**Critically Appraised Topic (CAT)**

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| **Project Team:**  |
| **7B-5** |
| **Project Team Participants:**  |
| **Magdelyn Mueller, Jessica Wertz, Kelsi Salzewedel and Elbethel Defare** |
| **Clinical Question:** |
| **What is the minimum crown to root ratio for removable partial denture abutment teeth?** |
| **PICO Format:** |
| **P:** |
| **Removable partial denture abutment teeth**  |
| **I:** |
| **The clinically accepted crown to root ratio (~1:1)** |
| **C:** |
| **Crown to root ratios that deviate from the clinically accepted ratio** |
| **O:** |
| **Significantly better prognosis**  |
| **PICO Formatted Question:** |
| **For removable partial dentures, does the clinically accepted crown to root ratio of 1 to 1 have a significantly better prognosis than an abutment that deviates from this ratio?** |
| **Clinical Bottom Line:** |
| **When treatment planning an RPD case with a potential abutment tooth that has a crown to root ratio that is less than the clinically accepted 1:1, is it more advantageous to extract and utilize the adjacent tooth which may have a more generally accepted crown to root ratio as the abutment?** |
| **Date(s) of Search:**  |
| **10/15/2020, 10/29/2020, 11/11/2020** |
| **Database(s) Used:** |
| **PubMed** |
| **Search Strategy/Keywords:** |
| **Articles restricted to**  |
| **MESH terms used:** |
| **Dental abutments; Denture, partial; Prognosis; Tooth Crown/ anatomy & histology; Tooth root/ anatomy & histology** |
| **Article(s) Cited:** |
| 1. Grossmann Y, Sadan A. The prosthodontic concept of crown-to-root ratio: a review of the literature. *J Prosthet Dent*. 2005;93(6):559-562. doi:10.1016/j.prosdent.2005.03.006
2. Tada S, Allen PF, Ikebe K, Zheng H, Shintani A, Maeda Y. The Impact of the Crown-Root Ratio on Survival of Abutment Teeth for Dentures. *J Dent Res*. 2015;94(9 Suppl):220S-5S. doi:10.1177/0022034515589710
3. Tada S, Ikebe K, Matsuda K, Maeda Y. Multifactorial risk assessment for survival of abutments of removable partial dentures based on practice-based longitudinal study. *J Dent*. 2013;41(12):1175-1180. doi:10.1016/j.jdent.2013.07.018
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| **Study Design(s):** |
| 1. A literature review that looks to assess the prosthodontic effect of the crown to root ratio, with special emphasis on teeth that are periodontically compromised. This study looked at peer-reviewed English dental literature between 1966 and 2003.
2. A longitudinal practice-based study looking to analyze the impact of CRR on the survival of abutment teeth for removable partial dentures. Survival was analyzed using Kaplan-Meier methods and Cox’s proportional hazard regression. Data collected from 147 patients provided with RPDs at a dental hospital in Japan with analysis of 236 clasp retained RPDs and 856 abutment teeth analyzed. Abutment teeth were divided into 1 of 5 risk groups according to CRR ((A (<0.75), B(0.76-1.00), C(1.01-1.25), D(1.26-1.50), E(>1.51)).
3. A practice based longitudinal retrospective study looking to determine the prognostic factors affecting the survival period of RPD abutments utilizing a multifactorial risk assessment. Survival of abutment teeth was estimated using the Kaplan-Meier method. Multivariate analysis was conducted by Cox’s proportional hazard modeling.
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| **Reason for Article Selection:** |
| The articles selected for this presentation were all based on their analysis of CRR that directly related to the clinical case presented in this presentation. All of these articles were either literature reviews (1), or longitudinal practice-based studies (2 and 3), that aimed at analyzing the impact of CRR on the survival period for RPD abutments. Article (1), “The prosthodontic concept of crown-to-root ratio: A review of the literature,” by Grossmann and Sadan, was chosen as it reviewed the current literature available for analyzing the effect of CRR on restorability, however the conclusions reached indicated a need for further research before any definitive definition could be established proves to be limited in usefulness to answering our clinical question posed. Article (2), “The Impact of the Crown-Root Ratio on Survival of Abutment Teeth for Dentures,” was the most applicable to the question posed in our clinical case, providing quantitative data for the selection of the abutment teeth. Article (3), “Multifactorial risk assessment for survival of abutments of removable partial dentures based on practice-based longitudinal study,” was selected as not only does this article discuss the effect of crown to root ratios on the survival of a removable partial denture abutment, the study also looks to identify other significant prognostic factors in the abutment survival period.  |
| **Article(s) Synopsis:** |
| 1. The literature review by Grossmann and Sadan looks into the assessment and prosthodontic impact of the crown to root ratio, in particular with periodontally compromised teeth. The purpose of this study was to assess the dispute as to the impact of crown to root ratio on diagnosis and treatment planning. This review looked at peer-reviewed English dental literature from 1966 to 2003 using Medline in addition to a manual search for peer-reviewed articles and textbooks. The results of this inquiry were that there is a lack of consensus and evidence-based research on this topic. The influence of CRR on diagnosis and treatment planning for periodontally compromised teeth has yet to be adequately studied. The conclusion of this study was that the clinical guideline for the evaluation of abutment teeth should include crown to root ratio only with other multiple clinical parameters which were numerous, including abutment mobility, total alveolar bone support along with others. It was concluded that the remaining periodontal bone support provides more accurate information than the linear measurement of the ratio.
2. The purpose of this longitudinal practice-based study was to assess the impact of CRR on the survival of abutment teeth for removable partial dentures. This individual cohort study was conducted from data collected from 147 patients provided with RPDs at a dental hospital in Japan. The study included 236 clasps retained RPDs with 856 abutment teeth analyzed. Patients with immediate RPDs and dentures with complex designs like maxillofacial prostheses or lingual plate connected dentures and patients who did not receive a conservative periodontal maintenance program at least once a year during the observational period were excluded. The data collected was assessed using the Kaplan-Meier methods and Cox’s proportional hazard regression to determine the statistics for the survival of abutment teeth. Adjustments were made for clinically relevant factors including age, sex, frequency of periodontal maintenance programs, occlusal support area, type of abutment tooth, status of endodontic treatment, and probing pocket depth. The abutment teeth were divided into 1 of 5 risk groups according to the CRR. The groups consisted of A (<0.75), B(0.76-1.00), C(1.01-1.25), D(1.26-1.50), E(>1.51). The results of the study indicate that the survival rates of groups A, B and C were found to be similar and favorable, while the results from groups D and E proved to have a lower prognosis. A higher CRR was found to be associated with a higher risk of abutment tooth loss among RPD wearers, however the study indicates that between a CRR of <0.75 and a CRR of 1.01-1.25 the outcomes were favorable. This study looked to quantify the guideline for CRR on the threshold that should drive treatment planning decision making, however there did exist limitations to the study as the patient population was limited, and the study itself was a retrospective study making it difficult to obtain complete data for all of the patients leading to the exclusion of some of the collected data.
3. The purpose of this practice-based longitudinal study was to determine the prognostic factors affecting the survival period of RPD abutments using a multifactorial risk assessment. This study was performed on the same cohort as the study cited in (2) above. The data was collected from 147 patients provided with RPDs at a dental hospital in Japan, however this retrospective cohort study aimed at analyzing the multifactorial risk assessment affecting RPDs, and determining the prognostic factors affecting the survival period. The results found that direct abutment teeth had a higher rate of loss than indirect abutment teeth with a total loss of 13.7% of abutment teeth noted, 17.9% of the direct abutments and 8.5% of the indirect abutments. There was a loss of 4.4% of non-abutment teeth. The five-year survival rate for abutments showed a similar pattern with 86.6% of direct abutments surviving, and 93.1% of the indirect abutments. From the data collected and analyzed with the Kaplan-Meier survival analysis, this study concluded that there were a number of different factors that were significant to affect the abutment survival. These prognostic factors included crown to root ratio, root canal treatment, pocket depth, type of abutment and occlusal support. This study had the limitation of having a limited patient pool to gather data from.
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| **Levels of Evidence:** (For Therapy/Prevention, Etiology/Harm) See <http://www.cebm.net/index.aspx?o=1025>[ ]  **1a** – Clinical Practice Guideline, Meta-Analysis, Systematic Review of Randomized Control Trials (RCTs)[ ]  **1b** – Individual RCT[ ]  **2a** – Systematic Review of Cohort Studies[x]  **2b** – Individual Cohort Study[ ]  **3** – Cross-sectional Studies, Ecologic Studies, “Outcomes” Research[ ]  **4a** – Systematic Review of Case Control Studies[ ]  **4b** – Individual Case Control Study[ ]  **5** – Case Series, Case Reports[x]  **6** – Expert Opinion without explicit critical appraisal, Narrative Review[ ]  **7** – Animal Research[ ]  **8** – In Vitro Research |
| **Strength of Recommendation Taxonomy (SORT) For Guidelines and Systematic Reviews**See article **J Evid Base Dent Pract 2007;147-150**[ ]  **A** – Consistent, good quality patient oriented evidence[x]  **B** – Inconsistent or limited quality patient oriented evidence[ ]  **C** – Consensus, disease oriented evidence, usual practice, expert opinion, or case series for studies of diagnosis, treatment, prevention, or screening |
| **Conclusion(s):** |
| Although the crown to root ratio is one of the primary variables used to evaluate future success of an abutment tooth in a partial denture, there is no objective standard for abutment evaluation. Further studies are required before a conclusive standard can be determined. Along with the crown to root ratio there are other considerations that can also contribute to predicting the long-term success of an abutment. These include factors like abutment mobility, alveolar bone support, root configuration and angulation, opposing occlusion, pulpal condition, presence of endodontic treatment and remaining tooth structure. The evidence currently available indicates that there is some deviation from the commonly accepted 1:1 CRR, however after a certain CRR CRR:1.26-1.50 had approximately a 10% difference in 7 year survival rate compared to the CRR closer to the 1:1 value, and a CRR>1.51 had a sharp decline after 3 years and 7 year survival rate that dropped below 50%. As clinicians we can use this information to rule out teeth that should not be included in the RPD design due to their poor projected long-term prognosis.  |