

## CASE REPORT

# Maxillary root amputation: Case report with a 14-year-follow-up and updated mini review

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**Key Clinical Message**

Root resection is performed to create a maintainable furcation area in teeth with advanced periodontitis. However, the long-term feasibility of this treatment remains controversial. We present a case in which distal root resection in a maxillary molar successfully preserved the form and function of the dentition for approximately 14 years.

**KEYWORDS**

furcation defect, long-term, molar teeth, periodontitis, prognosis

## 1 | INTRODUCTION

Periodontal diseases are a group of inflammatory processes that affect the tooth-supporting structures, which, if left untreated, can progress and cause bone loss, thereby impairing the survival of the teeth.<sup>1–3</sup> Maxillary molars are the most commonly lost teeth, followed by the mandibular molars.<sup>4,5</sup>

Treatment of periodontal disease focuses mainly on arresting disease progression and preserving the form and function of the dentition involved. Managing periodontal disease around multirooted teeth is challenging for periodontists because of the complex anatomy of the tooth furcation area, which favors plaque accumulation and hinders personal and professional cleaning attempts. The furcation is defined as the anatomic area of a multirooted tooth in which the roots diverge, and pathologic resorption of the bone in this region is known as “furcation involvement.”<sup>6</sup>

Furcation involvement is associated with a poor prognosis and higher tendency for tooth loss<sup>4</sup> due to the complex anatomy<sup>7–9</sup> and difficulty in maintaining oral hygiene, performing periodontal debridement,<sup>10–13</sup> and periodontal

maintenance.<sup>5</sup> Several treatment options have been proposed to manage furcation involvement by cleaning the area and rendering it more cleansable. Treatment options vary according to the degree of furcation involvement and patient- and clinician-related factors and include simple debridement of the defect using either closed or surgical approaches; furcation plasty/osseous plasty; regenerative approaches involving guided tissue regeneration around the furcation; and respective approaches involving tunneling,<sup>14</sup> root resection/amputation, or hemisection. In case of failure of these options, tooth extraction is necessary.

Root amputation and hemisection are the least desired approaches by both patients and clinicians because of the assumption of inferior results compared with other therapies, such as dental implants. However, this assumption is contrary to the findings in several studies that reported high success rates when these procedures were performed correctly on properly selected patients. Herein, we present the 14-year follow-up of a maxillary right first molar (tooth #16) in which root amputation was performed and explain how this procedure saved the tooth during cancer treatment.

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## 1.1 | Case history

A 33-year-old woman was referred to our periodontal department by a prosthodontist for surgical crown lengthening of the endodontically treated tooth #16. The patient was medically fit and did not smoke. Clinical examination revealed fair oral hygiene with calculus deposition over the mandibular anterior teeth. Periodontal evaluation revealed a localized deep periodontal pocket with a probing depth (PD) of 6–7 mm distal to tooth #16 and distal grade 2 furcation involvement.<sup>15</sup> In addition, a periodontal pocket with a PD of 4–5 mm and grade 1 furcation involvement distal to tooth #26, 2 mm gingival recession around tooth #46 with lingual grade 2 furcation involvement, gingival recession on the lingual of the mandibular anterior teeth, and buccal of tooth #34 Recession type two (RT 2),<sup>16</sup> and short anterior crowns were observed. The patient had

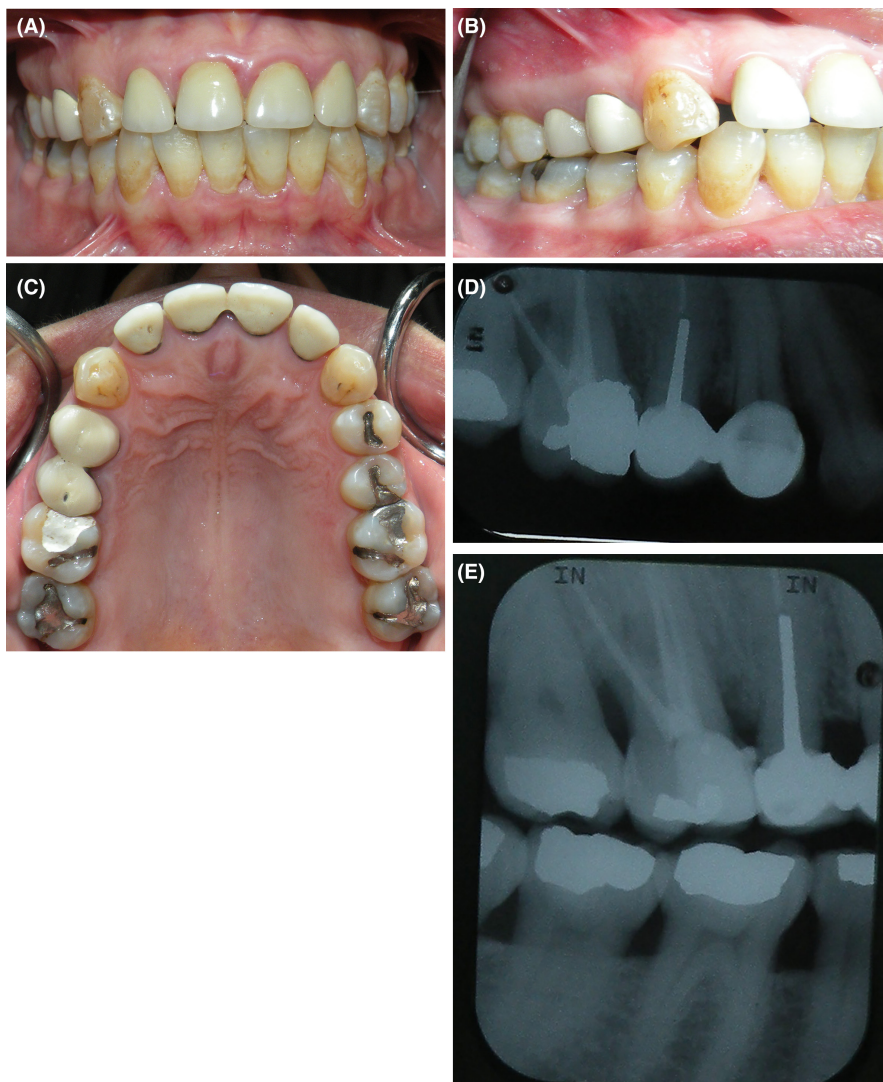
class 1 molar and canine relationships on both sides according to Angle's classification (Figure 1).

## 2 | DIFFERENTIAL DIAGNOSIS AND INVESTIGATIONS

Endodontic-induced bone loss as well as the possibility of traumatic occlusion were considered. However, further investigations and consultations have ruled out those factors.

### 2.1 | Periodontal diagnosis

The patient was diagnosed with periodontitis stage 3 grade B with a molar incisor pattern<sup>17</sup> (formerly localized aggressive periodontitis),<sup>18</sup> with recession type two



**FIGURE 1** Pre-treatment photos showing #16. (A) Frontal view, (B) lateral view, (C) Occlusal view, (D) Periapical radiograph, and (E) bitewing radiographs.

(RT 2)<sup>16</sup> on the lingual of teeth #33–43 and buccal of tooth #34, as well as altered passive eruption of the maxillary incisors.

### 3 | TREATMENT

Phase 1 therapy, including oral hygiene instructions, scaling, and root planing, was performed, and combination antibiotic therapy consisting of 500 mg amoxicillin and 500 mg metronidazole orally was administered three times a day for a week. During the reevaluation, a significant improvement in patient's oral hygiene and bleeding index was noticed, however, with very little improvement distal to #16. Thus, periodontal surgical therapy was initiated after reevaluation. The patient underwent open flap debridement around teeth #26 and #46, connective tissue grafting around tooth #34, and anterior esthetic crown lengthening.

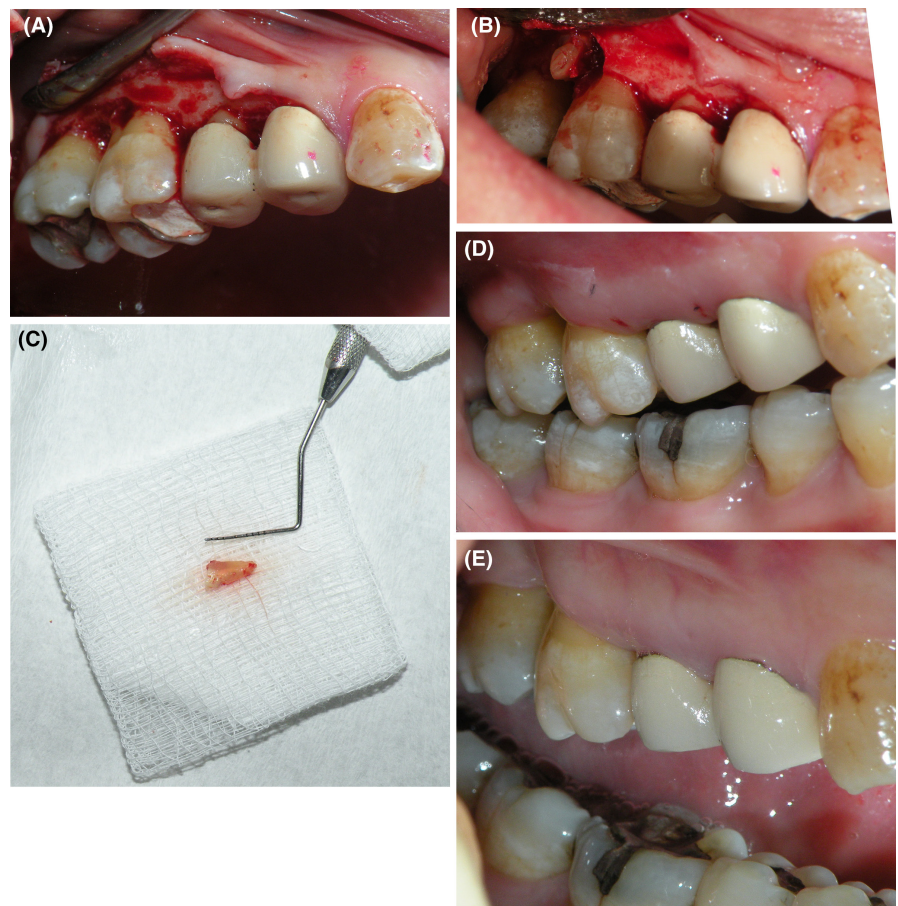
Tooth #16 was previously endodontically treated, and flap reflection revealed that the vertical defect involved more than two-thirds of the distal root with deep grade 2 furcation involvement. Therefore, distal root amputation was performed to maintain the tooth while eliminating the pocket and furcation area, rendering the area

accessible for maintenance using oral hygiene measures. (Figure 2).

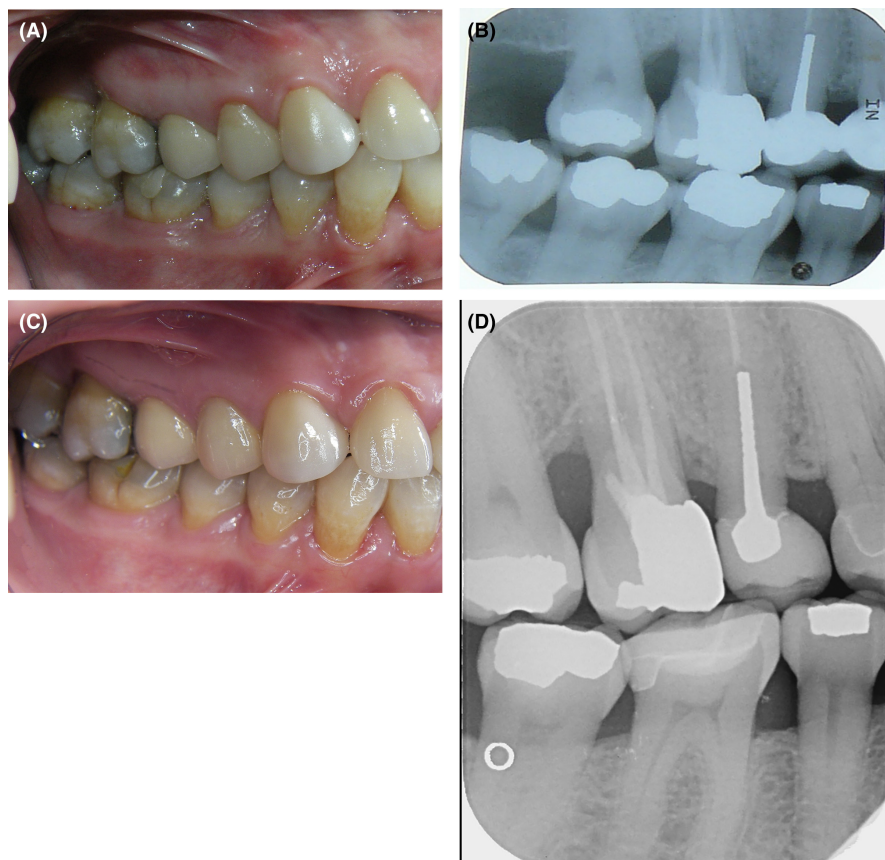
Subsequent prosthodontic evaluation revealed that the tooth was subjected to low occlusal forces, the access cavity was small with minimal loss of tooth structure, precluding the need for tooth crowning.

### 4 | FOLLOW-UP

The patient was followed up every 4–6 months for around 10 years. During this period, her overall periodontal condition was stable, and routine maintenance was performed. Although few incidents of disease exacerbation with PDs of approximately 4–5 mm around the molars occurred, local nonsurgical measures were sufficient for their management (Figure 3). During that period, the patient developed type 2 diabetes mellitus and hypertension. Towards the end of the ninth year after surgery, the patient was diagnosed with breast cancer for which she underwent respective surgery and received hormonal treatment and bisphosphonate injections. The patient could not adhere to the periodontal maintenance program during this period and missed multiple appointments. Consequently, her oral hygiene reduced,



**FIGURE 2** Surgical root amputation. (A): Flap reflection, (B) Distal root amputation, (C) the resected Root (D) 1-week follow up after suture removal, and (E) 3-months follow-up.



**FIGURE 3** Follow-up of the procedure after (A) 1-year clinical view, (B) 1-year Radiographs, (C) 6-years clinical view, and (D) 10-years bitewing radiograph.

and the periodontal status began to deteriorate. Probing depth (PD) around tooth #16 increased and arresting disease progression was difficult. Around 4 years later, the patient finished her breast cancer treatment and resumed her dental visits; PD around tooth #16 had significantly increased up to 9 mm, and surgical intervention was necessary. Cone-beam radiographic evaluation revealed bone loss around the tooth, and extraction and implant placement were planned (Figure 4). However, the tooth was in function and had successfully preserved the space for approximately 14 years.

## 5 | DISCUSSION WITH MINI REVIEW OF THE LITERATURE

Furcation involvement is a major factor hindering the prognosis of molar teeth because of the difficulty in maintaining an area free from dental plaque. Root resection and/or amputation is a possible strategy for managing this situation by creating an area that is more accessible for oral hygiene measures. Several previous studies have evaluated the long-term success of this procedure.<sup>19–25</sup> Table 1 summarizes some of the studies available in the literature with their main findings.

The success rate ranged from 100%<sup>14,30</sup> to 40%<sup>32</sup>; however, a systematic review published in 2009 reported the

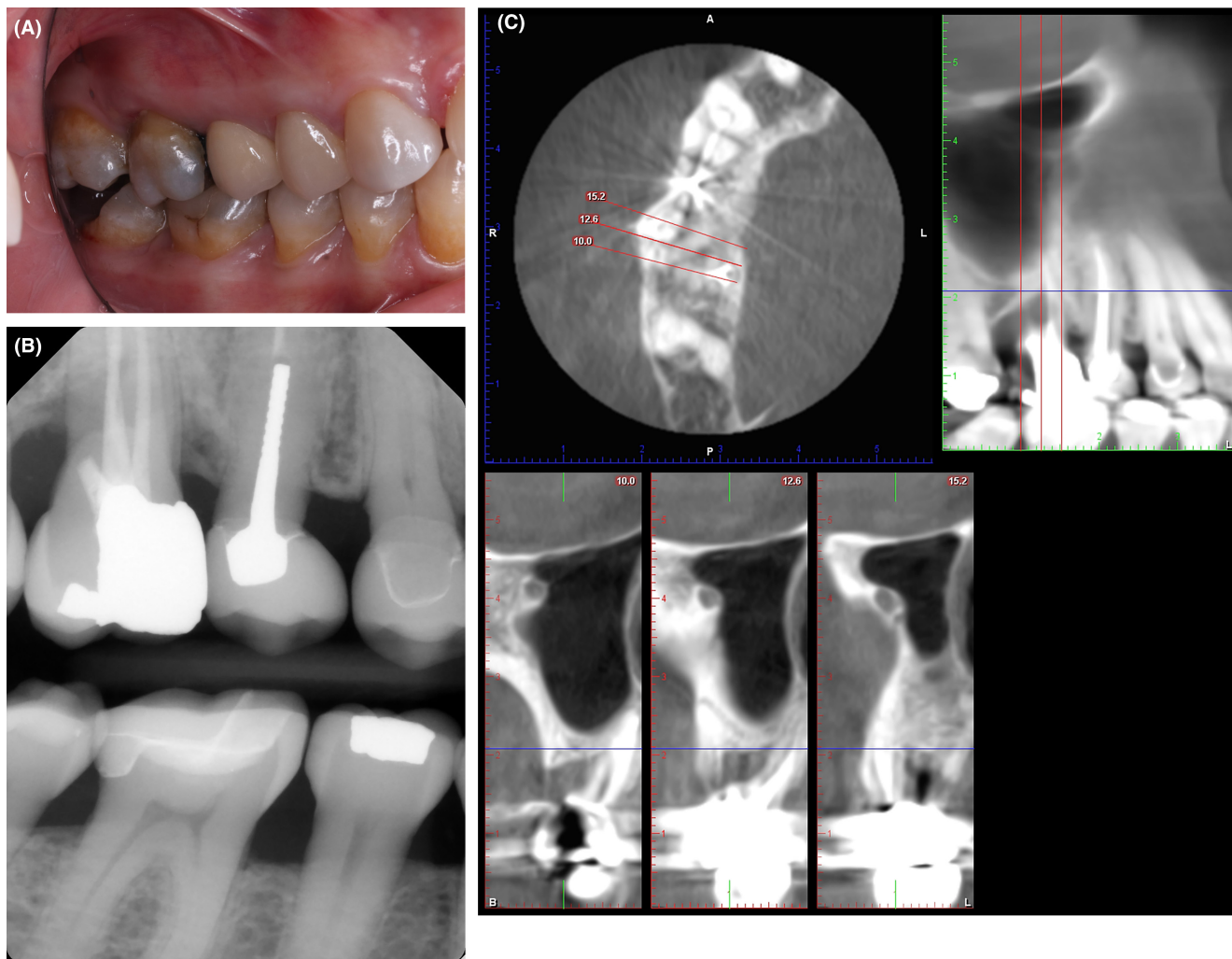
survival rate to range between 62%–100% over an observation period of 15–13 years.<sup>36</sup> A more recent systematic review published during 2020 indicated an overall survival rate of 38%–94.4%, which is similar to that of scaling, root planing, and open flap debridement.<sup>37</sup> The difference in success rates between studies can be attributed to several factors, including the criteria for case selection, type of final restoration, follow-up duration, and criteria for defining success.<sup>38</sup>

Derks et al.<sup>33</sup> evaluated the long-term survival rates of root-resected teeth over approximately 30 years. They reported a cumulative survival rate of 90.6% for the first 10 years, which decreased considerably thereafter, with a median survival duration of 20 years after root resection.

Owing to the importance of proper case selection and careful performance of the procedure for improving the overall survival rate, several authors have attempted to define the essential criteria for determining procedural success.

Newel attributed failures to residual root fragments and furcation lips and ledges that were not properly identified and managed during surgery,<sup>26</sup> while Carnevale et al.<sup>29</sup> considered osseous recontouring and apical repositioning of the flap essential for procedural success.

Mjzooob and Kon stressed the importance of careful evaluation of the procedure and proper planning



**FIGURE 4** (A) 14years clinical view, (B) 14years bitewing radiograph, and (C) 14years Cone beam computed tomography for the indicated tooth.

for subsequent restorations because only 8% of root-resected molars have favorable periodontal support postoperatively.<sup>39</sup>

Park reported that teeth with >50% residual supporting bone had higher survival rates.<sup>31</sup> In contrast, Lee et al. reported an increased risk for procedural failure in teeth with mobility  $\geq$  grade 2 before root resection and removal of the supporting bone.<sup>32</sup> Persistent mobility of any degree after phase-one therapy and the involvement of two or more proximal surfaces were considered contraindications by Klavan et al.<sup>23</sup>

Rasperini presented a decision tree wherein root amputation/resection was indicated only for cases with grade 3 furcation involvement with the vertical component of the furcation not exceeding the middle third of the root and attachment loss limited to only one root.<sup>40</sup>

The choice between maintaining a tooth with root amputation or replacing it with a dental implant is debatable. Fugazzotto et al.<sup>41</sup> compared the success rates of

root-resected molars to those of dental implants placed in the molar region and found success rates ranging between 95.2% and 100% over 15years of observation, with cumulative success rates of 96.8% for root-resected molars and 97% for implants. Zafiropoulos et al.<sup>42</sup> reported a complication rate of 32.1% in root-resected molars compared to 11.1% in implants in the molar region over approximately 4years. Similarly, Kinsel et al.<sup>43</sup> reported a 15.9% failure rate for root-resected molars compared to 3.6% for single implants.

Higher failure rates for implants in the maxillary molar region are attributed to the bone quality in that region.<sup>44</sup> Simonis et al.<sup>45</sup> reported complications in approximately 48.03% of implants. Therefore, all factors should be considered, and treatment options should be discussed with the restorative dentist and presented to the patient before finalization of the treatment plan.

In this case, root amputation successfully maintained the form and function of the dentition for more than 10years.

Author	Follow-up period range in years (average)	No. of teeth	Overall percentage of teeth lost/failed
Bergenholtz, 1972 <sup>24</sup>	2–11	45	6
Klavan, 1975 <sup>23</sup>	1–7 (3)	34	2.9
Hamp and Nyman <sup>14</sup>	5	87	0
Langer et al., 1981 <sup>22</sup>	10	100	38
Erpenstein, 1983 <sup>25</sup>	1–7 (2.9)	34	8.8
Buhler, 1988, <sup>20</sup>	10	28	32
Newel 1991 <sup>26</sup>	0.5–7	70	30
Basten 1996 <sup>27</sup>	2–23 (11.5)	49	8
Blomlof et al 1997 <sup>28</sup>	3–10 (5.8)	146	22
Carnevale 1998 <sup>29</sup>	10	175	7
Hou 1999 <sup>30</sup>	5–13 (6.7 ± 1.9)	85	0
Park et al 2009 <sup>31</sup>	10	342	29.8
Lee et al 2012 <sup>32</sup>	10	149	59.7
Derks 2018 <sup>33</sup>	4–30 (14.7 ± 6.8)	90	33.3
Alassadi 2020 <sup>34</sup>	1–16.8 (5 ± 4.3)	85	44.7%
AlSayed 2020 <sup>35</sup>	1–15 (9.62 ± 3.08)	130	43.1%

TABLE 1 Studies evaluating long-term failure rates of root amputation.

We believe that problems only started when the patient showed reduced compliance with maintenance visits. Even though, we think that this treatment gave the patient the chance to postpone bone grafting and dental implant placement for better timing. Placing implants earlier might have led to the development of peri-implantitis owing to the difficulties associated with their maintenance.

## 6 | CONCLUSION

We reported a case with long-term follow-up after root amputation. Root resection helped maintain the form and function of the dentition for more than 10 years, allowing for better timing for dental implant placement. This case highlights the importance of proper maintenance visits and patient compliance.

### AUTHOR CONTRIBUTIONS

**Sumaiah Ajlan:** Conceptualization; methodology; project administration; resources; writing – original draft.

### FUNDING INFORMATION

Non applicable.

### CONFLICT OF INTEREST STATEMENT

No conflict of interest to declare.

### DATA AVAILABILITY STATEMENT

The data that supports this case are available with the corresponding author upon reasonable request.

### ETHICS STATEMENT

The patient has signed a written informed consent in accordance with Journal's policy.

### CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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**How to cite this article:** Ajlan SA. Maxillary root amputation: Case report with a 14-year-follow-up and updated mini review. *Clin Case Rep.* 2024;12:e8553. doi:[10.1002/ccr3.8553](https://doi.org/10.1002/ccr3.8553)