Incidence and Prevalence of Caries on Natural Teeth Adjacent to Implants

Aster Vas[1], Elaheh Vaheb[1], Era Kakar[1], Yousef Amrou[1], Tamires Dutra[1], Muhammed Saleh[1], Purnima Kumar[1]
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Background

Dental implants demonstrate high long-term survival and are often chosen over extensive conservative treatment for compromised teeth. However, while implants themselves are not susceptible to dental caries, their presence may influence the health of adjacent natural teeth. Altered plaque accumulation patterns, interproximal cleaning difficulty, and changes in local oral ecology around implants may increase the risk of caries development on neighboring teeth.

Emerging evidence suggests a notable incidence of caries adjacent to implant restorations. Studies have reported secondary caries as a common complication near posterior restorations, and recent data indicate increased complications, predominantly caries, affecting teeth next to implants. Despite this, the caries risk to adjacent natural teeth remains insufficiently investigated, particularly over longer follow-up periods and in relation to patient-level and implant-level factors.

Given the increasing use of dental implants, understanding their potential impact on surrounding dentition is essential for long-term treatment planning and preventive care.

Objective

This study aims to:

1. Evaluate the incidence of interproximal caries on natural teeth adjacent to dental implants over a minimum 3-year follow-up.
2. Assess the prevalence of interproximal caries in the same population.
3. Identify patient-level and implant-level factors associated with increased caries risk.

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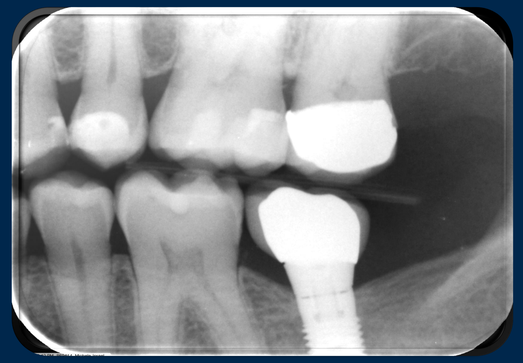

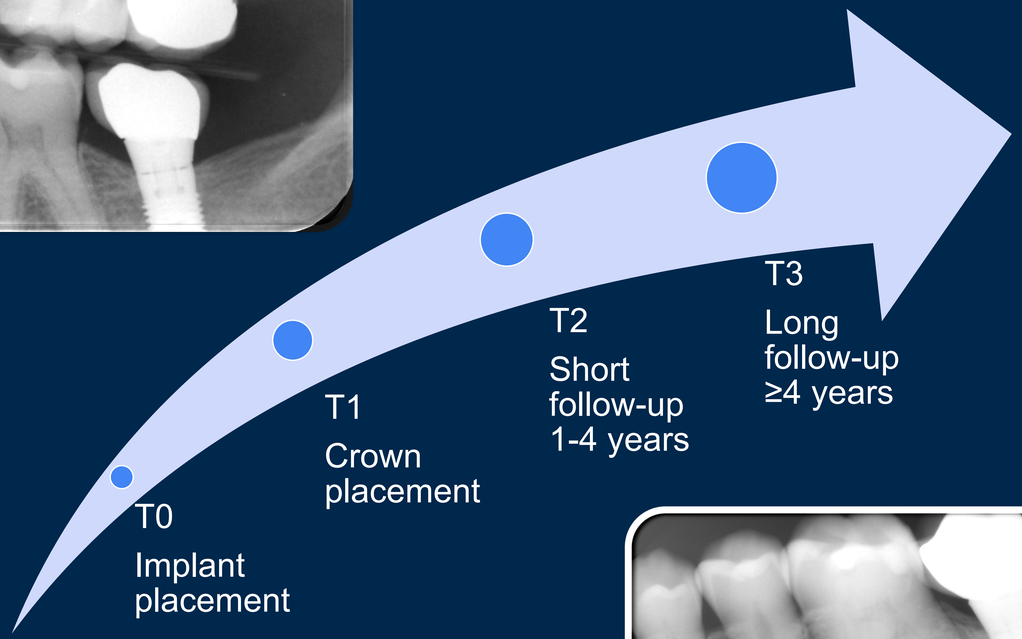

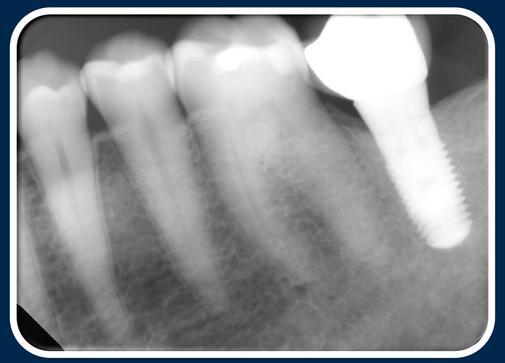

Methods

This retrospective longitudinal cohort study was conducted at the University of Michigan School of Dentistry and included patients who received dental implants between 2013 and 2021 with a minimum follow-up of three years and natural teeth adjacent to implants. Electronic health records and radiographs were reviewed for **333 patients (463 implants)** meeting the inclusion criteria.

Interproximal caries on natural teeth adjacent to implants were assessed at four time points: implant placement (T0), crown placement (T1), short-term follow-up (T2; 1-4 years), and long-term follow-up (T3; ≥4 years). Caries status (primary, secondary, and pre-existing), restorations, DMFT index, bleeding on probing, and horizontal implant-tooth distance were recorded. Radiographic measurements were standardized and calibrated, achieving intra-examiner reliability of $\kappa = 0.80$.

Patient-level variables included age, sex, smoking status, systemic conditions (including xerostomia-related factors), medications, and maintenance compliance. Implant-level factors included implant dimensions, design characteristics, and implant-tooth distance. Incidence and prevalence of interproximal caries were calculated, and risk factors were analyzed using negative binomial regression (subject-level), mixed-effects Poisson regression (implant-level), and logistic regression models, with results reported as incidence rate ratios (IRR) and 95% confidence intervals.

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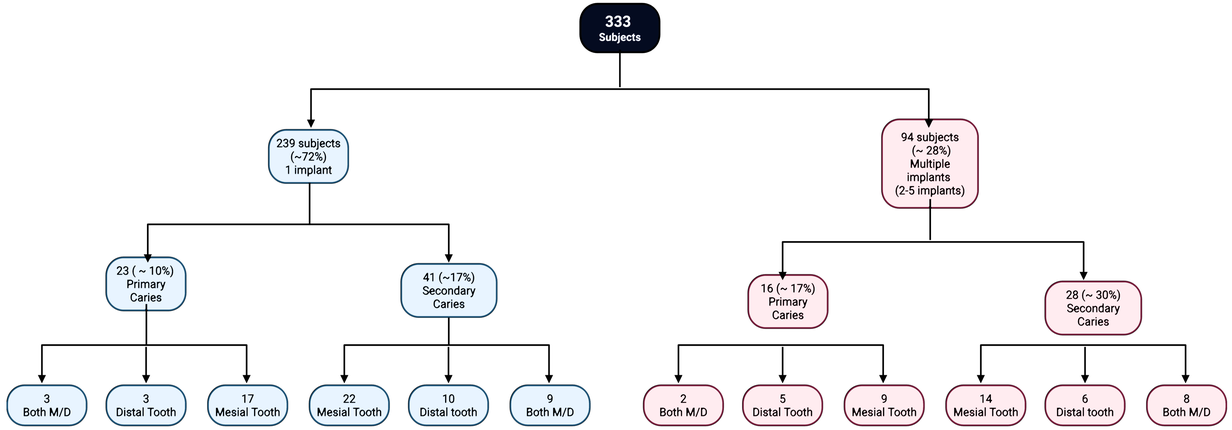
Patient - level



Number of Subject	Number of new caries episodes
26	1
10	2
4	3
1	4

Number of implant sites	Number of new caries episodes
15	1
5	2
3	3
1	4
1	6
2	9
1	10

Results

. A total of **333 patients** with **463 implants** and **926 adjacent teeth** were included (mean age 63.1 ± 10.5 years). Most patients had a single implant (72%), and nearly all implant sites (92%) already had restorations on at least one adjacent tooth at baseline, reflecting a high pre-existing restorative burden. Follow-up ranged from **12 to 146 months** after crown placement.

. At the patient level, new interproximal caries (primary or secondary) developed in teeth adjacent to implants; however, the number of implants per subject was **not associated** with increased caries risk. This finding was consistent at both the subject level (IRR = 1.10; 95% CI 0.86–1.45; p = 0.484) and implant level (IRR = 1.11; 95% CI 0.83–1.50; p = 0.463). Patient factors such as age, sex, and smoking status were also not significantly associated with caries development.

. At the implant level, **176 new carious lesions** were observed among adjacent teeth. Caries occurred more frequently on **mesial surfaces**. Primary caries affected ~8% of adjacent teeth, while secondary caries was present at ~19% of implant sites. These findings highlight a substantial restorative and caries burden in teeth neighboring implants over long-term follow-up.

. Analysis of local peri-implant factors revealed that **shorter implant-to-mesial tooth distance** was significantly associated with increased caries risk (OR = 0.81; p = 0.0128). Additionally, higher baseline caries experience (DMFT index) increased the likelihood of new caries (OR = 1.06; p = 0.0125). Other implant design variables and positional factors were not significant predictors.

. We found that closer proximity to the mesial tooth was associated with a higher risk of caries (OR 0.809, 95% CI 0.677–0.809, p = 0.0128). Additionally, as expected, subjects with a higher baseline caries experience were at greater risk for peri-implant caries (OR 1.060, 95% CI 1.01–1.060, p = 0.0125).

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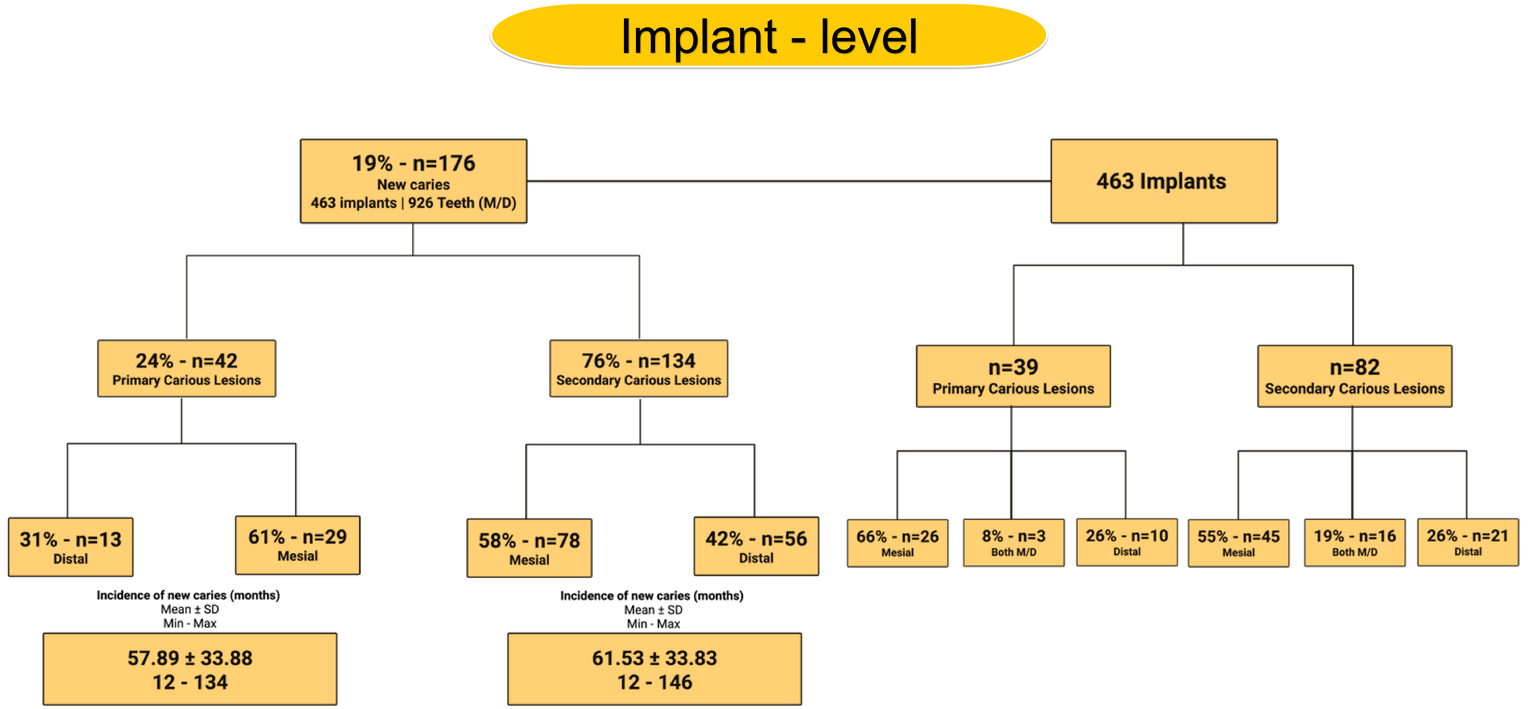
At the implant level, **176 new carious lesions** were observed among adjacent teeth. Caries occurred more frequently on **mesial surfaces**. Primary caries affected ~8% of adjacent teeth, while secondary caries was present at ~19% of implant sites. These findings highlight a substantial restorative and caries burden in teeth neighboring implants over long-term follow-up.

Analysis of local peri-implant factors revealed that shorter implant-to-mesial tooth distance was significantly associated with increased caries risk (OR = 0.81; p = 0.0128). Additionally, higher baseline caries experience (DMFT index) increased the likelihood of new caries (OR = 1.06; p = 0.0125). Other implant design variables and positional factors were not significant predictors.
We found that closer proximity to the mesial tooth was associated with a higher risk of caries (OR 0.809, 95% CI 0.677–0.809, p = 0.0128). Additionally, as expected, subjects with a higher baseline caries experience were at greater risk for peri-implant caries (OR 1.060, 95% CI 1.01–1.060, p = 0.0125).

Results



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Conclusion

Natural teeth adjacent to dental implants exhibit a substantial burden of interproximal caries over long-term follow-up, particularly secondary lesions. However, caries development was not associated with the number of implants placed per patient.

Instead, risk was influenced by **local and patient-specific factors**, including closer implant-to-tooth proximity and higher baseline caries experience (DMFT).

These findings suggest that while implants themselves do not inherently increase caries risk through implant number, they may contribute to localized ecological changes that, combined with pre-existing caries susceptibility, elevate the likelihood of disease in adjacent teeth.

Careful restorative planning, maintenance of adequate interproximal space, and close preventive monitoring of high-caries-risk patients are therefore essential to preserve neighboring dentition following implant therapy.

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References

1. Borg-Bartolo, R., et al., *Global prevalence of edentulism and dental caries in middle-aged and elderly persons: A systematic review and meta-analysis.* J Dent, 2022. **127**: p. 104335.
2. Kupka, J.R., et al., *How far can we go? A 20-year meta-analysis of dental implant survival rates.* Clin Oral Investig, 2024. **28**(10): p. 541.
3. Heitz-Mayfield, L.J.A. and G.E. Salvi, *Peri-implant mucositis.* J Clin Periodontol, 2018. **45 Suppl 20**: p. S237-s245.
4. Pjetursson, B.E. and K. Heimisdottir, *Dental implants - are they better than natural teeth?* Eur J Oral Sci, 2018. **126 Suppl 1**: p. 81-87.
5. Holm-Pedersen, P., N.P. Lang, and F. Müller, *What are the longevities of teeth and oral implants?* Clinical Oral Implants Research, 2007. **18**(s3): p. 15-19.
6. Smith, R.B., S.B. Rawdin, and V. Kagan, *Influence of Implant-Tooth Proximity on Incidence of Caries in Teeth Adjacent to Implants in Molar Sites: A Retrospective Radiographic Analysis of 300 Consecutive Implants.* Compend Contin Educ Dent, 2020. **41**(1): p. e1-e5.
7. Tagger-Green, N., et al., *Effect of posterior implant restorations on adjacent teeth and tissues: A case-control study.* Clin Implant Dent Relat Res, 2023. **25**(3): p. 473-480.
8. Park, S.Y., et al., *Long-term outcomes of adjacent and antagonistic teeth after implant restoration: a focus on patient-related factors.* J Periodontal Implant Sci, 2021. **51**(2): p. 135-143.
9. *Fridenberg N, Tagger-Green N, Katz M, Levartovsky S. Assessment of complications in adjacent natural teeth compared to contralateral teeth in single posterior implant cases. Sci Rep. 2025 Jan 16;15(1):2136. doi: 10.1038/s41598-025-86076-x. PMID: 39820803; PMCID: PMC11739628.*
10. *Dabdoub SM, Tsigarida AA, Kumar PS. Patient-specific analysis of periodontal and peri-implant microbiomes. J Dent Res. 2013 Dec;92(12 Suppl):168S-75S. doi: 10.1177/0022034513504950. Epub 2013 Oct 24. PMID: 24158341; PMCID: PMC3827621.*
11. *Fejerskov O, Kidd EA: Dental Caries: The Disease and Its Clinical Management. Blackwell Munksgaard, 2008, p 5.*
12. *Hals, E., Nernaes, Å., 1971. Histopathology of in vitro Caries Developing around Silver Amalgam Fillings. Caries Research 5, 58–77.. https://doi.org/10.1159/000259733*