



Validity of A Dental Implant Risk Assessment Tool: A Pilot Study

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INTRODUCTION

There is currently no validated tool to estimate a patient’s aggregate risk for peri-implantitis. The purpose of this pilot study was to evaluate the validity of a recently published dental implant Risk Assessment Questionnaire (RAQ) (Table 1.).

Risk Indicators Based on History		
	Subscales	Points
Smoking	<=5 cigarettes/day	1
	6-20 cigarettes/day	3
	>20 cigarettes/day	6
Diabetes	HbA1c 5.7-7	0
	7<HbA1c<=8	3
	>8	6
Implant placement in site with previous implant loss		2
Use of anti-resorptive agents	Oral	0
	IV for osteoporosis	4
	IV for cancer	Red Flag*
	Any stage of MRONJ	Red Flag
Current use of SSRI		1
Current use of PPI		1
History of head and neck radiation >55 Gy		Red Flag

Risk Indicators Based on Clinical Examination		
	Subscales	Points
	Periodontal disease	Treated/ inactive Untreated/ active
	Slight chronic periodontitis	2 4
	Moderate/severe chronic periodontitis	4 6
	Aggressive periodontitis	6 Red Flag
Plaque levels at exam	Moderate plaque PI>20-50%	2
	Heavy plaque PI>50%	4
Thin tissue biotype		2
Bruxism		3
Implant placed in maxillary posterior		3
Inexperienced clinician		3

Risk Indicators Evaluated after Implant Placement		
	Subscales	Points
Soft tissue	Lack 2mm attached tissue around implant	2
	Distance <3mm from peri-implant tissue margin to bone crest	2
Bone	Bone volume less than 2mm to buccal side of implant	4
Implant position	Closer than 3mm to adjacent implant	4
	Closer than 1.5mm to adjacent tooth	4
Treatment plan includes prostheses that limits access for cleaning		6
Cemented restorations	Cemented and at or above the gingival margin	2
	Cemented and subgingival	4
Poor compliance with recommended recall		3
Not accommodating for biologic width with the implant/prosthesis design		2

Table 1. UCSF Risk Assessment Questionnaire

Red Flag*: indicates alternatives to implants and/or specialty referral should be considered.

MATERIALS & METHODS

A retrospective chart review was conducted on consecutive patients on recall in the Graduate Prosthodontic Clinic at UCSF, and two private practices. Patients with implants in function 1 to 3 years were identified radiographically as having minimal bone loss (MBL) or pathological bone loss. (PBL). A 20-item RAQ was completed to estimate an aggregate risk score for peri-implantitis for each implant (Table 1.). The inter- and intra-rater reliability of collecting RAQ scores was analyzed. The association between the RAQ scores and peri-implant bone loss was analyzed using generalized linear mixed model (GLMM) and the odds ratio (OR) was calculated.

The implants were further classified into four risk level groups based on quartiles of the RAQ scores as the following: level 1: 25% quartile (RAQ scores ≤ 6 points), level 2: 50% quartile ($6 < \text{RAQ scores} \leq 9$ points), level 3: 75% quartile ($9 < \text{RAQ scores} \leq 16$), level 4: 100% quartile (RAQ scores > 16). The association between RAQ risk levels and peri-implant bone loss was analyzed using binary logistic regression. ORs of each risk level group were calculated by comparing with level 1 risk group as the baseline. A complete sensitivity and specificity report was created by the Receiver Operating Characteristic (ROC) curve. The sensitivity and specificity were determined by the optimal cutoff point on the ROC curve. The area under the curve (AUC) was calculated, which reflects the overall accuracy of the RAQ as a diagnostic tool.

	Implant level (168 implants)				Patient level (63 patients)			
Risk Indicators	MBL		PBL		MBL		PBL	
	count	percentage	count	percentage	count	percentage	count	percentage
	102	100%	66	100%	39	100%	24	100%
Risk Indicators Based on History								
Smoking	15	14.7%	34	51.5%	5	12.8%	5	20.8%
Diabetes	9	8.8%	2	3.0%	3	7.7%	2	8.3%
Previous loss implant	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Anti-resorptive	0	0.0%	6	9.1%	0	0.0%	2	8.3%
SSRI	21	20.6%	23	34.8%	4	10.3%	5	20.8%
PPI	16	15.7%	0	0.0%	3	7.7%	0	0.0%
Head & neck radiation	4	3.9%	0	0.0%	1	2.6%	0	0.0%
Risk Indicators Based on Clinical Examination								
Periodontal disease	45	44.1%	52	78.8%	22	56.4%	17	70.8%
Plaque levels	48	47.1%	25	37.9%	24	61.5%	12	50.0%
Thin tissue biotype	18	17.6%	26	39.4%	7	17.9%	7	29.2%
Bruxism	51	50.0%	5	7.6%	18	46.2%	4	16.7%
Max posterior	22	21.6%	40	60.6%	11	28.2%	12	50.0%
Inexperience clinician	3	2.9%	12	18.2%	2	5.1%	5	20.8%
Risk Indicators Evaluated after Implant Placement								
Soft tissue < 3 mm height or < 2 mm thickness	20	19.6%	26	39.4%	9	23.1%	6	25.0%
Buccal bone < 2 mm thickness	9	8.8%	20	30.3%	5	12.8%	3	12.5%
Implant position to buccal	8	7.8%	5	7.6%	5	12.8%	3	12.5%
Prosthesis limits access for cleaning	10	9.8%	11	16.7%	4	10.3%	3	12.5%
Cemented restorations	10	9.8%	7	10.6%	7	17.9%	3	12.5%
Poor compliance	9	8.8%	10	15.2%	6	15.4%	5	20.8%
Not accommodating for biologic width with the implant/prosthesis design	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Table 2. Prevalence of Risk Indicators of Peri-implantitis
MBL: minimal bone loss; PBL: pathological bone loss.

RESULTS

In total, 63 patients with 168 implants were evaluated; 39 patients with 102 implants in the MBL group and 24 patients with 66 implants in the PBL group (Table 2.). The weighted Cohen’s kappa analysis of the intra-rater reliability were 0.72, 0.59 and 1.0 of the three raters, respectively. The inter-rater reliability was 0.66. A strong positive association was found between the RAQ scores and peri-implant bone loss (p=0.003). The OR of RAQ was 1.259 which means with RAQ increasing one point, the risk of having PBL increases 25.9%. The implants were further classified into four risk level groups based on quartiles of RAQ scores as the following: Level 1: 25% quartile (RAQ scores <=6 points), level 2: 50% quartile (RAQ scores <=9 points), level 3: 75% quartile (RAQ scores <=16), level 4: 100% quartile (RAQ scores >16). The binary logistic

regression showed a strong positive association was found between RAQ risk levels and peri-implant bone loss (p<0.001). The ORs of risk level 2, 3 and 4 were 2.727 (95% CI 0.763-9.752), 12.105 (95% CI 3.636-40.306) and 30.000 (95% CI 8.495-105.948) respectively (Table 3). The ROC curve analysis showed the sensitivity and specificity of the RAQ were 80.3% and 71.6% respectively (Figure 1.). The AUC was 0.802 (Std. Dev. 0.035, 95% CI 0.733-0.870), showing good accuracy of the overall performance of the RAQ as a diagnostic test for implant PBL.

CONCLUSION

A strong positive association was found between the RAQ scores and the peri-implant bone loss. The RAQ demonstrates good sensitivity, specificity and overall accuracy as a diagnostic tool to predict future incidence of peri-implantitis based on patient’s aggregate risk.

Odds Ratio	Description	RAQ Peri-implant Bone Loss Risk Level	
OR2	OR of 50% RAQ scores	2.727 (p=0.120)	2
	CI lower	0.763	
	CI upper	9.752	
OR3	OR of 75% RAQ scores	12.105 (p<0.001)	3
	CI lower	3.636	
	CI upper	40.306	
OR4	OR of 100% RAQ scores	30.000 (p<0.001)	4
	CI lower	8.495	
	CI upper	105.948	

Table 3. RAQ Risk Levels Odds Ratio Chart
Risk level 1 group (25% RAQ scores) was used as baseline for ORs calculation.

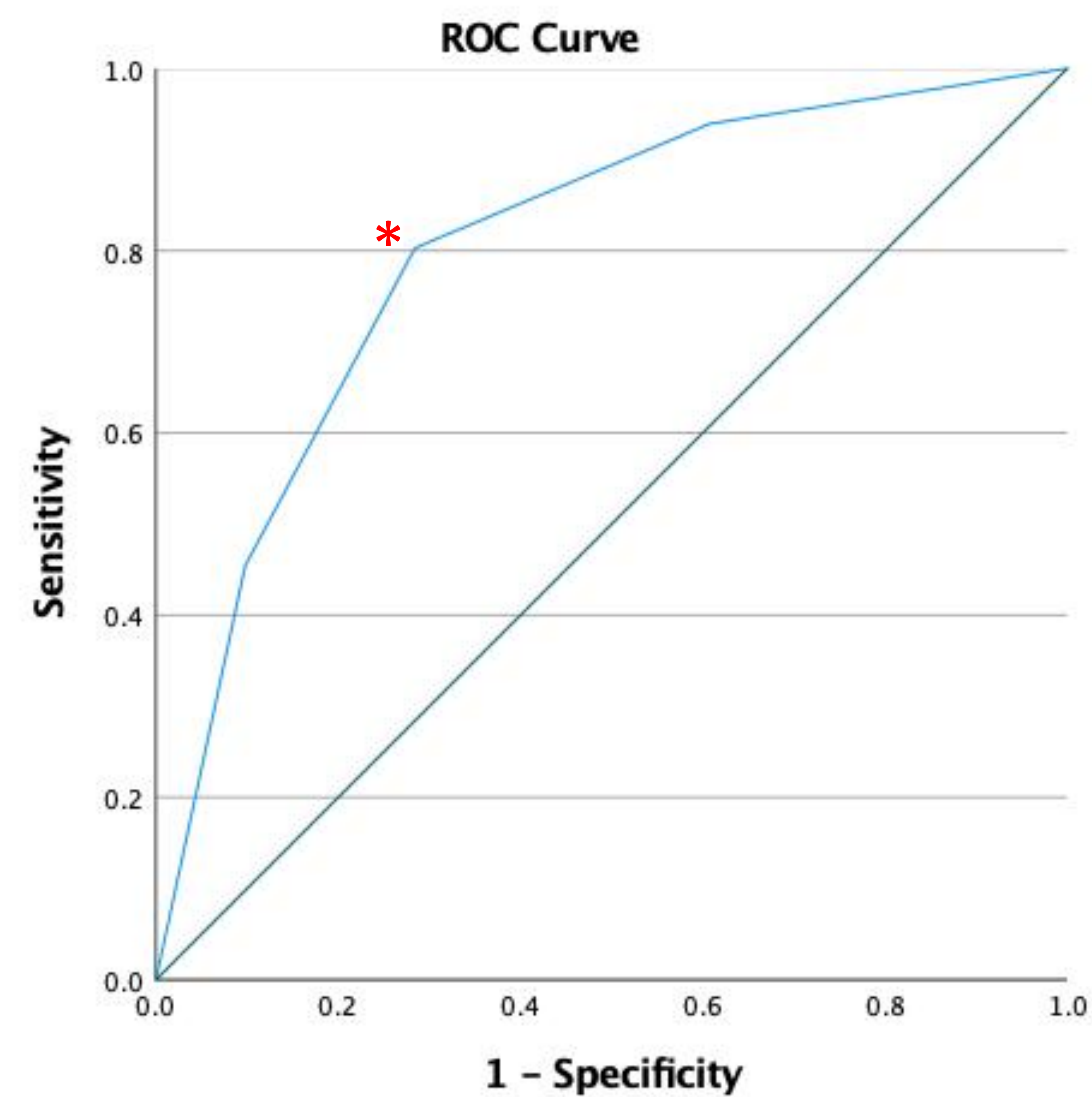


Figure 1. RAQ ROC Curve
* Optimal cutoff point for RAQ sensitivity and specificity which is the closest to the point (0,1) on the curve. The sensitivity and specificity of the RAQ are 80.3% and 71.6% respectively.