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THE FIRST REPORT OF GRAPHITE TATTOO IN THE SOFT PALATE: A NOVEL CASE WITH A REVIEW OF ARTICLES

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Abstract

Pigmented lesions of the oral mucosa can have intrinsic or extrinsic origin. Pigmentation with extrinsic origin occurs by extrinsic agents such as carbon, silver (amalgam), graphite, and iron dust. Graphite tattoos usually appear in response to incidental or intentional thrust of an external object such as pencil lead. Their common site of incidence is the gum and hard palate, and usually occurs in boy children and adolescents. If the dentist cannot make a precise diagnosis for the pigmented lesions considering its clinical conditions, biopsy is necessary for ruling out malignancies including melanoma. In this study, a graphite tattoo has been presented in the soft palate of a 47-year-old woman, which is unique to the best of our knowledge.

A well-defined blue-black symmetric round macule was observed on the left side of the soft palate adjacent to the midline of a 47-year-old woman, 3 mm in diameter, who had referred to oral and maxillofacial medicine ward of faculty of dentistry with complaint of "black nevus has appeared in my soft palate". After extensive reviews across all databases, excisional biopsy was done for the patient using a punch with 3 mm diameter, and a piece of graphite was extracted.

In this case presentation, a unique case to the best out of knowledge was reported according to searches done from 1940 to 2023 in the soft palate of a 47-year-old woman. Surprisingly, the patient had no memory of trauma or thrust of a pencil or breakage of its lead in her oral mucosa.

Keywords: *graphite tattoo, soft palate, pigmented lesions*

Introduction

Pigmented lesions of the oral mucosa can have intrinsic or extrinsic origin [*Meleti M et al., 2008; De Giorgi V et al., 2009*]. Pigmentation with extrinsic origin occurs by extrinsic agents such as carbon, silver (amalgam), graphite, and iron dust. From among them, amalgam tattoos have the highest prevalence [*De Giorgi V et al., 2009*]. Graphite tattoos usually appear in response to incidental or intentional thrust of an external object such as pencil lead [*Adel K et al., 2004*]. Their common site of incidence is the gum and hard palate, and usually occurs in boy children and adolescents. The size of graphite tattoos can range from 1 to 15 *mm* which present as blue-grey-black macules [*Anderegg Jr C, Lyles M, 1992; Phillips G et al., 2005; Moraes R et al., 2015*]. If the dentist cannot make a precise diagnosis for the pigmented lesions considering its clinical conditions, biopsy is necessary for ruling

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Figure 1. *Well-defined blue-black symmetric round macule on the left side of the soft palate adjacent to the midline.*

out malignancies including melanoma [*Anderegg Jr C, Lyles M, 1992*]. In this study, a graphite tattoo has been presented in the soft palate of a 47-year-old woman, which is unique to the best of our knowledge.

Case report

A 47-year-old woman referred to the oral and maxillofacial medicine department of faculty of dentistry with the complaint of "a black nevus has appeared in my soft palate" in October 2022. This woman found out about this pigmentation in December 2021 through examination by a general dentist.

The patient stated that this pigmentation has had no size change so far compared to the previous year when she found to have it, and has not had any symptoms including burning sensation, pain, or discomfort.

In the medication history of the patient, taking levothyroxine 25 *mg* was reported to manage her hypothyroidism.

In the intraoral examination, a well-defined and well-bordered blue-black symmetric round macule was observed on the left side of the soft palate adjacent to the midline (Fig. 1). The diameter of this lesion was 3 *mm*, was not sensitive upon palpation, and did not blanch upon applying pressure.

Material and methods

First, search was done from 1940 to 2023 with keywords ("amalgam tattoo" AND "hard palate"), ("amalgam tattoo" AND "soft palate"), ("graphite tattoo" AND "hard palate"), and ("graphite tattoo" AND "soft palate") across databases including Google Scholar, PubMed, Embase, Ovid, Cochrane, Scopus, and Science Direct. The goal was to find similar papers that have given reports on graphite tattoo or amalgam tattoo in the soft or hard palate region. Table 1 summarizes the found case reports.

As can be seen, only two cases of amalgam tattoo had been reported in the soft and hard palate and two cases of graphite tattoo had been reported in the hard palate, while no case report existed on presence of graphite tattoo in the soft palate.

Table 1 shows the search results. Table 2 presents a summary of the cases that had reported graphite tattoo in the hard palate.

For taking biopsy and diagnosis, first an infiltrate injection of lidocaine with epinephrine was done around the pigmented lesion in the soft palate. Excisional biopsy was done for the patient with 3 *mm* diameter. After punching, the extracted surface was still pigmented. Through examination by probe, its consistency was hard.

Table 1

Papers that have given reports on graphite tattoo or amalgam tattoo in the soft or hard palate region

	Exogenous pigmentations			
Location	Soft palate		Hard palate	
Substant	GT	AT	GT	AT
Pubmed	1	0	0	0
Google scholar	1	0	1	2
Cochrane	0	0	0	0
Embase	0	0	0	0
Scopous	0	0	1	0
Science direct	0	0	0	0
Ovid	0	0	0	0
Result	1	0	1	2

Notes: *GT - Graphite tattoo, AT - Amalgam tattoo*

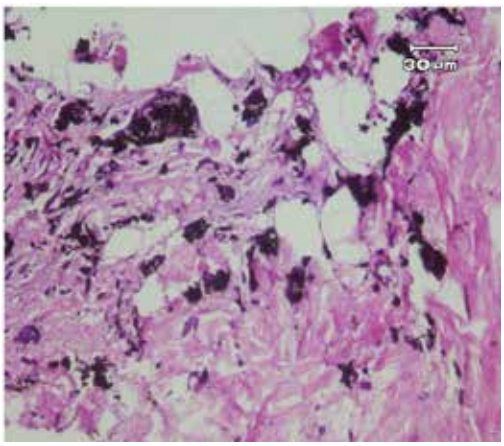

Figure 2. *Excision of a piece of graphite in the excisional biopsy.*

Table 2

Summary of published articles on graphite and amalgam tattoos (1940-2023)

Article design	Treatment	Color	Size	Location	Age	Sex	Authors/Year
Graphite tattoos							
Case report	Biopsy	Blue-black	0.5 *cm*	Right hard palate	27	F	Molini 2016
Case report	Biopsy	Bluish gray	0.3x0.1x0.5 *cm*	Left hard palate	62	F	Moraes RM 2015
Amalgam tattoos							
Case report	Biopsy	Brownish black	Extensive	Right hard palate	56	M	Kamal FM 2019
Case report	Biopsy	Black	0.8 *cm*	Soft palate	66	F	Mayall FG 1992

Notes: *F – female; M – male*

Upon applying pressure to its surroundings, the pigmented object was detached off the surrounding mucosa, whereby a 3 *mm* piece of graphite was seen. The tissue isolated from the soft palate was sent for pathology examination (Fig. 2). Tissue sectioning in the pathology reported "unremarkable oral mucosa with exogenous pigmentation" (Fig. 3-6).

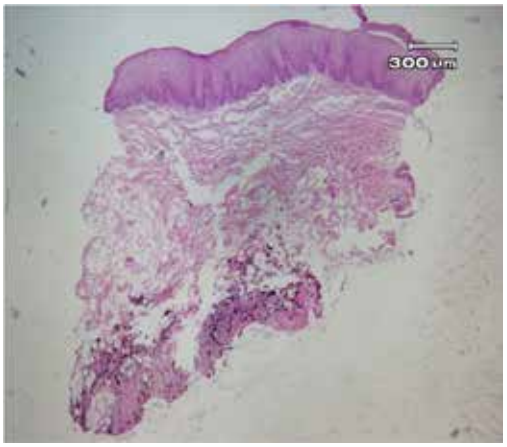

Figure 3. *Epithelium and connective tissue can be seen, diffuse fine black pigmentation located among the regional adipose tissues. Microscopic view (×40 magnification).*

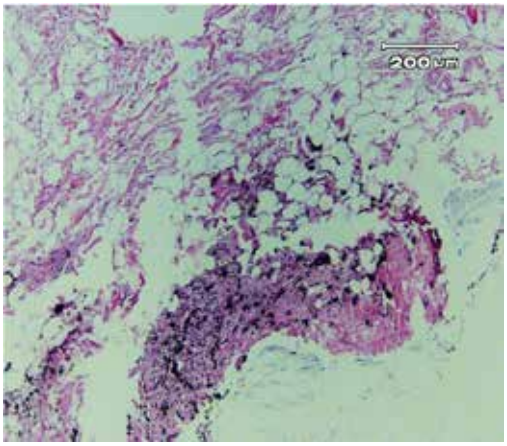

Figure 4. *Exogenous particles can be seen among regional adipose tissues. Microscopic view (×100 magnification).*

Discussion

Clinical differential diagnoses for pigmented lesions are very extensive, including intrinsic and extrinsic, single and multiple, local and systemic pigmentations [*Meleti M et al., 2008*]. This case was a local and single lesion, whereby no similar pigmentation was seen at any point of the mouth or skin, and was not reported by the patient. Intrin-

Figure 5. *Exogenous black pigmentations seen in both separately and small aggregations. High power field microscopic view (×400 magnification).*

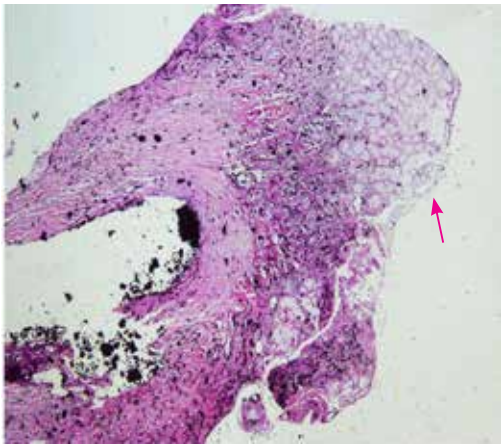

Figure 6. *Exogenous particles seen beneath the minor salivary glands. Mcroscopic view (×10 magnification).*

sic pigmentations can have bilirubin, hemoglobin, or melanin origins [*Radhakrishnan S et al., 2021*]. Here, bilirubin origin was not applicable to this case. Also, due to the negative result of diascopy test, intrinsic pigmentations with hemoglobin origin were again not placed in the differential diagnosis [*Rudd M et al., 2001; Glick M, 2021*]. intrinsic pigmentations with melanin origin include melanotic macule, nevus, melanoacanthoma, and melanoma, in terms of order of prevalence. Extrinsic pigmentations include amalgam tattoo and graphite tattoo [*Meleti M et al., 2008*]. The most important condition in differential diagnosis of all pigmented lesions is melanoma, which necessitates taking a biopsy [*Anderegg Jr C, Lyles M, 1992*].

Melanoma claims 0.5-1% of all oral malignancies and has the lowest prevalence, while being the most fatal one. Any oral mucousal region can be affected by melanoma, though the palate is the most common site of involvement. Oral melanoma has no specific clinical symptoms in the early stages, and emerges with pigmented macule which is poorly circumscribed, which was similar to the mentioned case in this regard [*Adel K et al., 2004; Meleti M et al., 2008; Femiano F et al., 2008; Muller S, 2010; Mohan M et al., 2013; Molini P et al., 2016; Glick M, 2021*]. Nevertheless, since around year had passed from initial diagnosis of the lesion for the patient, and the patient did not report any size change, thus this diagnosis was ruled out.

Another pigmented lesion with melanin origin is melanoacanthoma. This lesion is usually dark pigmented macular or plaque-like lesion which is poorly circumscribed and grows fast, and mostly occurs in women [*Rohilla K et al., 2013; Glick M, 2021*]. As the size of the lesion had not changed over the previous year, and it had well-defined borders, melanoacanthoma was also ruled out from the list of differential diagnosis.

Ultimately, melanotic macule, melanocytic nevus, amalgam tattoo, and graphite tattoo remained in the initial differential diagnoses, which could not be ruled out through clinical examination.

In order of prevalence, pigmented lesion in the mentioned case fell in the differential diagnosis with melanotic macule. In spite of ambiguous etiology, it seems that trauma can be involved in development of melanotic macule. Any mucosal region can be affected, through the gum and lower lip are more common regions. It is also more probable to occur in women and adults. Melanotic macule has well-defined borders and has usually homogenous pigmentation [*Buchner A et al., 2004*]. The gender and age of incidence of melanotic macule were similar to the mentioned case, while its common site of indigence was unlike this case.

Oral melanocytic nevus is rare, emerges as single lesions, and is more common in women. It is often asymptomatic, and exist as brown and blue macule, smaller than 1 *cm* [*Adel K et al., 2004; Muller S, 2010*]. Unlike the rarity of oral nevus, blue nevus has the second highest prevalence in oral nevi [*Meleti M et al., 2008; Lee H et al., 2010; Santos T et al., 2011; Molini P et al., 2016*]. Its most common site of incidence is the hard palate [*Pinto A et al., 2003; Santos T et al., 2011*]. The site, size, and color of melanotic nevus were similar to the mentioned case.

Extrinsic pigmentation includes amalgam tattoo and graphite tattoo, with the most common being amalgam tattoo. Amalgam tattoo is a pigmented lesion that occurs due to amalgam restorations or their replacement. They are often opaque in radiography, but if they are small, they may be radiolucent. Also, after one year, due to absorption of silver by the bloodstream, amalgam tattoo may not be observed as radiopaque [*Moraes R et al., 2015*]. No opacity was seen in soft palate area in her panoramic radiography (Fig. 7). In the extensive searches done across all databases, the site of incidence of amalgam tattoos had been reported the gum and hard palate, and there was only one report of soft palate.

As mentioned in the Methods section, after excisional biopsy through punch, we encountered a hard object; after examination with the probe, surprisingly a 3 *mm* piece of pencil lead was excised.

Figure 7. *Panoramic radiology.*

Apparently, this piece of pencil should have been buried inside the soft palate with trauma and there should have been a memory of breakage of pencil lead in the oral mucosa of the patient. However, when she was asked about this matter, unbelievably and in spite of diploma level of education as well as having full awareness, she recalled no such memory, and no matter how much the dentist insisted, she expressed no past history of trauma.

Graphite tattoo was the last condition that could fall in the differential diagnosis of this pigmentation. Thrusting the pencil lead in the mouth especially during childhood and adolescence can result in graphite tattoo [*Rihani F, Da'ameh D, 2006*]. In reviewing papers, in spite of extensive searches done, so far no such a case had been reported, and to the best out of knowledge, this was a unique case of graphite tattoo in the soft palate.

Conclusion

In this case presentation, to the best out of knowledge, according to searches done from 1940 to 2023, a unique case of graphite tattoo was reported in the soft palate of a 47-year-old woman, who surprisingly recalled no memory of trauma or thrust of pencil and breakage its lead in her oral mucosa. Diagnosis of graphite tattoo for the pigmentation present in this study was unique considering the gender (female), site of pigmented lesion (soft palate), and relatively high age of the patient (47 years), as well as no recall of thrusting any external object such as pencil lead. Such a rare finding can resolve suspicion of existence of other pigmented lesions especially initial stages of oral melanoma.

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