



COST-EFFECTIVENESS AND LONG-TERM OUTCOMES OF PERIODONTAL REGENERATION VERSUS DENTAL IMPLANTS: A RETROSPECTIVE STUDY

Qasim Omer Butt, Yousef Amrou¹, Abdusalam E. Alramali, Hamzeh Almashni, Pablo Galindo-Fernandez, Hom-Lay Wang, Muhammad H. A. Saleh

¹ DEPARTMENT OF PERIODONTICS AND ORAL MEDICINE, SCHOOL OF DENTISTRY, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN, USA

² DEPARTMENT OF ORAL MEDICINE, ORAL PATHOLOGY, ORAL AND MAXILLOFACIAL SURGERY, UNIVERSITY OF TRIPOLI SCHOOL OF DENTISTRY, TRIPOLI, LIBYA

INTRODUCTION:

Periodontal regeneration (PR) and extraction with implant placement are both established options for managing teeth with stage III–IV periodontitis, but direct comparative data on their long-term outcomes and cost-effectiveness remain limited.

AIM:

This retrospective study evaluated long-term survival, success, complications, and cost-effectiveness of PR-treated teeth versus dental implants in an advanced periodontitis population using tooth-level risk profiling with the Periodontal Risk Score (PRS).



VS



Methods

Retrospective cohort study conducted at the University of Michigan postgraduate periodontics clinics
Data collected over 12 years (2011–2023)

Treatment Protocols

PR GROUP

Baseline (T0): pre-treatment exam
Follow-up (T1): ≥ 12 months post-regeneration

IMPLANT GROUP

T0: implant placement
T1: 1 year post-placement or at prosthetic loading
T2: ≥ 24 months after loading

MAINTENANCE PROGRAM

All patients entered supportive periodontal maintenance programs after therapy

Data Collection

PATIENT VARIABLES

Age, sex, Smoking status (non, former, light, heavy)
Diabetes status, Number of maintenance visits
Follow-up duration

PR CLINICAL PARAMETERS

PR group included PD, CAL, BOP, Recession, Tooth Mobility, FI and KTW, Defect morphology

IMPLANT PARAMETERS

Marginal bone loss (MBL), Radiographic bone loss percentage (RBL%),
History of periodontitis

Outcome Assessed

- **PR survival vs Implant survival**
 - **PR success** (*CAL gain $> 2\text{ mm}$ with pocket closure $\leq 4\text{ mm}$*) vs **Implant success** (*Pisa Consensus criteria*)
- **Biological and technical complications**
 - **Cost-effectiveness of PR vs Implants**, evaluated using **ICER** (*Incremental Cost-Effectiveness Ratio*)

Results

Parameter	Implant Group	Periodontal Regeneration (PR) Group
Simple Logistic Regression	Simultaneous Augmentation (OR=11)	FI (OR=4); Defect morphology (1-wall vs 3-wall) (OR=4)
Multiple Binary Regression	None	Periodontal Risk Score (PRS2 OR=22; PRS3 OR=35)

Table 1. Predictors of treatment survival identified by simple and multiple regression models in implant

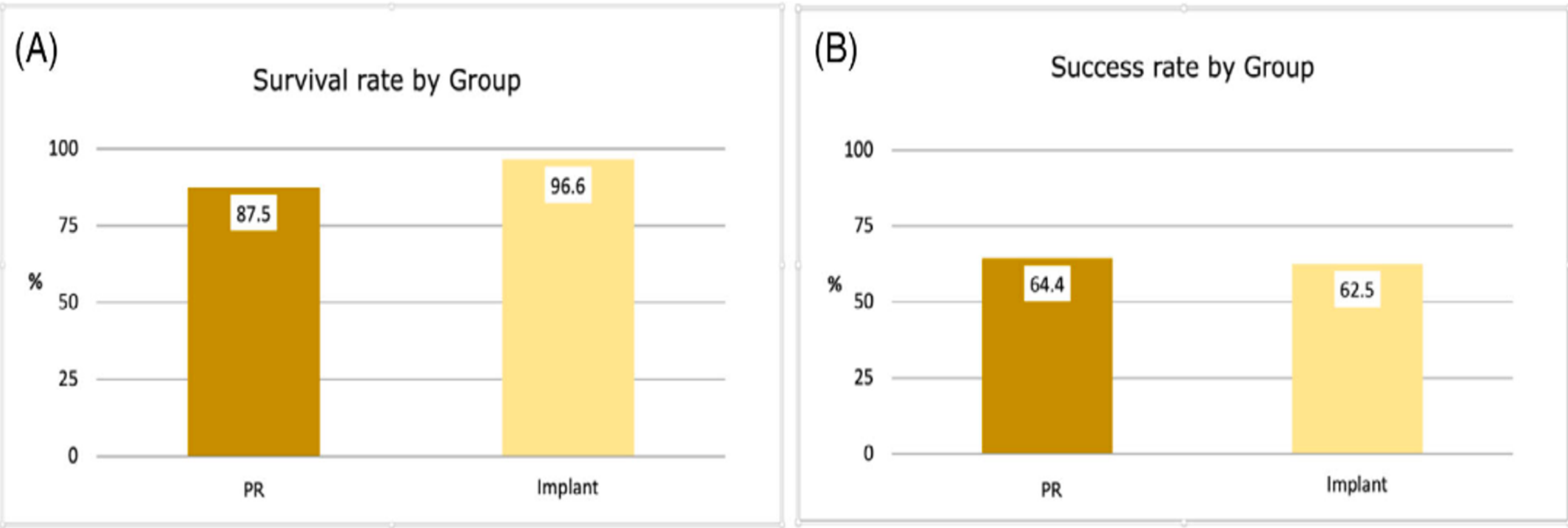


Figure 1. (A) Survival rates of teeth treated with periodontal regeneration (PR) and dental implants over a mean follow-up of 6.4 years, demonstrating high survival in both groups (87.5% for PR and 96.6% for implants), with no statistically significant difference between treatments (OR = 0.36, p = 0.20)). (B) Success rates based on clinical and radiographic criteria, showing comparable outcomes between PR (64.4% and implant therapy (62.5%), with no significant difference in the probability of

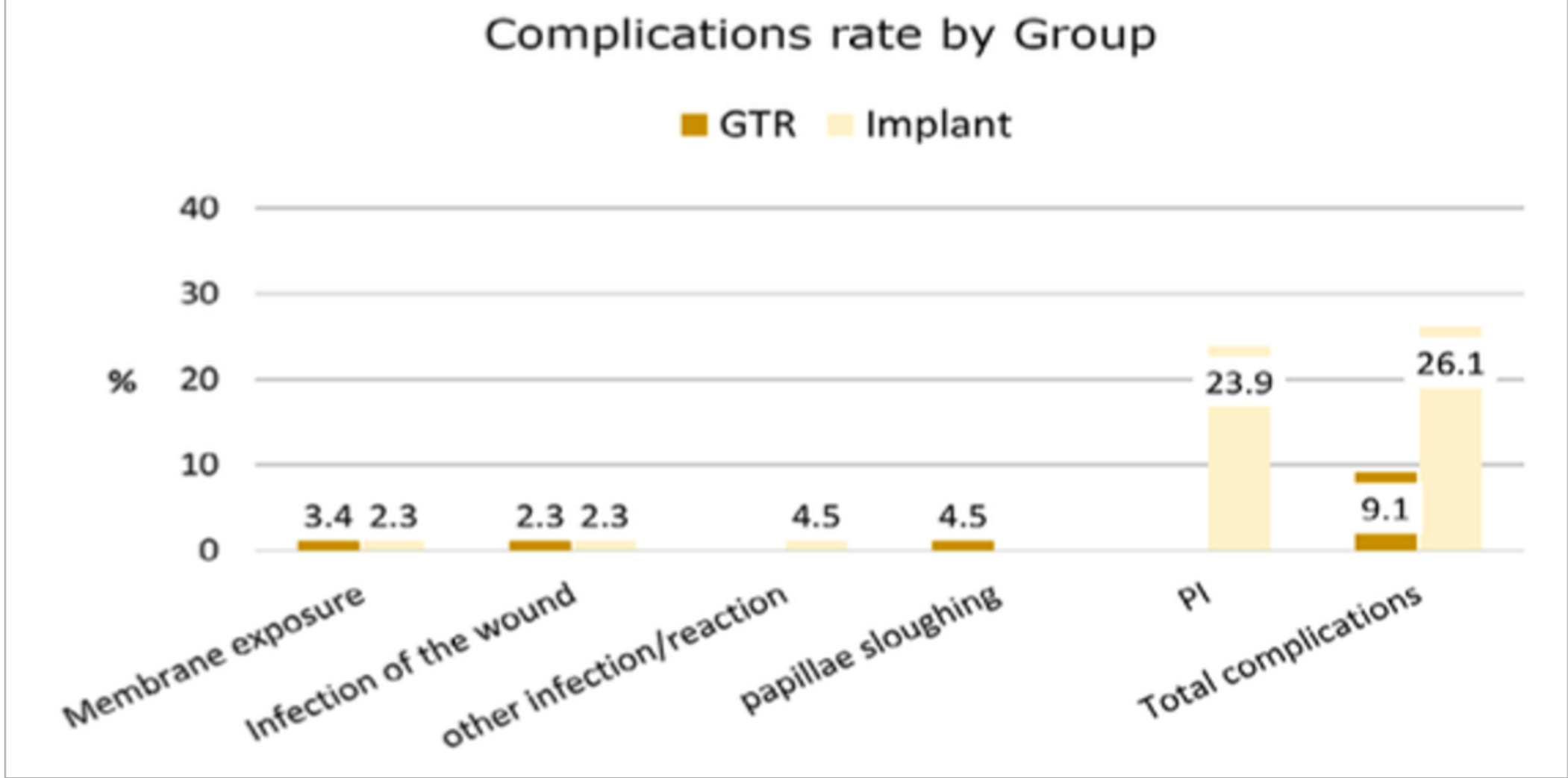


Figure 2 : Complication rates in the periodontal regeneration (GTR) and implant groups over the follow-up period.

Minor postoperative complications in the GTR group included membrane exposure (3.4%), wound infection (2.3%), and papillae sloughing (4.5%), totalling 9.1%. The implant group had a higher complication rate (26.1%), mainly peri-implantitis (23.9%), and few early infections (2.3%). The implant group's complication rate was significantly higher (OR = 3.54, p = 0.006).

Parameter	Implant Group	Periodontal Regeneration (PR) Group
Mean Survival Time (years)	12.65	9.3
Mean Cost (USD)	\$2170	\$1268

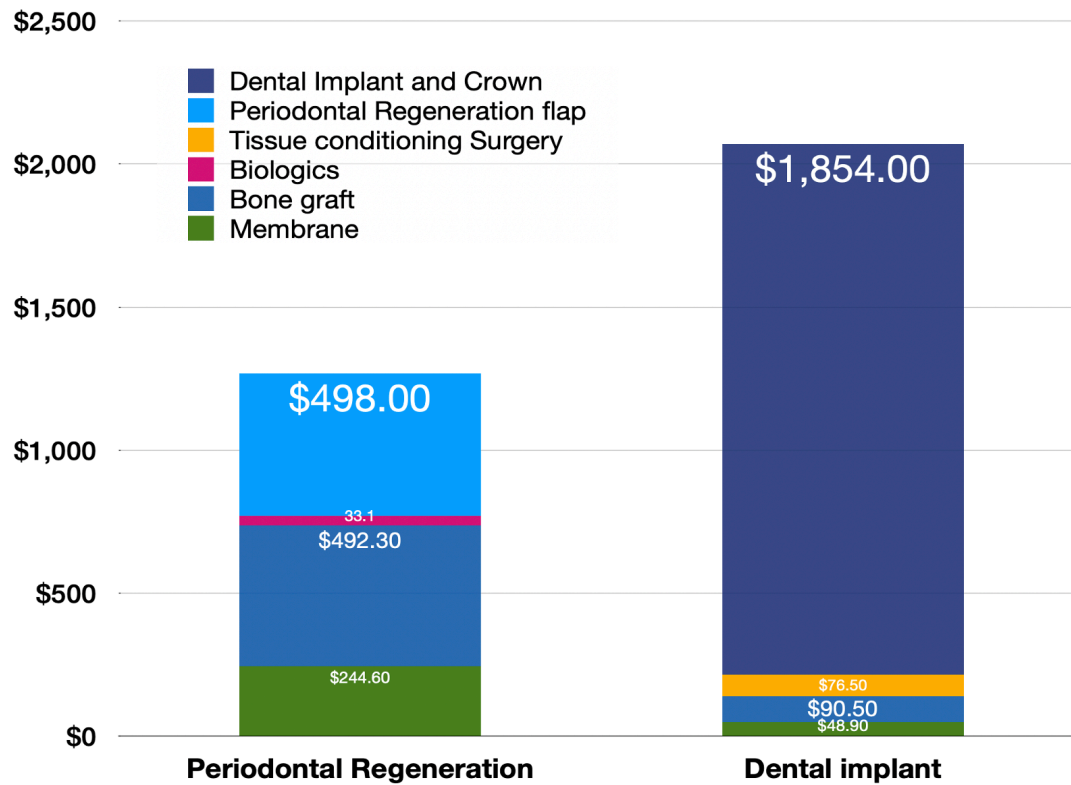


Table 2. Mean survival time and treatment costs for implant therapy and periodontal regeneration

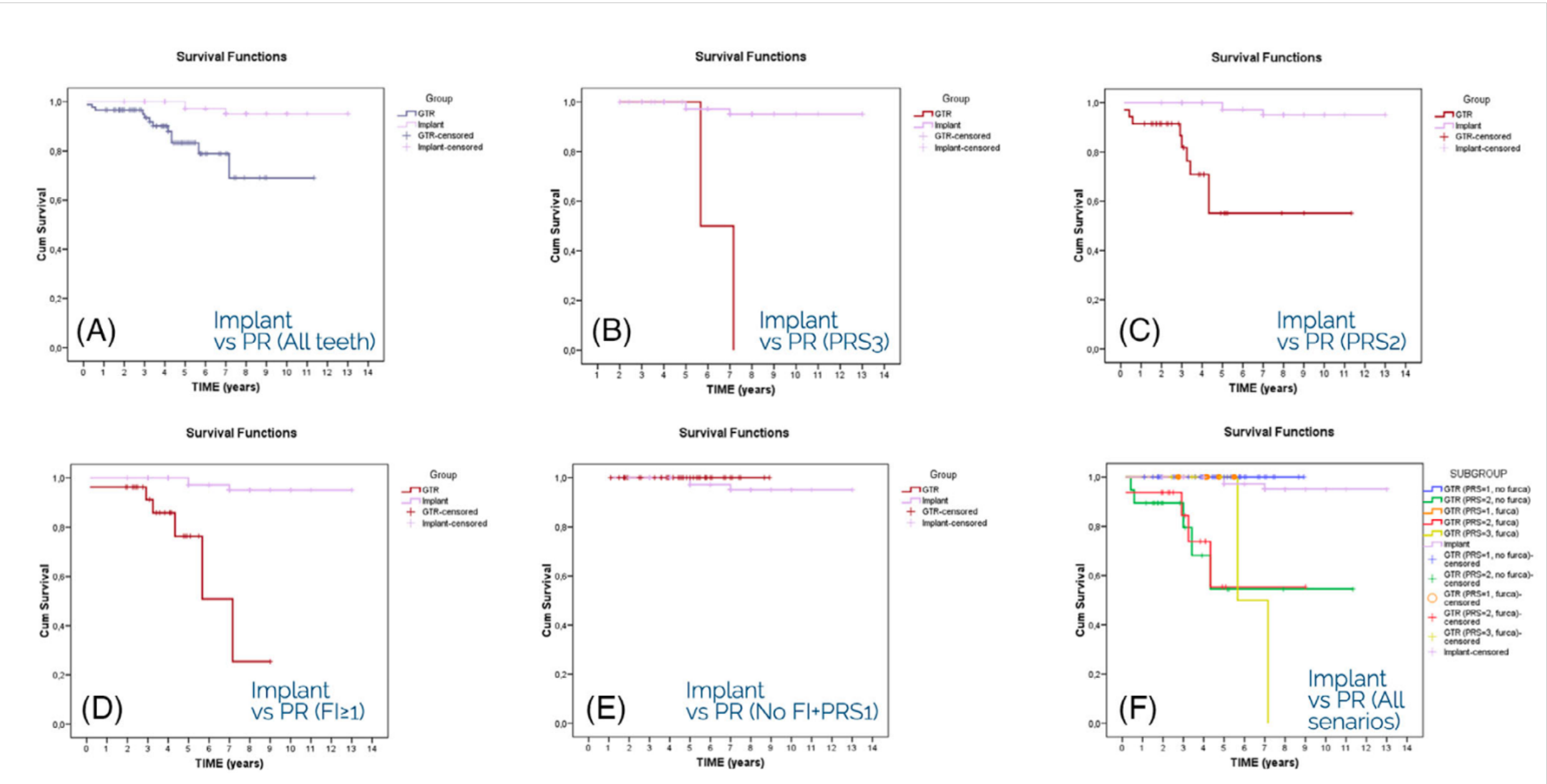


Figure 3. Kaplan–Meier survival curves compare the long-term survival of periodontal regeneration (PR)–treated teeth and dental implants over an average of 6.4 years. (A) Both groups had high survival, with PR teeth at 87.5% and implants at 96.6%. (B) For teeth with poor prognosis (PRS3), PR survival dropped quickly to about 50% at 5 years and nearly 0% by 6–7 years, while implants stayed above 90%. (C) For teeth with moderate prognosis (PRS2), PR survival fell to 55–60% by 4–5 years, but implants remained above 90–95%. (D) In sites with furcation involvement (FI ≥1), PR survival declined to 25–30% after 7–8 years, while implant survival stayed above 90%. (E) For teeth without furcation involvement and good prognosis (PRS1), both treatments had nearly 100% survival. (F) Overall, initial prognosis and furcation involvement greatly affected PR survival, but implants showed consistently high survival regardless of baseline risk.

Table 3. Cost-effectiveness of periodontal regeneration versus implants stratified by tooth prognosis and furcation involvement

Clinical scenario	Cost per additional year of survival (USD)	Survival comparison
All PR-treated teeth vs implants	US\$238	Comparable survival between PR and implants
Teeth with PRS2–PRS3 and/or FI ≥1	\$125–\$153	PR outperformed implants in survival
Teeth with PRS1 and no furcation involvement	US\$311	PR outperformed implants in survival

Conclusions

The decision to place an implant or pursue periodontal regeneration should primarily be based on tooth prognosis and furcation involvement, as these significantly affect survival, success, and cost. Implants are typically justified for high-risk, poor-prognosis teeth, while regeneration is preferred for low-risk teeth with better long-term prospects. Personalized treatment planning incorporating the Periodontal Risk Score, defect morphology, and furcation degree is crucial to optimize outcomes and resource use in managing periodontally compromised teeth.