

Long-term incisal plane change of single implant-supported crowns in anterior maxilla; a retrospective radiographic analysis

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Introduction

Implant-supported crowns have become the most common treatment for the loss of a single tooth. Adolescents are not good candidates for implant therapy since the implant, like an ankylosed tooth, fails to adapt to the maxillo-mandibular growth, resulting in infra-occlusion of the implant-supported crown. Although more subtle and slowly progressing, the same phenomenon has been observed in adults and has been attributed to the continuous facial growth and the continuous eruption of teeth (Fig. 1). According to the literature, infra-occlusion in adult patients ranges from 0.10 to 1.86 mm at follow-up intervals from 1 to 15 years (Bernard et al. J Clin Periodontol 2004).



Fig. 1. Clinical cases of single implant-supported crown infra-occlusion in the esthetic zone (#9 upper, #8 lower).

Aims

- To evaluate the longitudinal changes in tooth/implant relationship in adults with single implant-supported restorations in the anterior maxilla.
- To associate the observed changes with patient, surgery or prosthesis related parameters.

Results

- The inter-rater reliability was 0.88, with a 95% CI 0.81 - 0.93.
- Infra-occlusion progressed over time by 0.08 mm/year, with a 95% CI 0.06 - 0.1 mm/year (Fig. 3). The amount of infra-occlusion was significantly different from zero ($p < 0.001$).
- Infra-occlusion was more pronounced for delayed vs immediate implant placement (0.09 vs 0.06 mm/yr, respectively, $p=0.04$) (Fig. 4).
- Infra-occlusion was significantly associated with age. The amount of infra-occlusion decreased by 0.0013 mm/yr per additional year of age ($p=0.014$) (Fig. 5).
- No association between infra-occlusion and gender, implant site, immediate vs delayed implant temporization with provisional prosthesis, surgical protocol (one vs two stage), guided bone regeneration (with vs without), and type of restoration (screw vs cement retained) was found.
- No differences were found between the American and Chinese populations.

Materials and Methods

- 76 patients (40 from the USA and 36 from China), mean age at implant surgery 45 years (range: 21-78), 46 males and 30 females.
- 77 single implant-supported crowns (48 central incisors, 24 lateral incisors, 5 canines).
- Peri-apical radiographs, taken at final prosthesis delivery (baseline) and at follow-up examinations (1-15 years post-loading), were assessed for implant infra-occlusion over time (Fig. 2).
- The vertical position of the implant-supported crown relative to the adjacent tooth was measured using an open-source image processing program (ImageJ/Fiji 1.46, NIH) by two independent examiners.

Patient demographics and distribution of factors with potential relationship to the presence of implant infra-occlusion

	USA	China	Total
Number of patients	40	36	76
Gender (Male/Female)	28/12	18/18	46/30
Mean age (Range)	56 (21-78)	36 (25-48)	45 (21-78)
Implant sites			
Central incisors	26	22	48
Lateral incisors	13	11	24
Canines	1	4	5
Implant prosthesis			
Cement retained	25	34	59
Screw retained	9	1	10
Not-known	6	2	8
Implant surgical protocol			
Immediate/Delayed	20/20	8/29	28/49
One stage/Two stage	12/28	10/26/1(not known)	22/54/1(not known)
Provisional restoration			
Immediate temporization	8	7	15
Delayed temporization	30	30	60
Not-known	2	0	2
Intra-operative guided bone regeneration (Yes/No)	12/28	17/20	29/48

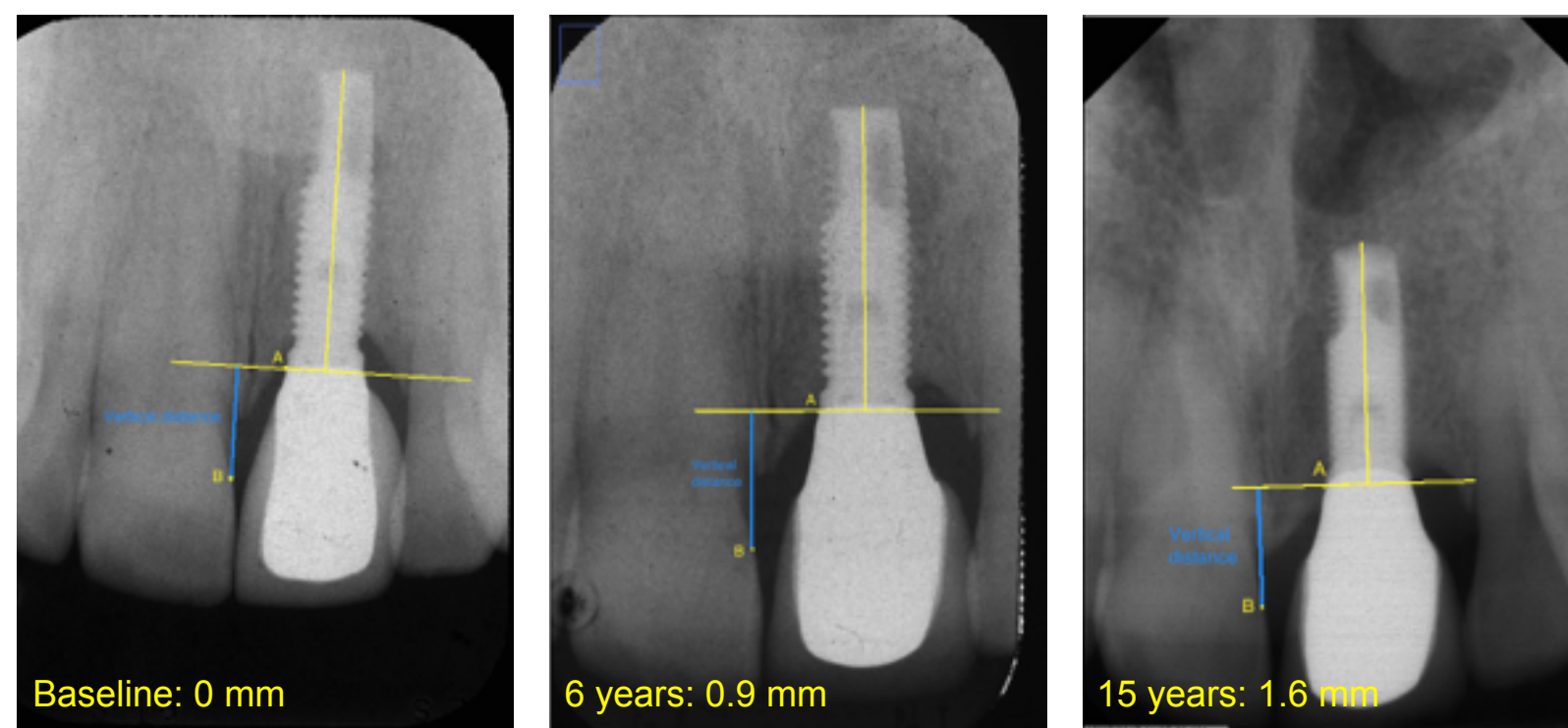


Fig. 2 Radiographic assessments of infra-occlusion over time. (A) implant-abutment junction, (B) CEJ of the adjacent tooth.

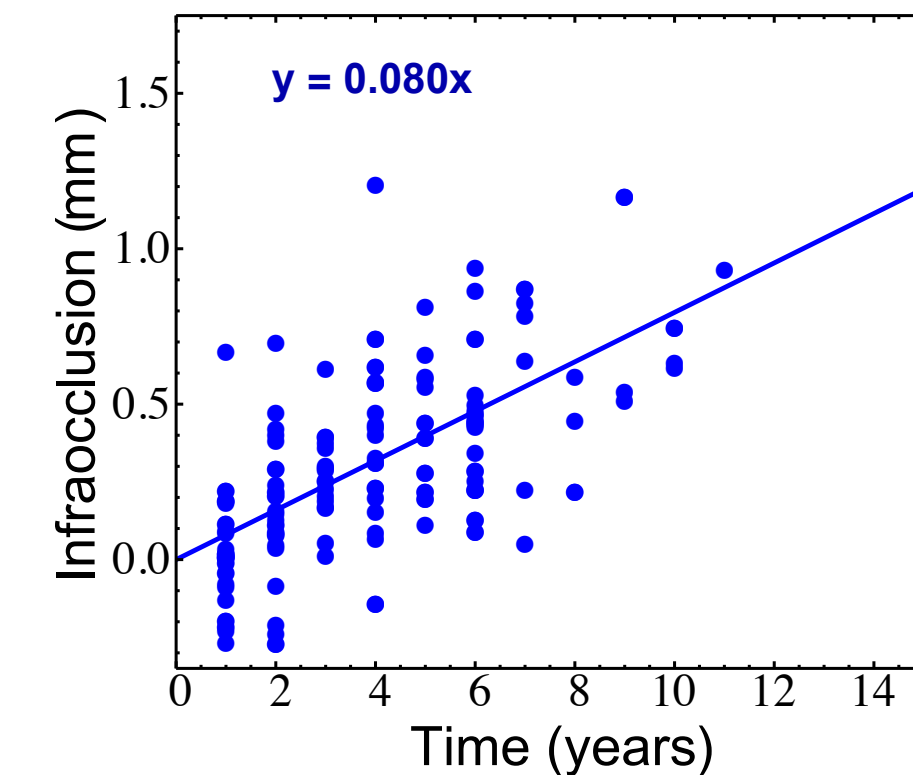


Fig. 3. Infra-occlusion (mm) by years after implantation with an overall trend line derived from the linear mixed model results.

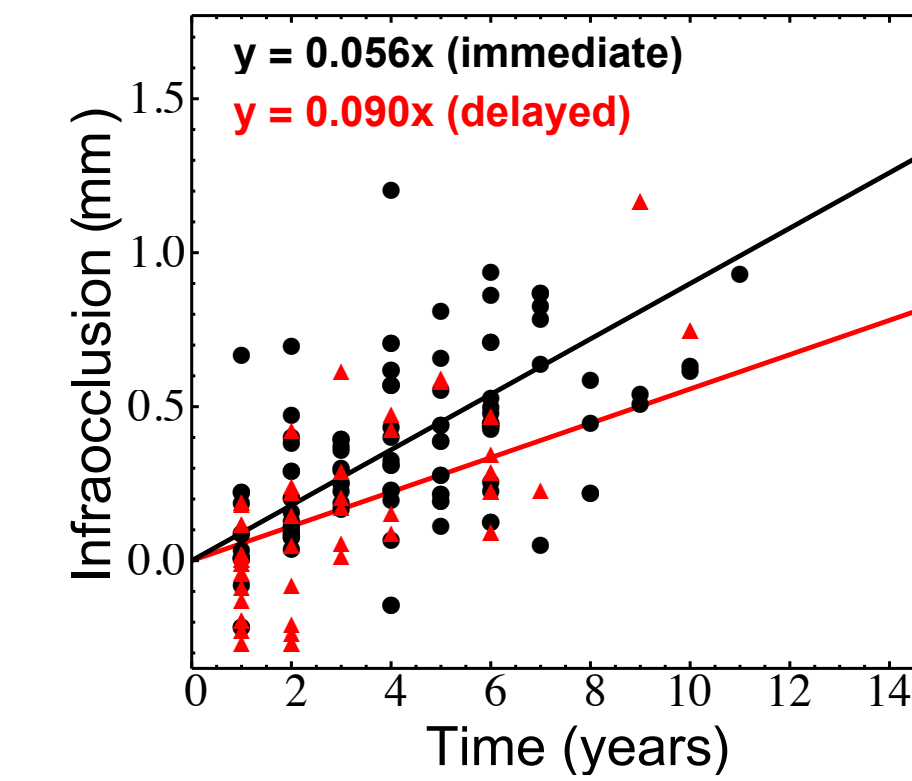


Fig. 4. The amount of infra-occlusion is significantly higher for delayed implant placement than for immediate implant placement.

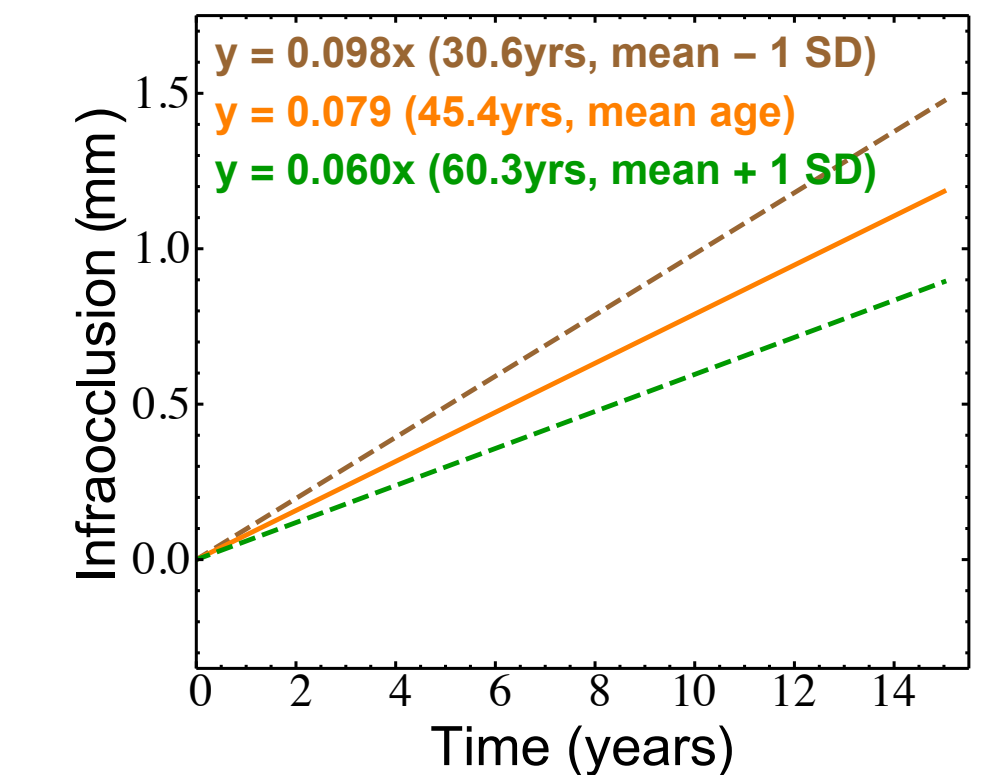


Fig. 5. The predicted infra-occlusion over time for a subject with age that is one standard deviation above and below the mean age.

Conclusions

- Adult patients with implant-supported crowns in the esthetic zone display long-term changes at the incisal plane which may jeopardize the smile esthetics.
- Greater infra-occlusion occurs in delayed- vs in immediate-implant placement
- Younger adults show more pronounced infra-occlusion than older ones.
- The magnitude of infra-occlusion was, in most situations, less than 1 mm. Clinicians need to be aware of the incisal plane change which may require replacement of the implant supported crown in the long term.

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