. Miettinen, M., Millar, B.J.. 2013. A review of the success and failure characteristics of resin-bonded bridges. Br. Dent. J. 215, 76-77.
25. Pjetursson, B.E.. Tan. W.C. Tan, K.. Bragger, U.. Zwahlen, M. Lang. N.P.. 2008. A systematic review of the survival and complication rates of resin-bonded bridges alter an observationperiod of at least 5 years. Clin. Oral Implants Res. 19, 131-141.
26. Robertsson, S.. Mohlin. B., 2000. The congenitally missing upper lateral incisor a retrospective study ol orthodontic space closure versus restorative treatment. Eur. J. Orthod. 22, 697-709,.

27. Smyd, S.E, 1961, The role of torque. torsi011, and bending in prosthodontics failures, J. Pros. Dent. 11, 95-111.
28. van Dalen, A., Feilzer, A.J.. K leverlaan, C.J., 2004. A literature review of two-unit cantilevered FPDs. Int. J. Prosthodont. 17, 281-284.
29. Wood, M., Kern, M., Thompson, V.P., Romberg, E., 1996. Ten-year clinical and microscopic evaluation of resin-bonded restorations Quintessence Int. 27, 803-807.