

Effectiveness of Extra-Short (≤ 6 mm) Dental Implants After Ten Years: A Systematic Review with Quantitative Synthesis



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Background

- Alveolar ridge resorption after tooth extraction often requires complex bone augmentation for standard implants, leading to increased complications, costs, and treatment time.
- Short dental implants (≤ 6 mm) have emerged as a reliable alternative with comparable 5-year survival rates to standard implants, particularly in native bone and full-arch rehabilitations.

Aim



- To evaluate the 10-year survival, marginal bone loss (MBL), and complication rates of short dental implants (≤ 6 mm), stratified by implant length, diameter, connection type (Internal vs External), anatomic location (Maxilla vs Mandible), design (Bone vs Tissue Level), and prosthetic configuration (Splinted vs Non-Splinted). This is the first systematic review to offer a long-term, stratified analysis of short implants across diverse clinical scenarios.

METHODS

- An electronic search was performed in **MEDLINE, EMBASE, and the Cochrane Library** up to **May 2024**.
- Inclusion criteria:** Randomized controlled trials (RCTs) or prospective cohort studies evaluating **short implants (≤ 6 mm)** that reported **survival rate** with a **minimum of 12 months follow-up after loading**.

PICO QUESTION

- Population (P):** systemically healthy adult human subjects of any age with ≥ 1 short dental implant (≤ 6 mm)
- Intervention (I):** Insertion of short dental implants (≤ 6 mm) restored with a fixed prosthesis.
- Comparison (C):**
 - #1: Anatomical position: mandible or maxilla;
 - #2: Implant length: 4mm or , 5-5.5mm or 6 mm;
 - #3: Implant diameter: regular (3.75-4.7 mm) or wide (4.8-6 mm);
 - #4: Prosthesis characteristics: Splinted versus non-splinted;
 - #5: Implant level: tissue- or bone-level;
 - #6: Implant connection: internal or external connection.
- Outcomes (O):**
 - #1: Implant survival rate (primary outcome);
 - #2: Marginal bone loss (MBL, implant level);
 - #3: Prosthetic complications;
 - #4: Early (before prosthesis placement) and late (after prosthesis placement) biological complications (patient-level).

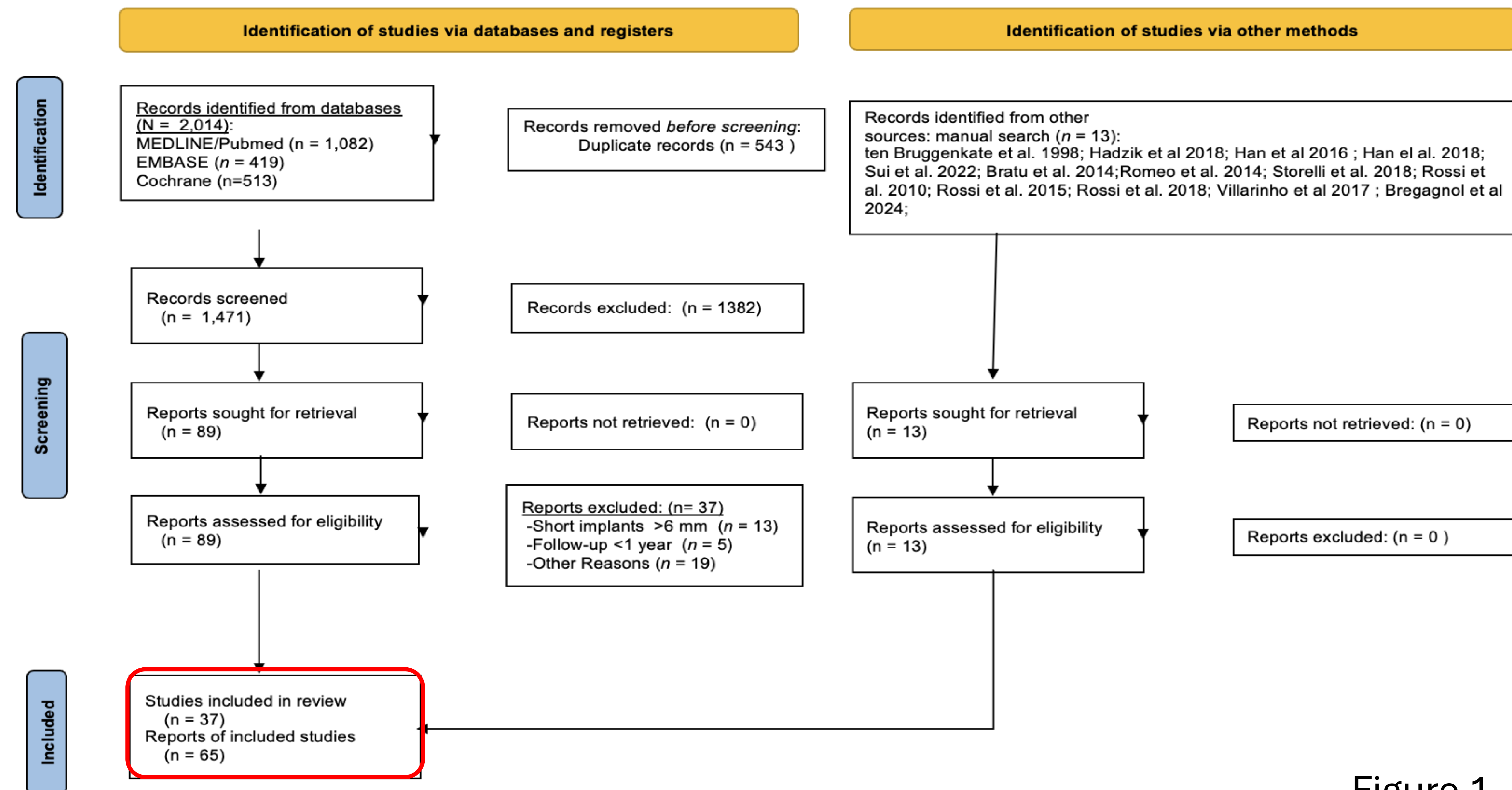


Figure 1

Results



Primary Outcome

- 10-Year Survival:** 95.0% ± 4.4% (n=2,185 implants, 65 studies);
*mandible significantly superior to maxilla (97.2% vs 93.8%, p<0.001)

Secondary Outcome

- **10-Year Bone Stability:** Mean MBL 0.22± 0.21 mm

✓ BETTER OUTCOMES ASSOCIATED WITH

Mandibular placement

6 mm length

Bone-level design

Splinted restorations

External connection (survival)

Internal connection (MBL preservation)

⚠ HIGHER RISK ASSOCIATED WITH

4 mm implants (lower survival + higher MBL)

Maxillary placement

Wide diameter (higher MBL)

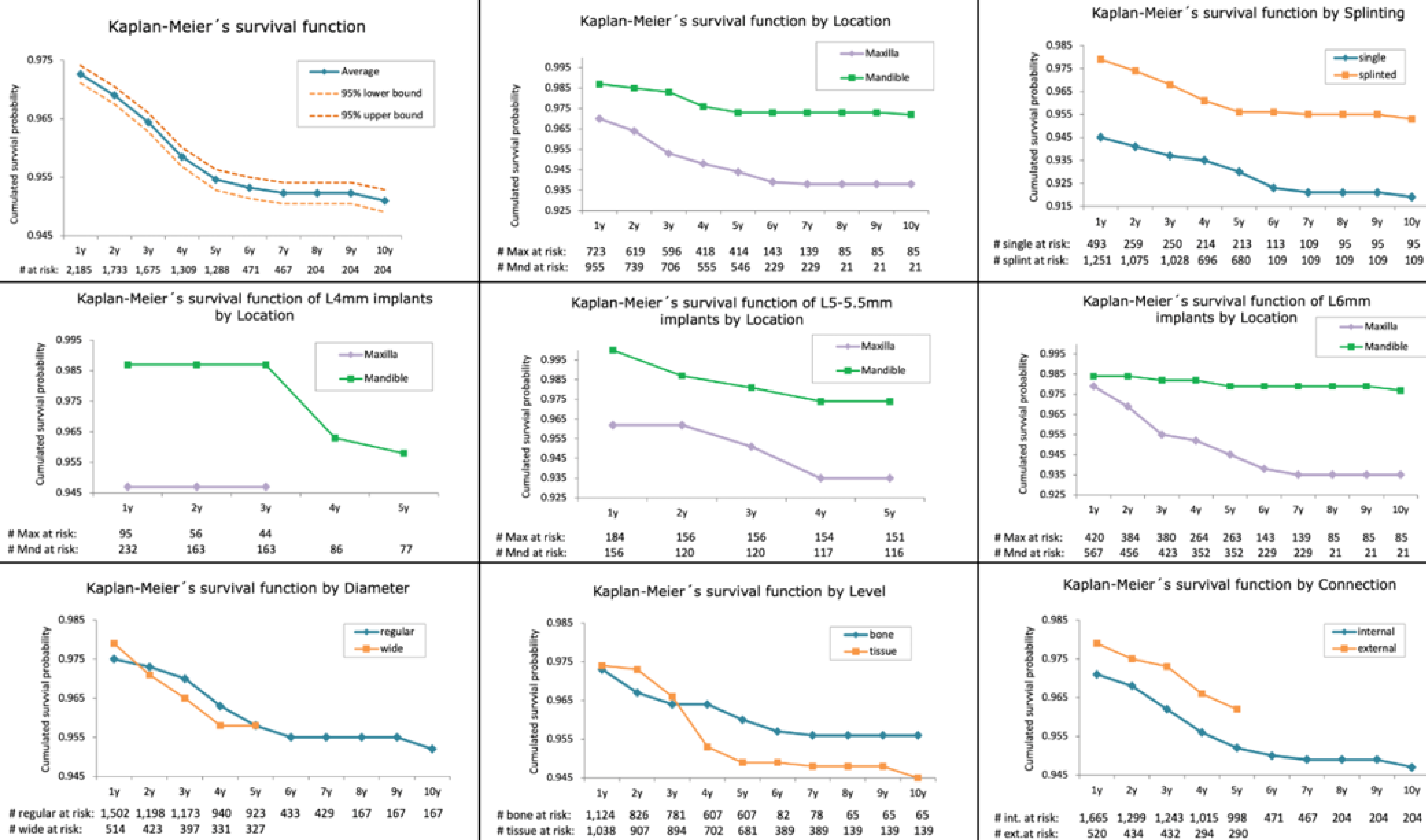
External connection (higher MBL)

Non-splinted restorations

		5-years		10-years	
		Mean ± SE	p-value	Mean ± SD	p-value
LENGTH			<0.001***		--
	4 mm	0.987 ± 0.003		--	
	5-5.5mm	0.888 ± 0.003		--	
	6mm	0.936 ± 0.002		--	
DIAMETER			<0.001***		--
	Regular	0.931 ± 0.002		--	
	Wide	0.944 ± 0.002		--	
LOCATION			<0.001***		<0.001***
	maxilla	0.931 ± 0.002		0.926 ± 0.002	
	mandible	0.943 ± 0.002		0.947 ± 0.002	
LEVEL			<0.001***		<0.001***
	bone level	0.978 ± 0.002		0.955 ± 0.001	
	tissue level	0.897 ± 0.003		0.919 ± 0.002	
CONNECTION			<0.001***		--
	internal	0.935 ± 0.002		--	
	external	0.939 ± 0.002		--	--
SPLINTED			<0.001***		<0.001***
	single	0.926 ± 0.002		0.917 ± 0.002	
	splinted	0.949 ± 0.001		0.956 ± 0.001	

Multifactorial ANOVA

Table 1



Results

Complications



Biological Complications:

- **Incidence:** 114 events in 1,984 implants over 4.97 ± 2.83 years; overall rate $2.51\% \pm 3.98$ per implant-year
- **Most Common:** Mucositis (n=55), peri-implantitis (n=20), transient paresthesia (n=16); 75 late complications, 39 early complications

Prosthetic Complications:

- **Incidence:** 130 events in 2,092 implants over 4.61 ± 2.81 years; overall rate $2.15\% \pm 2.99$ per implant-year
- **Most Common:** Screw loosening (n=66), ceramic chipping (n=26), abutment fracture (n=13), de-cementation (n=12)

CONCLUSIONS

Short implants (≤ 6 mm) have demonstrated a high 10-year survival rate, minimal clinically relevant marginal bone loss, and a low incidence of prosthetic and biological complications. They represent a reliable long-term option for the rehabilitation of atrophic ridges, providing an effective alternative to bone augmentation procedures.