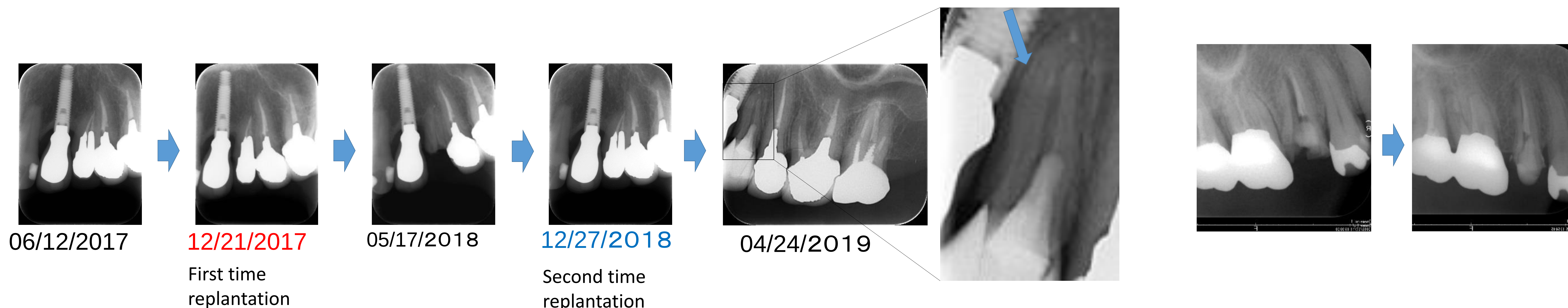


The treatments of Vertical Root Fractures: An Option to Prevent Occlusal Collapse

Katsumi Uoshima, Masako Nagasawa
Niigata University Graduate School of Medical and Dental Sciences

Introduction:

The number of teeth extraction because of root fracture has been relatively increasing. From a prosthodontic point of view, preserving vertically fractured teeth if possible is very important to prevent the progression of natural tooth loss.



There is no COI that should be declared regarding this study.

Objective:

We have been trying to save those teeth and this clinical study aims to wrap up the data to date and to investigate post-treatment survival rate and discuss the risk factors.

Methods:

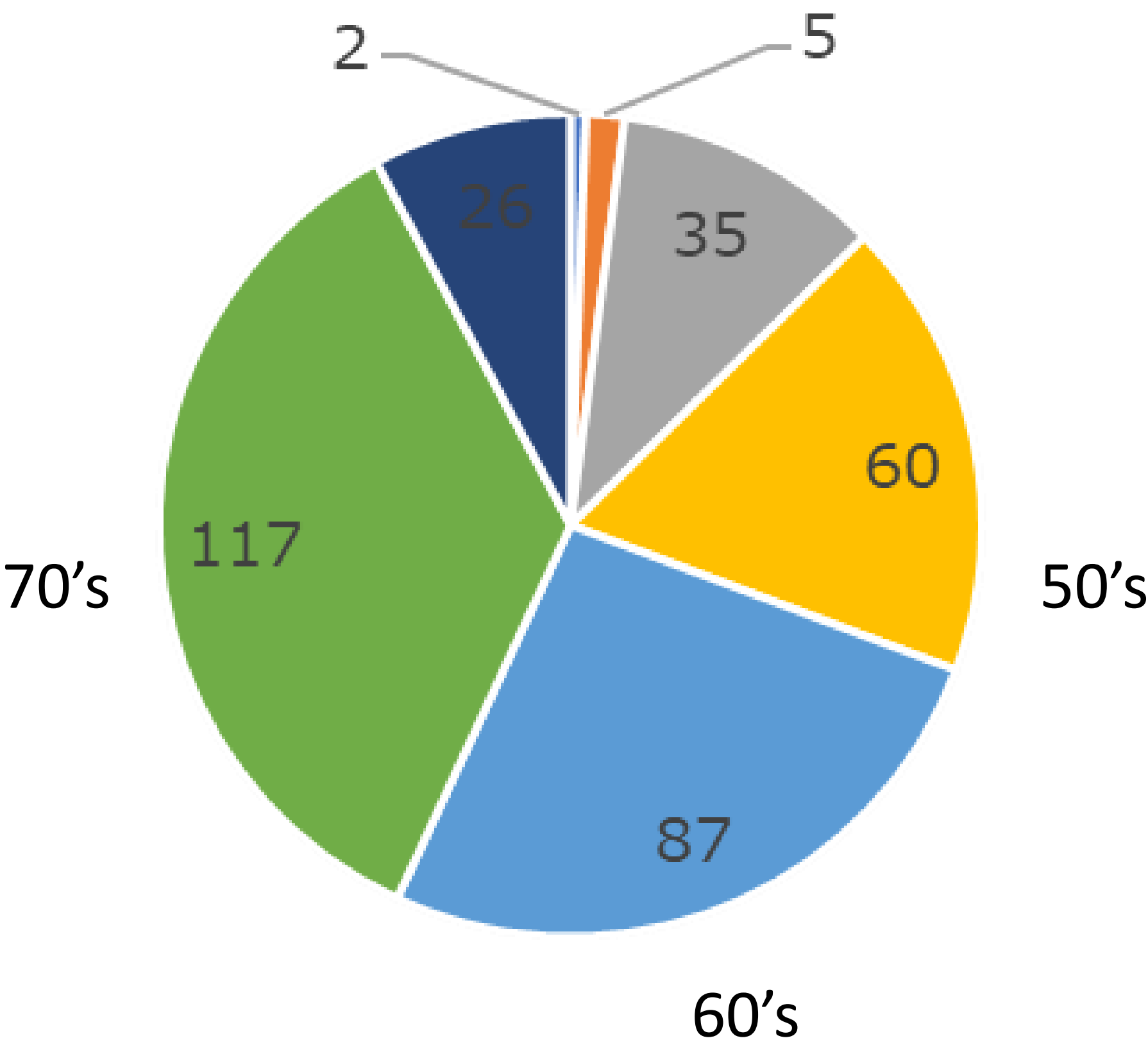
A retrospective survey was conducted on 332 patients (75 males and 257 females) who underwent the restorative treatments of vertically fractured root at Niigata University Medical and Dental Hospital from 2001 to 2022. The Kaplan-Meier method was used for the survival analysis of teeth after root fracture restoration. A log-rank test and Cox regression analysis were conducted for factor analysis. This study was approved by the Ethical Review Committee of Niigata University (IRB No. 2015-5095).

Survey items;

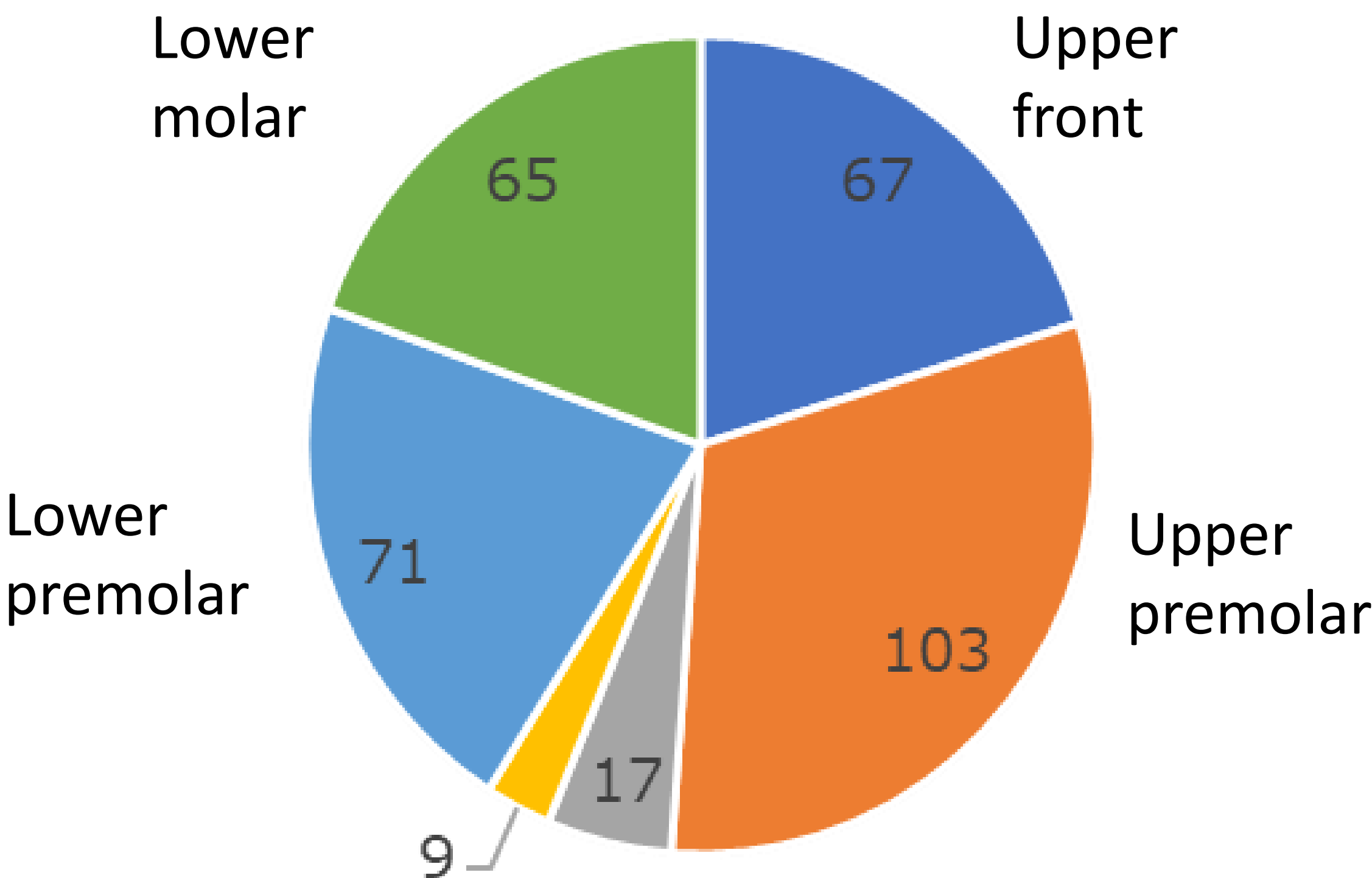
Age, tooth position, type of prosthetic device at the time of fracture, length of the post part of the abutment structure, presence or absence of adjacent teeth, type of abutment, Eichner's classification, classification by Miyaji's occlusal triangle, fracture condition, root fracture repair treatment method, final prosthetic device after root fracture repair treatment, and survival period of the treated tooth.

Results

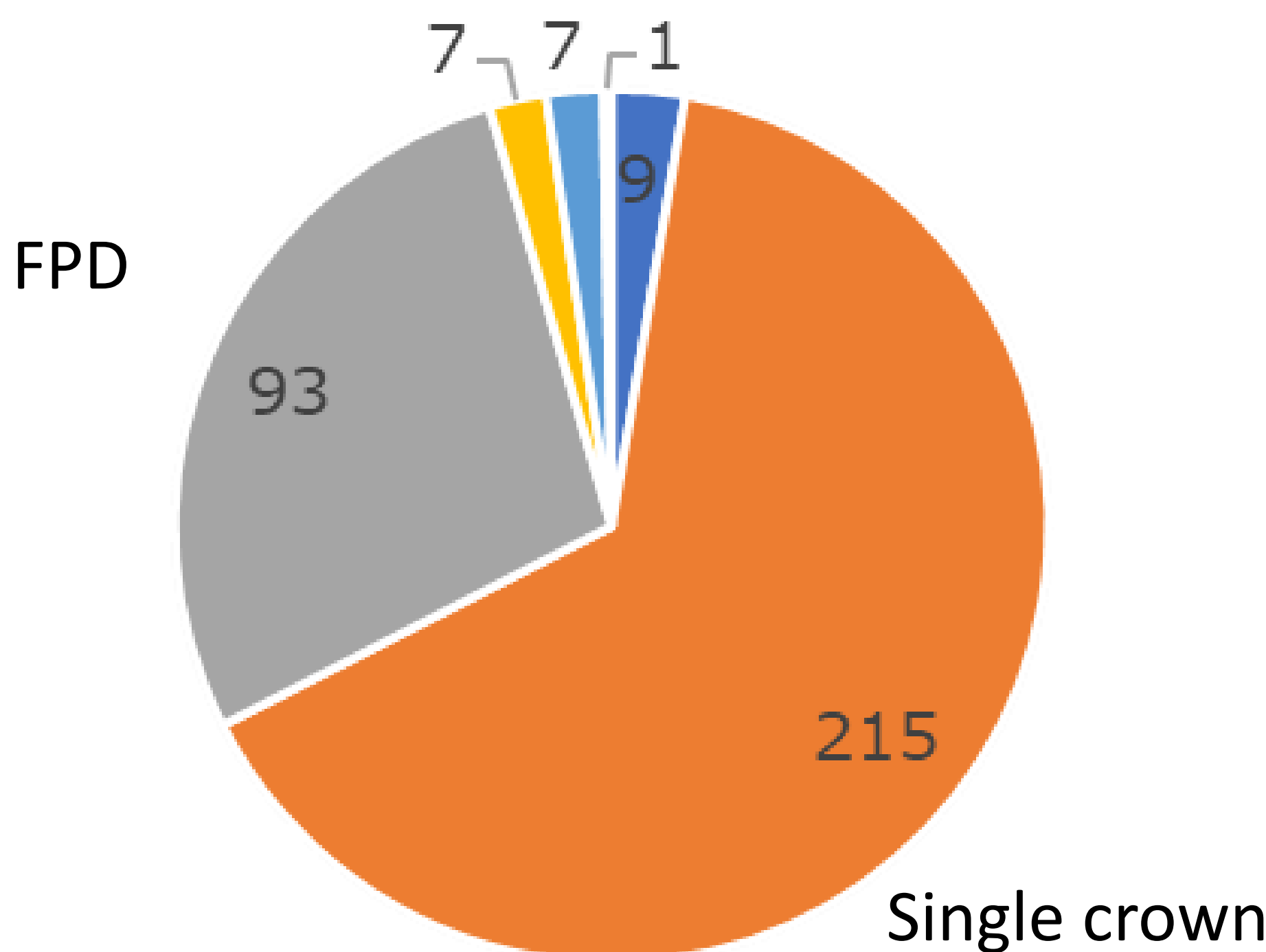
Age



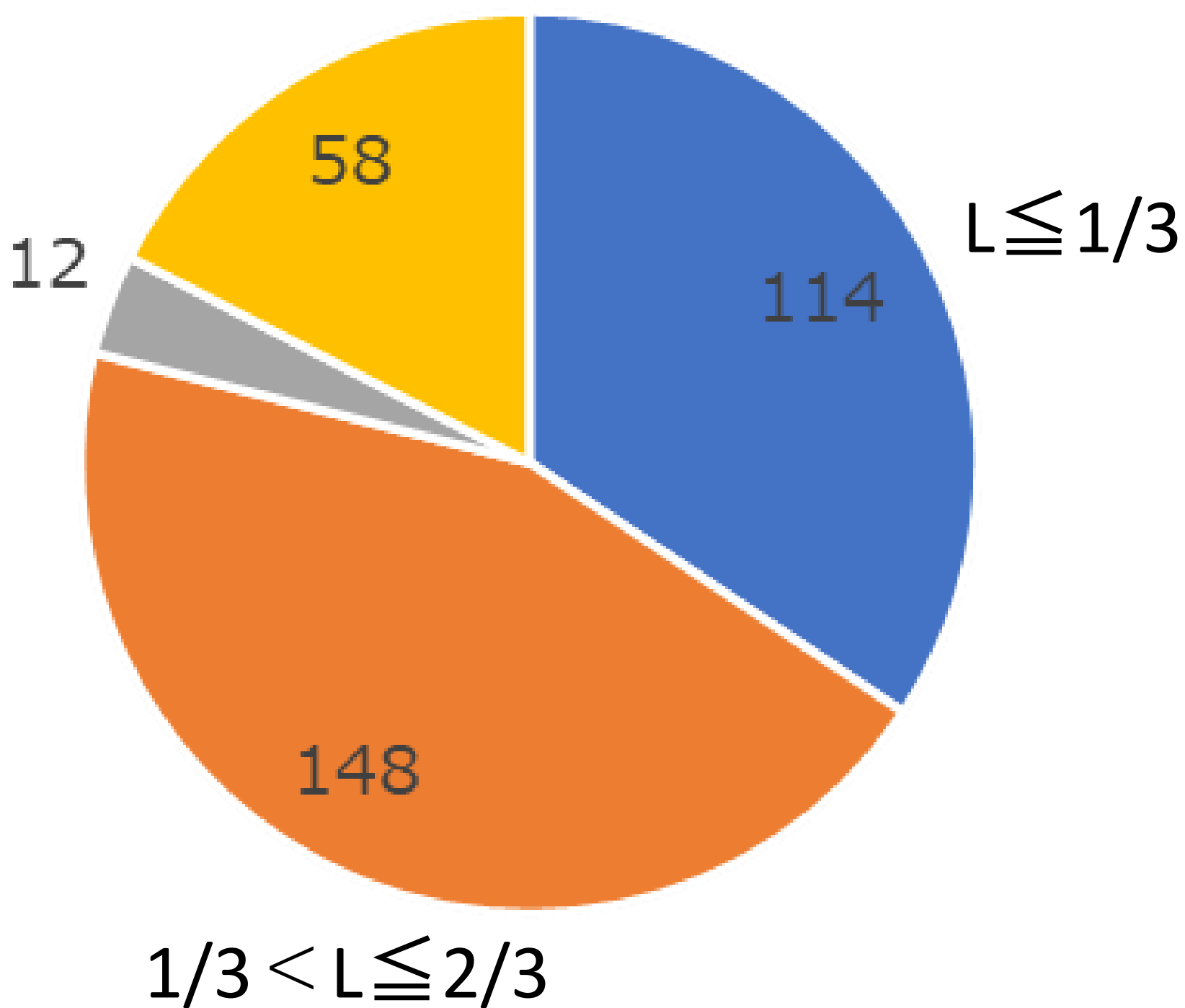
Tooth position



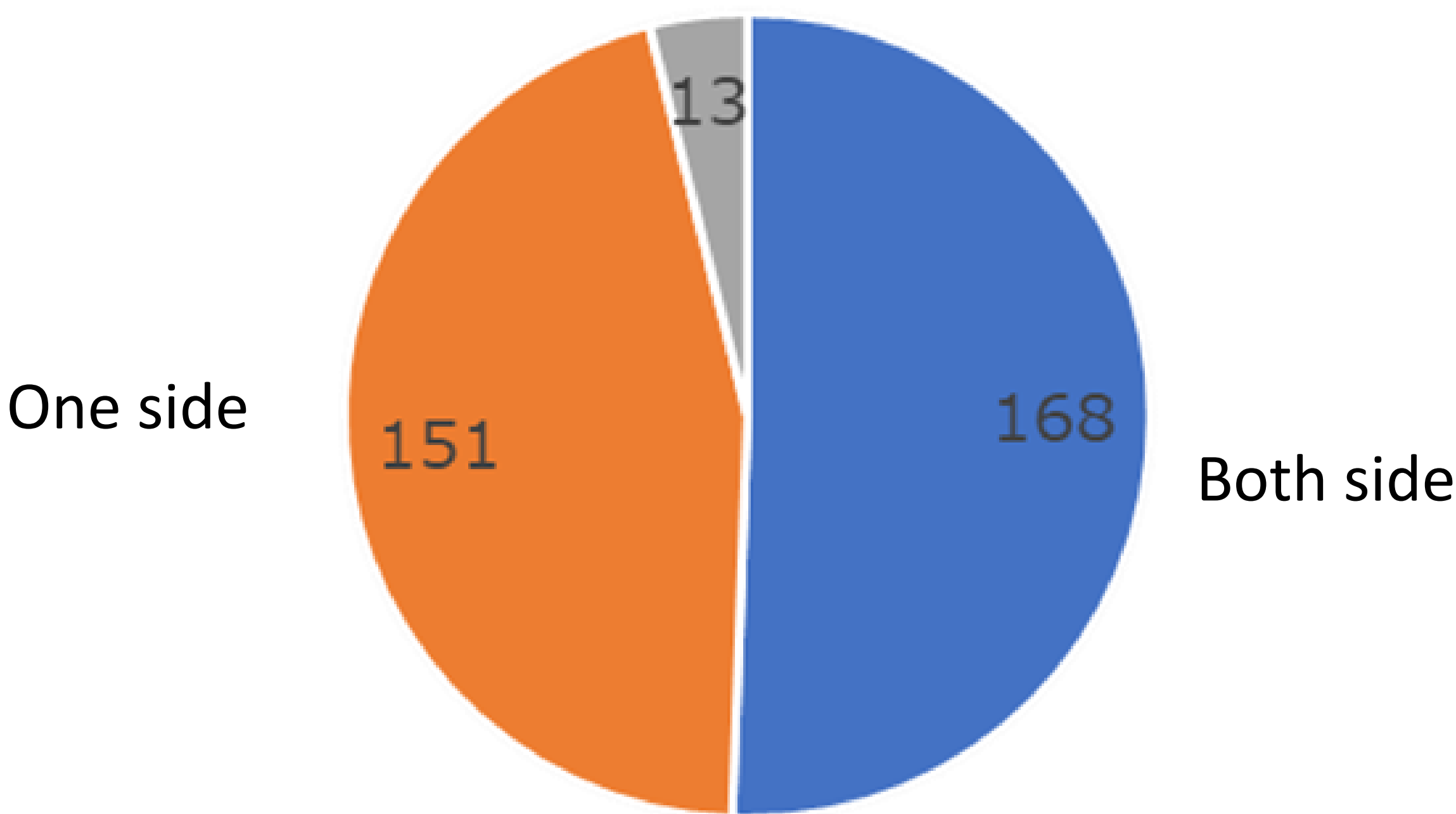
Prosthetic device at the time of fracture



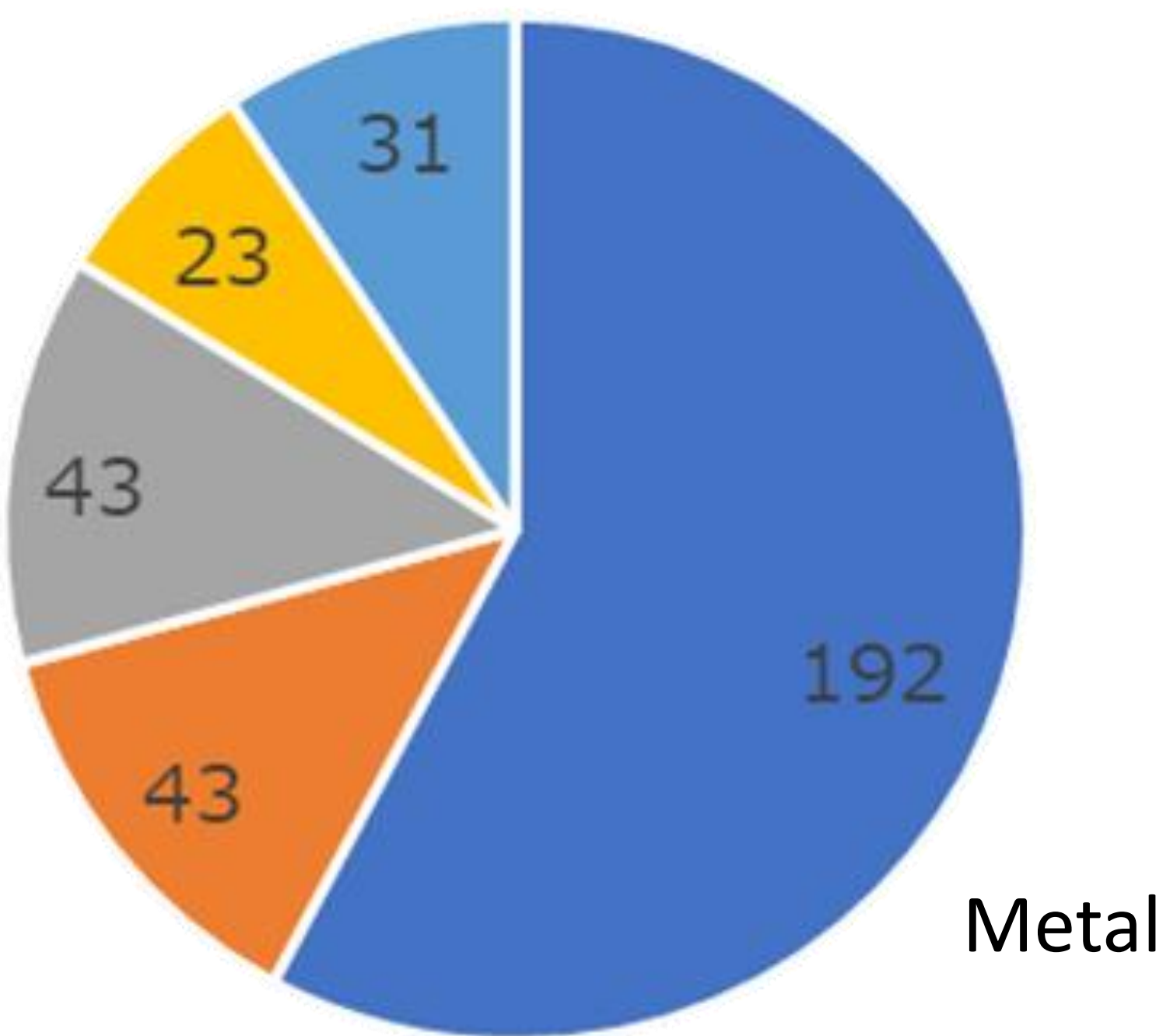
Post length



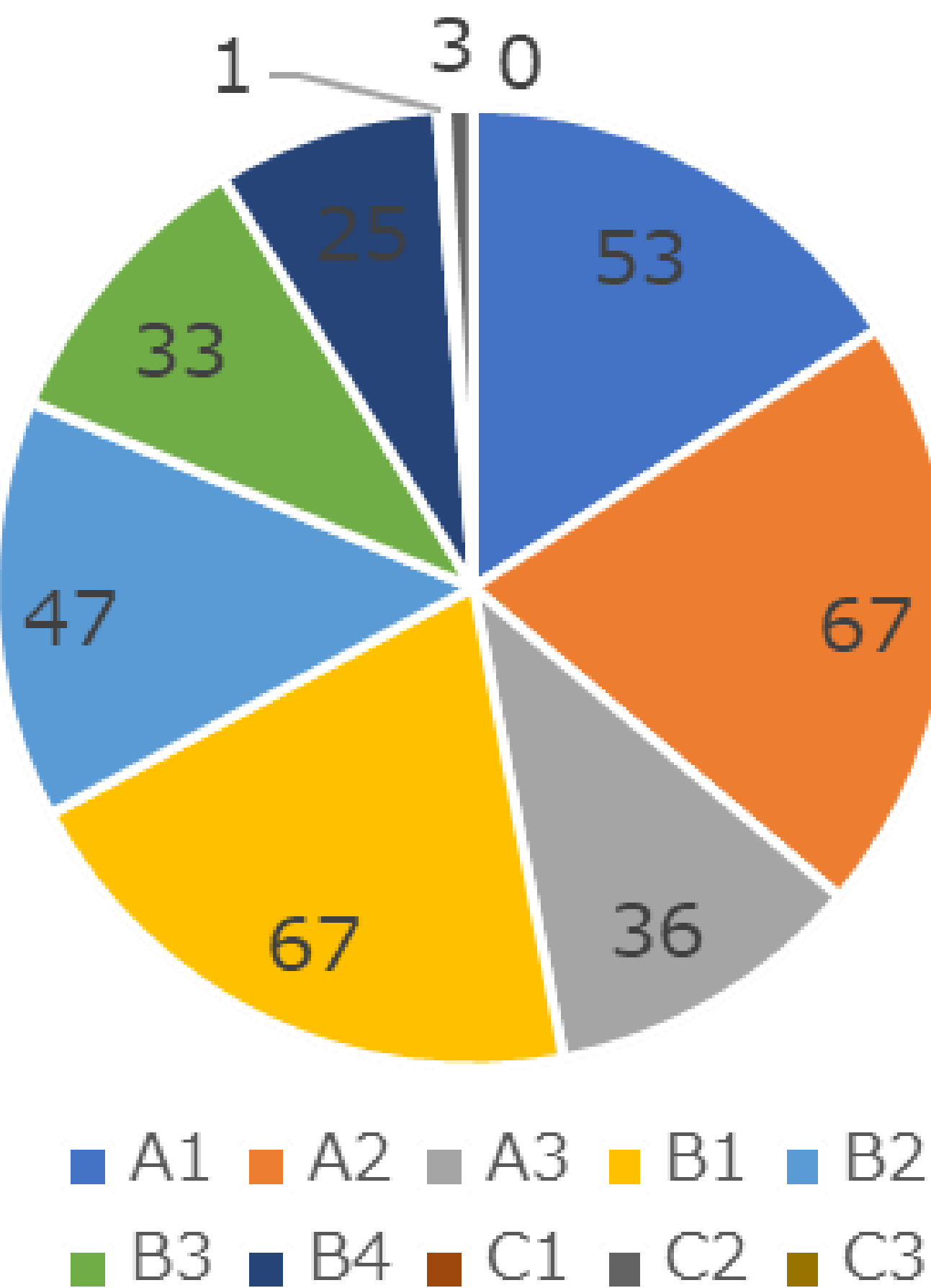
Adjacent teeth



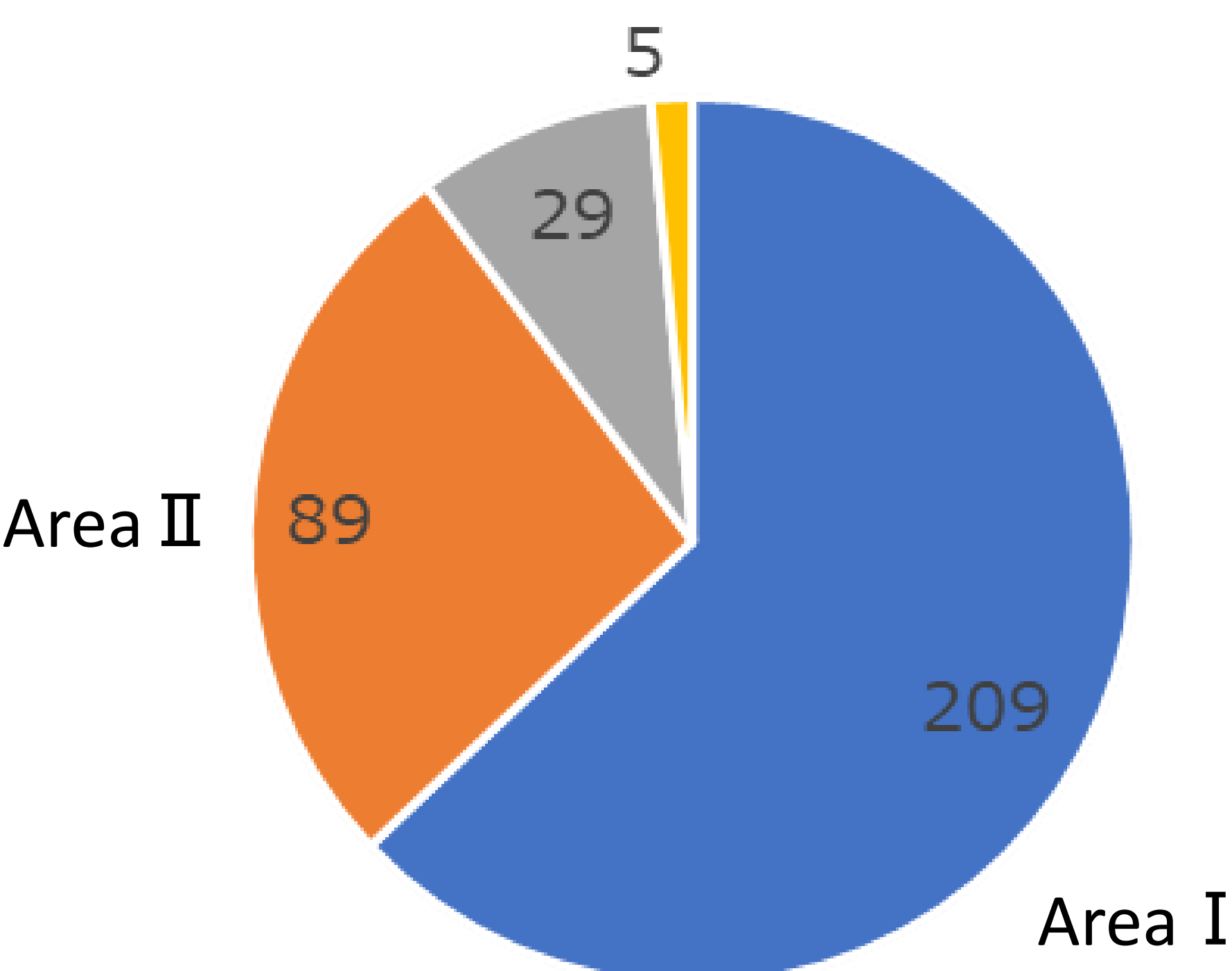
Abutment type



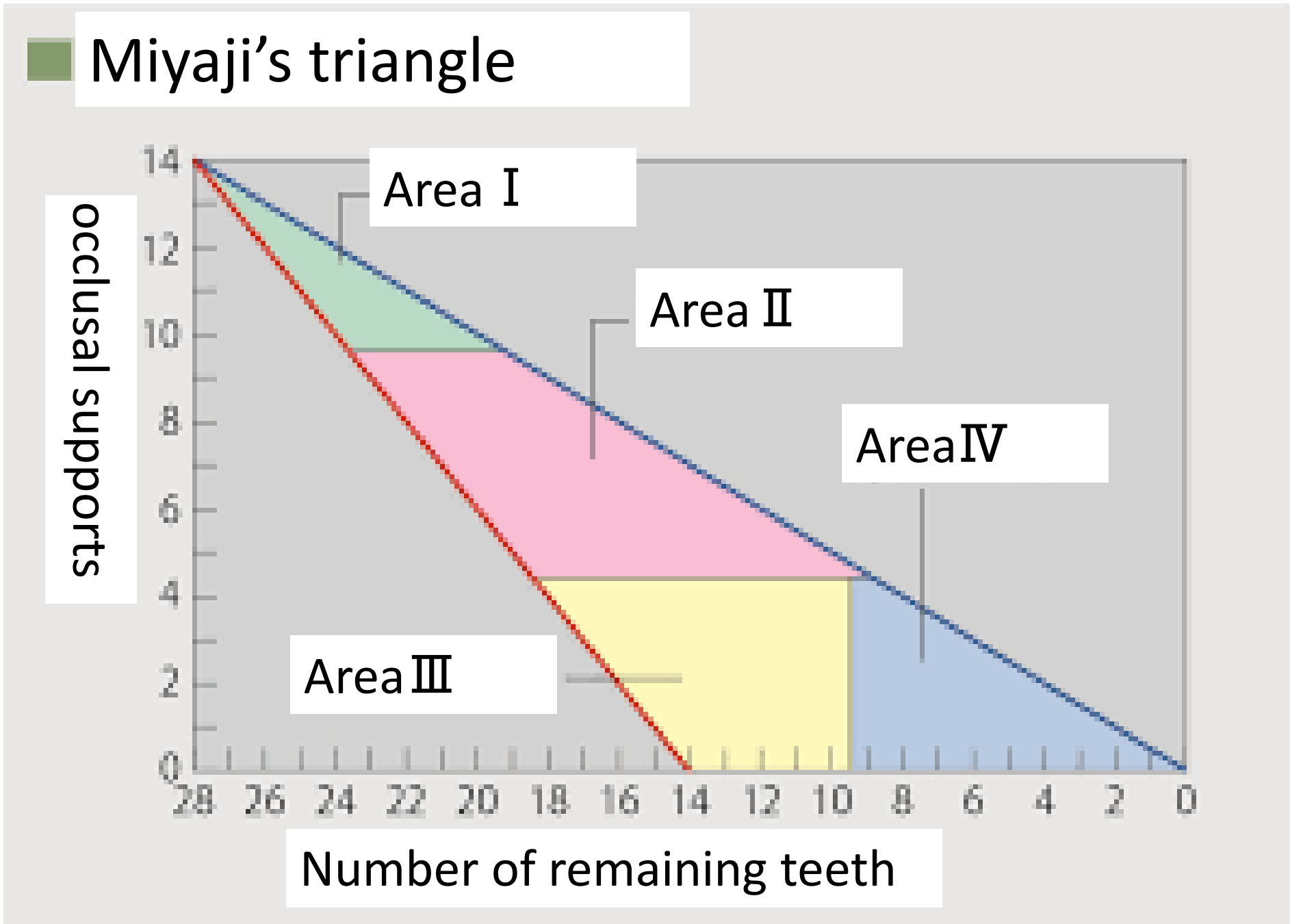
Eichner's classification



Miyaji's occlusal triangle

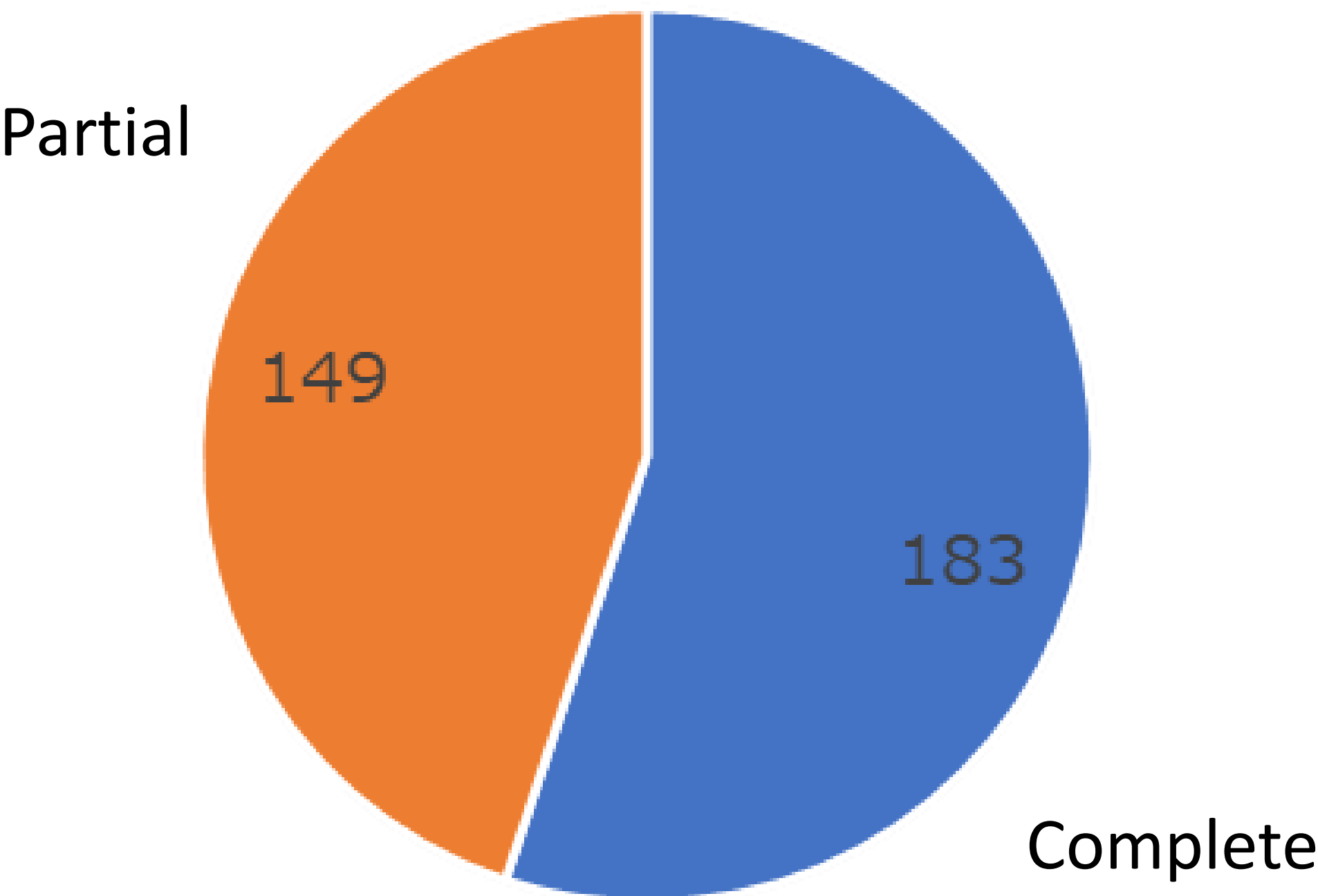


What is Miyaji’s triangle?

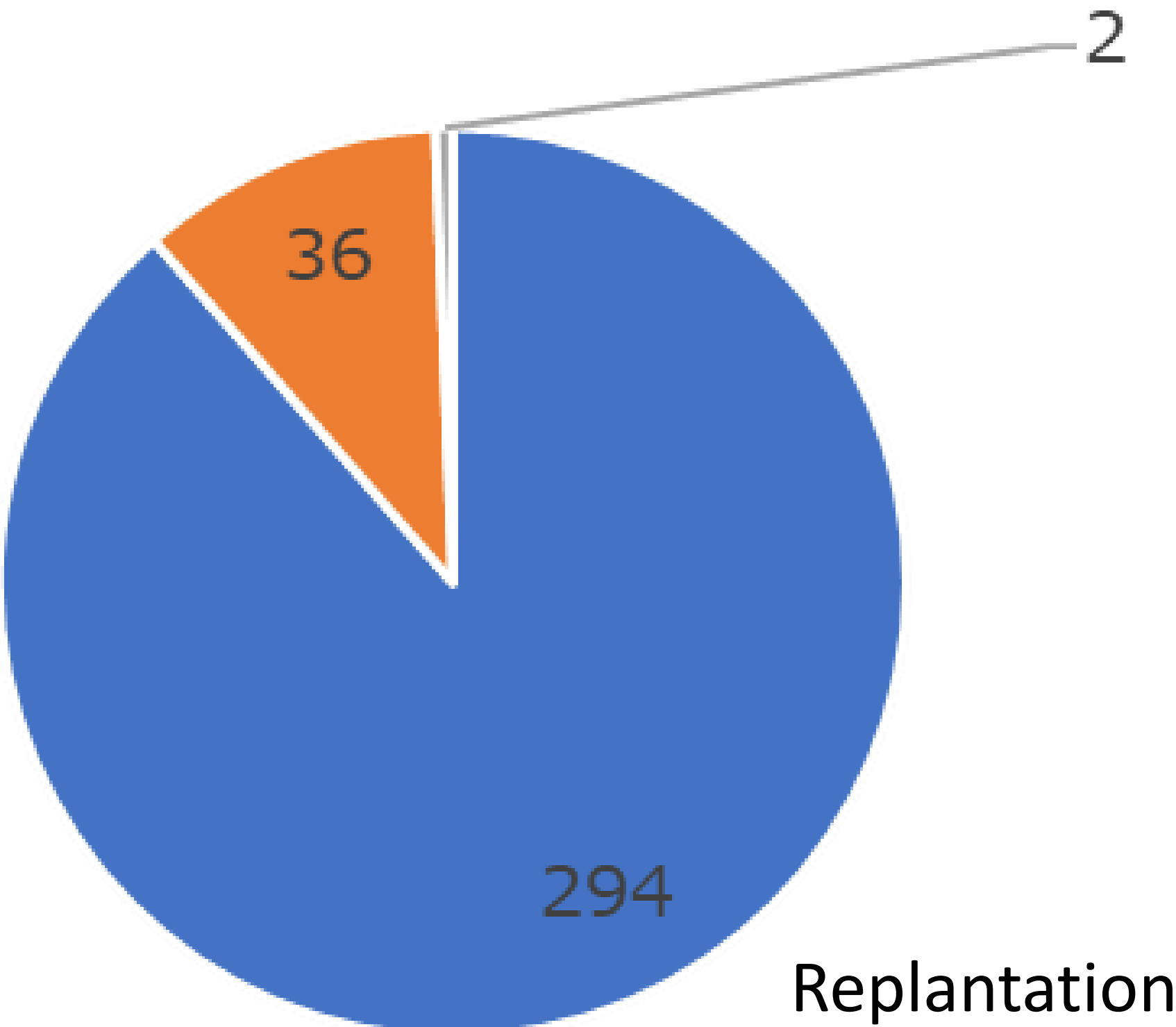


It predicts the possibility of occlusal collapse based on the number of remaining teeth and the number of occlusal supports.

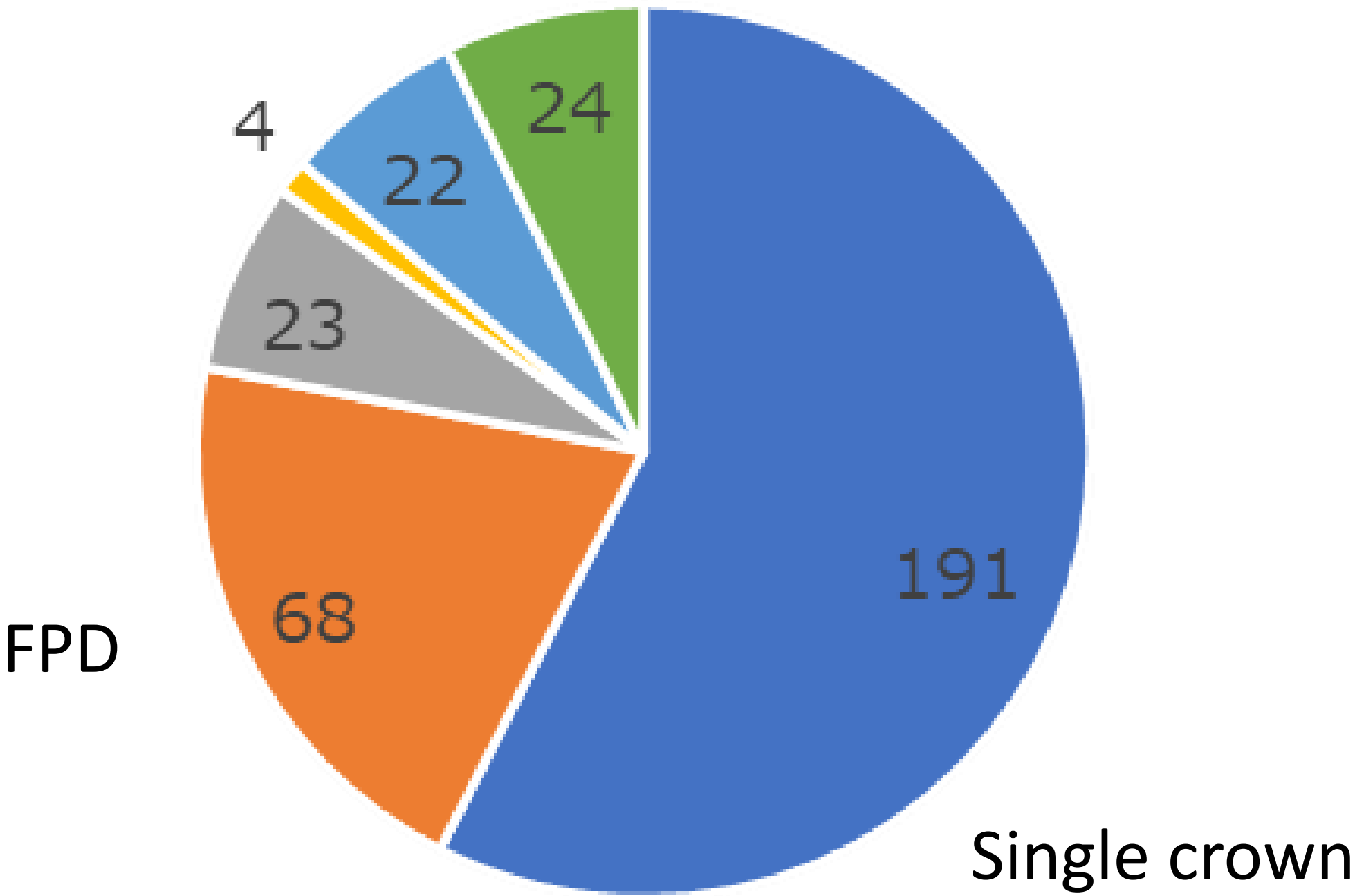
Fracture condition



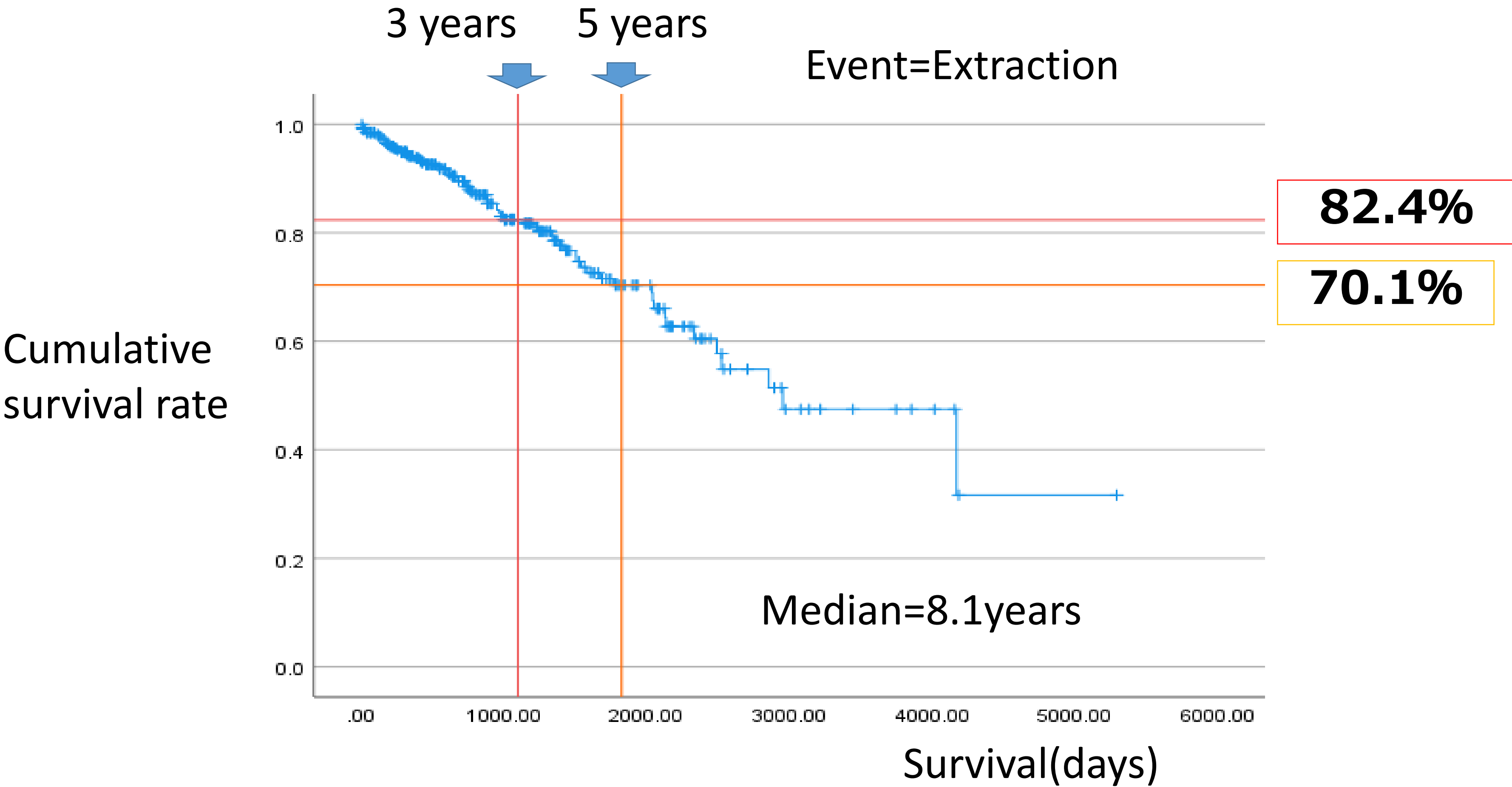
repair treatment method



final prosthetic device



Survival rate (Kaplan-Meier)



log-rank test

factor	group	event	termination	P-value
gender	male	18	57	0.2
	female	48	209	
age	20-60	35	154	0.23
	70-	31	112	
upper or lower	upper	38	149	0.2
	lower	28	117	
adjacent teeth	on both side	24	144	0.01
	none or one side	42	122	
Eichner	A	17	139	< 0.01
	B,C	49	127	
Miyaji	I	31	178	0.03
	II, III, IV	35	88	
fracture type	complete	39	144	0.29
	partial	27	122	

Risk factors

Cox regression analysis

factor	group	hazard ratio	95% confidence interval		P-value
			lower limit	upper limit	
gender	female(ref:male)	0.62	0.36	1.13	0.11
age	70-(ref:20-60)	1.03	0.61	1.74	0.9
location	lower(ref:upper)	1.16	0.69	1.93	0.57
adjacent teeth	one or none(ref:both)	1.78	1.05	3.08	0.03
Eichner	B,C(ref:A)	2.27	1.14	4.62	0.02
Miyaji	II, III,IV(ref: I)	0.94	0.52	1.75	0.84
fracture type	partial(ref:complete)	0.69	0.42	1.14	0.15

Results summary:

Root fractures were most common among women in their 60's to 70's, with single crowns being the main prosthesis. The type of fracture was predominantly complete (60%), followed by non-complete fractures with a fracture line (30%). The maxillary region was more frequently affected than the mandible, with the most common site being the maxillary premolar, followed by mandibular premolar and maxillary anterior teeth. According to Miyaji's occlusal triangle, the occlusal support region was 60% for area I and 30% for area II, and B1, A2, and A1 in order of Eichner's classification. Re-plantation was the most common treatment. **The survival rate after root fracture treatment was 82.4% after 3 years and 70.1% after 5 years, with a median of 8.1 years.** The log-rank test showed **no adjacent teeth** ($p=0.01$), **Eichner's classification B and C** ($p<0.01$), and **Miyaji's occlusal triangle II, III, IV** ($p=0.03$) were significant. The Cox proportional hazard model showed that **the absence of adjacent teeth** posed a risk compared to existing adjacent teeth ($HR=1.78$, 95%CI 1.05-3.08, $p=0.03$), and a higher risk was associated with **Eichner's classification B and C** compared to class A ($HR=2.27$, 95%CI 1.14-4.62, $P=0.02$).

Conclusion:

The treatments of vertical root fractures could be an effective strategy to prevent occlusal collapse prior to tooth extraction and dental implant placement. Root fractures frequently occur in oral cavities with few missing teeth and substantial occlusal force. The risk factors for fractured teeth treatment include more missing teeth and fewer occlusal supports.