Scientific Research Publishing

Open Journal of Stomatology, 2025, 15(7), 151-158
https://www.scirp.org/journal/ojst
ISSN Online: 2160-8717
ISSN Print: 2160-8709

A Case of Giant Dental Calculus

Toshiyuki Inou[1], Keiichi Uchida[1], Tatsuo Takaya[1], Hiroyuki Kitamura[2], Yu Chi Hung[1], Emi Oki[1], Nina Wakimoto[1], Toshiaki Ara[2], Hiroshi Mori[1], Nanae Dewake[3], Nobuo Yoshinari[3]

[1]Department of Oral Diagnostics and Comprehensive Dentistry, Matsumoto Dental University Hospital, Shiojiri, Japan
[2]Department of Pharmacology, School of Dentistry, Matsumoto Dental University, Shiojiri, Japan
[3]Department of Periodontology, School of Dentistry, Matsumoto Dental University, Shiojiri, Japan
Email: Toshiyuki.inou@mdu.ac.jp

How to cite this paper: Inou, T., Uchida, K., Takaya, T., Kitamura, H., Hung, Y.C., Oki, E., Wakimoto, N., Ara, T., Mori, H., Dewake, N. and Yoshinari, N. (2025) A Case of Giant Dental Calculus. *Open Journal of Stomatology*, **15**, 151-158.
10.4236/ojst.2025.157014

Received: May 30, 2025
Accepted: July 4, 2025
Published: July 7, 2025

Abstract

This report aimed to present a case of giant dental calculus. A 53-year-old man presented with a chief complaint of a swelling sensation in the right cheek. His general examination revealed a moderate physical and nutritional status. He had a history of myocardial infarction as a systemic disease. The remaining teeth showed caries and periodontal disease, with severe dental calculus deposition and redness and swelling of the gingiva. All teeth exhibited a high degree of dental plaque and calculus, especially those in the mandibular right canine to left molar area, covering the floor of the mouth from the buccolingual to the lingual side. The hard tissue was removed and analyzed by infrared absorption spectrometry. The results showed phosphate groups, carbonate groups, and protein-derived absorption bands, which led to the diagnosis of carbonate apatite. A diagnosis of dental calculus was made based on intraoral findings, panoramic radiographs, and component analysis. It was determined that the remaining teeth could not be preserved because significant alveolar bone resorption and caries were observed. Therefore, they were extracted, and prosthetic treatment was initiated. The precise cause of the giant dental calculus remains unknown.

Keywords

Giant Dental Calculus, Infrared Absorption Spectrometry, Carbonate Apatite, Oral Care

1. Introduction

Dental calculus forms when saliva, which contains minerals such as calcium and phosphorus, reacts with dental plaque to produce calcium phosphate in an irreg-

ular form, which is transferred to hydroxyapatite, which then grows into dental calculus. If the plaque is left untreated, it begins to calcify after 4 - 8 h and transforms into dental calculus after 2 - 3 days. Plaque often becomes dental calculus in approximately 2 weeks. With the increased awareness of oral hygiene prevention, the number of cases of significant dental calculus deposition has significantly decreased. This report presents a case of giant dental calculus.

2. Case Report

A 53-year-old male visited the initial examination room at Matsumoto Dental University Hospital in late May 2021 with a chief complaint of a swelling sensation in the right cheek area. Approximately 1 month earlier, a tooth in the mandibular region (tooth identification unknown) had fallen out but was left untreated. After 1 week, the patient became aware of a swelling sensation in the right cheek area and visited the hospital for a thorough examination and treatment. The patient expressed a desire to have his bite restored. The patient exhibited a marked fear of dental treatment. Consequently, he had not consulted a dentist for over two decades, and thus, a definitive timeline regarding tooth loss was not available. Upon examination, he was 167 cm tall, weighed 62 kg, had no eating problems, and was in moderate physical and nutritional status. After requesting information from the patient's primary care provider, we learned that the patient had a history of a wide anterior wall septal infarction and had undergone percutaneous coronary intervention. Given this history, the patient was taking antithrombotic medications and beta blockers. The patient had smoked up to three years prior. The patient's family history showed a history of cardiac disease, hypertension, diabetes, and dyslipidemia in the patient's father. The hospital does not offer screening tests for systemic diseases, such as blood tests. His facial features were symmetrical, with no pain or swelling in the right cheek area. Examination of the remaining teeth revealed caries and periodontal disease, with high levels of dental calculus deposition and redness and swelling of the gingiva. Almost all teeth had a high degree of plaque and dental calculus, especially those in the mandibular right canine to left molar area, covering the floor of the mouth from the buccolingual side. Additionally, hard tissue that appeared to be layered granular dental calculus with a mixture of yellowish-white and brownish-brown color was observed (**Figure 1**). Panoramic radiographs showed significant alveolar bone resorption in the remaining teeth and floating teeth, particularly in the mandible, where relatively clear opacities were observed in the layers from the right first molar to the left canine (**Figure 2**). These opacities showed no continuity with the jawbone. Based on intraoral conditions, dental calculus was strongly suspected. Therefore, the dental calculus was carefully removed in three sessions while the intraoral condition was being examined. After calculus removal, gingival swelling and bleeding were observed in the oral cavity, and caries were observed in the remaining teeth (**Figure 3**). The total weight of the tissue that was identified as dental calculus was 9.1 g (**Figure 4**), including the tooth that was debrided. The removed dental cal-

culus was analyzed using infrared absorption spectrometry at SRL International (Tokyo, Japan) (Figure 5). Consequently, phosphate groups were identified at 1100 cm^{-1}, 600 cm^{-1}, and 560 cm^{-1}, carbonate groups at 1550 cm^{-1}, 1450 cm^{-1}, 1420 cm^{-1}, and 870 cm^{-1}, and protein-derived absorption bands at 1650 cm^{-1}. However, the absorption bands at 700 cm^{-1} and 710 cm^{-1}, which are characteristic of calcium carbonate, were not observed. Accordingly, the component was identified as carbonate apatite, as indicated by the aforementioned evidence. The samples contained unidentifiable components. Therefore, the component ratios could not be calculated. The remaining teeth could not be saved because the probing depth was more than 10 mm and the teeth's mobility was M3 with caries. Therefore, it was necessary to perform tooth extraction and subsequent prosthetic treatment, which is currently ongoing.

Figure 1. The remaining teeth showed caries and periodontal disease, with advanced dental calculus deposition and redness and swelling of the gingiva. All teeth exhibited high levels of plaque and dental calculus. Hard tissue, which appeared to be layered granular hard dental calculus, covered the floor of the mouth from the buccolingual side in the mandibular right canine to the left molar area.

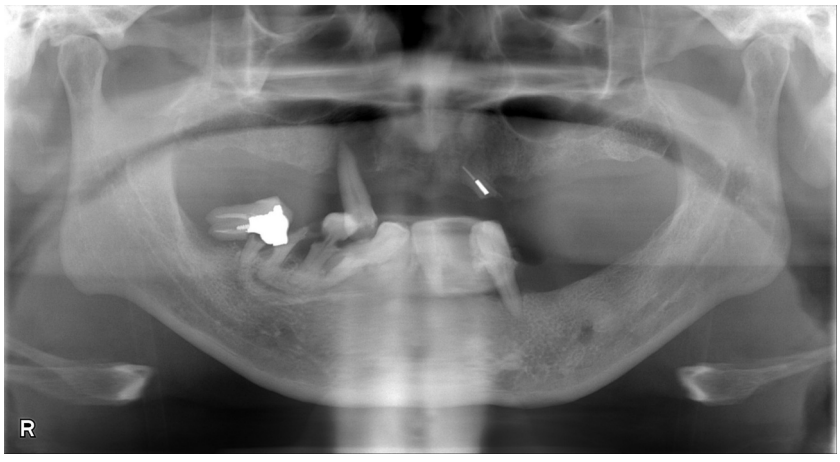

Figure 2. Panoramic radiographs showed significant alveolar bone resorption in the remaining and floating teeth and relatively clear opacities in the mandible in layers from the mandibular right first molar to the mandibular left canine.

Figure 3. Gingival swelling and hemorrhage were observed in the oral cavity after scaling, and caries were observed in the remaining teeth.

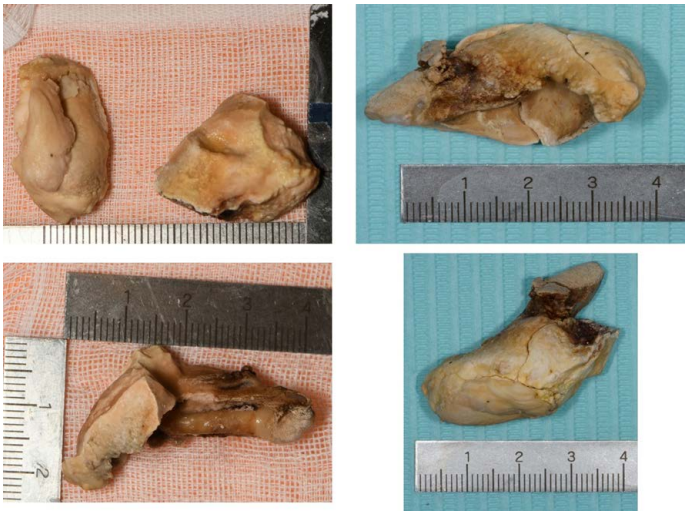

Figure 4. The total weight of the tissue that appeared to be dental calculus and the tooth that had fallen out with it was 9.1 g.

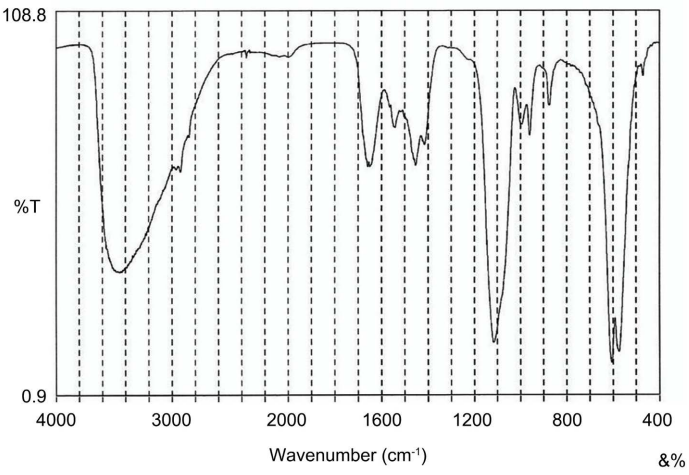

Figure 5. Component analysis using infrared absorption spectrometry. The absorption bands derived from phosphate and carbonate groups were present. However, the absorption bands from calcium carbonate were not observed, leading to a diagnosis of carbonate apatite.

3. Discussion

Dental calculus is a form of calcified plaque deposited on tooth surfaces. It is formed by the attachment of calcium and phosphate in saliva to the interbacterial matrix in plaque due to inadequate toothbrushing [1]-[3]. Dental calculus composition is not constant due to differences in the degree of calcification and plaque constituents. However, inorganic components account for approximately 80% of the total, with calcium phosphate being the main inorganic component, and the remainder are organic components, which are plaque-derived proteins, lipids, and water [2] [3].

Dental calculus is classified into subgingival and supragingival based on whether it is generated above or below the cervical area (on the enamel or cementum side) [2]-[5]. Saliva is strongly involved in supragingival dental calculus formation, and the site of its occurrence coincides with the opening of major salivary glands. Subgingival margin dental calculus is derived from gingival sulcus exudates and inflamed tissue exudates and differs from supragingival margin dental calculus derived from saliva in its composition, being harder than supragingival margin dental calculus due to its higher magnesium content and inorganic density [2]. Additionally, salivary glands are greatly involved in supragingival dental calculus formation: the buccal aspect of the maxillary molars, where parotid gland openings are located, and the lingual aspect of the mandibular anterior teeth, where submandibular and sublingual gland openings are located on the opposite sides [6]. However, because of the involvement of gingival sulcus exudates in the formation of subgingival margin dental calculus, no characteristic site of dental calculus attachment has been reported [5].

Few cases of giant dental calculus have been reported in Japan. Shibasaki *et al.* [5] reported diabetes mellitus and Parkinson's disease as the causes of giant dental calculus, with periodontal tissue destruction occurring due to the tendency of periodontal tissue to form gingival papilla swelling and abscesses in patients with diabetes. Furthermore, a high incidence of periodontal disease and severe periodontal tissue destruction has been reported in patients with diabetes with poor glycemic control [7]. However, no differences in gingival morbidity have been reported between patients with diabetes with proper oral management and those without diabetes [8]. Additionally, patients with diabetes who have good glycemic control have shown no significant increased risk of periodontal disease [9]. Shibasaki *et al.* [5] reported that patients with Parkinson's disease are more prone to dental calculus accumulation. Regarding the relationship between dental calculus formation and systemic diseases, Nagata *et al.* [10] investigated the dental calculus deposition index in patients with urinary tract calculus. They reported that the index was approximately three times higher in patients with urinary tract infection (UTI) than in control subjects without UTI, indicating a relationship. Additionally, dental calculus deposition has been reported to be significantly higher in dialysis patients [11]. In our case, the patient had no systemic diseases, such as diabetes or Parkinson's disease, no history of physical disability or mental illness

that prevented him from managing his oral cavity, and he ate normally by himself. Based on the patient's oral condition and the fact that he had not had a dental examination in over 20 years, the huge dental calculus might have formed because of gingival recession and destruction that occurred with the formation of subgingival margin dental calculus, which covered the gingiva, and because of the continued extremely poor oral hygiene.

The infrared absorption spectrometry analysis of the dental calculus removed from the patient's mouth revealed that carbonate apatite was the predominant component, consistent with common dental calculus analysis. The results of this analysis appear to meet the requirements for dental calculus [12] [13]. However, the analysis revealed a slightly higher inorganic component, which may be because the dental calculus formed over a long period of time, and the sample was collected from the inside of the dental calculus to avoid contaminants, such as food residues, on the surface during the analysis. Comparative studies of the inorganic and organic components of the salivary glands have shown that the Ca and P contents of the stimulated and unstimulated total saliva are significantly increased in individuals with dental calculus deposits compared with those without dental calculus deposits and that the pH is significantly increased in the stimulated total saliva [14] [15]. However, no significant difference in the protein levels was observed. Additionally, Rapp [16] reported that total stimulated saliva exhibited increased Ca and P content in individuals with dental calculus deposition. However, no conclusions have been reached on the Ca and P content of the inorganic components of total saliva. Some reports have shown that the Ca and P content increases in individuals with higher levels of dental calculus deposition, whereas others have shown no relationship between the Ca and P content and dental calculus deposition [17] [18]. Therefore, studies examining the relationship between the Ca and P content of saliva and the degree of dental calculus deposition are needed.

The treatment for giant dental calculus requires careful removal of the dental calculus while first using an ultrasonic scaler and a hand scaler because gingivitis and severe periodontal disease may be present during removal, which may cause bleeding, and ulcer formation may be observed on the gingiva covered with dental calculus. Perhaps this would not have occurred if the patient had followed good toothbrushing habits and regular oral care.

4. Conclusion

This report presents a case of giant dental calculus. However, the cause of its occurrence remains unclear, which warrants further research.

Patient Consent

Informed consent was obtained from the patient.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Dawes, C. (1998) Recent Research on Calculus. *New Zealand Dental Journal*, **94**, 60-62.

[2] Lindhe, J., Nyman, S. and Lang, N.P. (2003) Chapter 19. Treatment Planning. In: Lindhe, J., Karring, T. and Lang, N.P., Eds., *Clinical Periodontology and Implant Dentistry*, 4th Edition, Blackwell Publishing, 414-431.

[3] Dawes, C. (1996) Factors Influencing Salivary Flow Rate and Composition. In: Edgar, W.M. and O'Mullane, D.M., Eds., *Saliva and Oral Health*, 2nd Edition, British Dental Association, 27-41.

[4] Friskopp, J. and Isacsson, G. (1984) A Quantitative Microradiographic Study of Mineral Content of Supragingival and Subgingival Dental Calculus. *European Journal of Oral Sciences*, **92**, 25-32. https://doi.org/10.1111/j.1600-0722.1984.tb00855.x

[5] Shibasaki, O., Muneta, Y., Kimura, S., Wada, T., Takeyama, M. and Kusakari, J. (1992) A Giant Dental Calculus in the Oral Floor. *Otolaryngology—Head and Neck Surgery*, **64**, 109-111. https://doi.org/10.11477/mf.1411900495

[6] Mishima, H., Tokuhiro, M., Tanaka, K., Ookubo, A., Miake, Y. (2011) Changes of Morphology and Composition in the Supragingival Dental Calculus by Gender and Age. *Journal of the Japanese Association of Regenerative Dentistry*, **9**, 31-39. https://doi.org/10.11223/jard.9.31

[7] Thorstensson, H., Kuylenstiema, J. and Hugoson, A. (1996) Medical Status and Complications in Relation to Periodontal Disease Experience in Insulin-Dependent Diabetics. *Journal of Clinical Periodontology*, **23**, 194-202. https://doi.org/10.1111/j.1600-051x.1996.tb02076.x

[8] Löe, H. (1968) Endocrinologic Influences on Periodontal Disease Pregnancy and Diabetes Mellitus. *Alabama Journal of Medical Sciences*, **5**, 336-348.

[9] Taylor, G.W., Burt, B.A., Becker, M.P., Genco, R.J., Shlossman, M., Knowler, W.C., *et al.* (1996) Severe Periodontitis and Risk for Poor Glycemic Control in Patients with Non-Insulin-Dependent Diabetes Mellitus. *Journal of Periodontology*, **67**, 1085-1093. https://doi.org/10.1902/jop.1996.67.10s.1085

[10] Nagata, T., Kasahara, C., Kido, J., Shinohara, H., Nishikawa, S., Ishida, H., *et al.* (1995) Epidemiological Investigation of the Dental Calculus Index in Patients with Urinary Stones. *Nihon Shishubyo Gakkai Kaishi* (*Journal of the Japanese Society of Periodontology*), **37**, 504-509. https://doi.org/10.2329/perio.37.504

[11] Naugle, K., Darby, M.L., Bauman, D.B., Lineberger, L.T. and Powers, R. (1998) The Oral Health Status of Individuals on Renal Dialysis. *Annals of Periodontology*, **3**, 197-205. https://doi.org/10.1902/annals.1998.3.1.197

[12] Yuzawa, M., Nakano, K., Kumamaru, T., Nukui, A., Ikeda, H., Suzuki, K., *et al.* (2008) Is the Crystal Component of the Human Urinary Calculus Including Carbonate Calcium Carbonate? *The Japanese Journal of Urology*, **99**, 681-687. https://doi.org/10.5980/jpnjurol1989.99.681

[13] Kono, T., Sakae, T., Nakada, H., Kaneda, T. and Okada, H. (2022) Confusion between Carbonate Apatite and Biological Apatite (Carbonated Hydroxyapatite) in Bone and Teeth. *Minerals*, **12**, Article No. 170. https://doi.org/10.3390/min12020170

[14] Tenenbaum, B. and Karshan, M. (1939) Factors in Saliva Correlated with the Occurrence of Calculus Study Conducted with the Aid of a Grant for Dental Research from the Carnegie Corporation. *The Journal of the American Dental Association*, **26**, 1965-1971. https://doi.org/10.14219/jada.archive.1939.0368

[15] Tenenbaum, B. and Karshan, M. (1944) The Composition and Formation of Salivary

Calculus. *The Journal of Periodontology*, **15**, 72-77. https://doi.org/10.1902/jop.1944.15.2.72

[16] Rapp, G.W. (1945) The Biochemistry of Oral Calculus.: I. Conditions Predisposing to Oral Calculus Deposition from the Department of Research of the Chicago College of Dental Surgery, Dental School of Loyola University. *The Journal of the American Dental Association*, **32**, 1368-1372. https://doi.org/10.14219/jada.archive.1945.0195

[17] Hernández-Castañeda, A.A., Aranzazu-Moya, G.C., Mora, G.M. and Queluz, D.d.P. (2015) Chemical Salivary Composition and Its Relationship with Periodontal Disease and Dental Calculus. *Brazilian Journal of Oral Sciences*, **14**, 159-165. https://doi.org/10.1590/1677-3225v14n2a12

[18] Takizawa, H. (1979) The Relationship between the Contents of Inorganic Substances in Whole Saliva and the Extent of Calculus Deposition, and the Number of Caries Teeth. *Nihon Shishubyo Gakkai Kaishi* (*Journal of the Japanese Society of Periodontology*), **21**, 417-428. https://doi.org/10.2329/perio.21.417