

Choosing crown material to avert metallic artefact in MRI scans: A case report

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Abstract

Magnetic resonance imaging creates metallic artefacts. An artefact may be defined as a distortion of signal intensity that does not have any anatomic basis in the plane being imaged. The main concerns that may arise during the MRI of a patient with a dental prosthesis include artefact creation, heat production, and/or risk of displacement. Dental materials can be classified based on their magnetic permeability properties as Diamagnetic, Paramagnetic and Ferromagnetic. This article will throw a light on choosing an appropriate material for the anterior crown, which will have the least magnetic susceptibility on MRI scans.

Keywords: Anterior crown, Diamagnetic, Metallic artefact, MRI, Paramagnetic.

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1. Introduction

Magnetic resonance imaging (MRI) is considered a powerful diagnostic method which enables the visualisation of soft tissue contrast without the use of ionising radiation. It creates images using a strong magnetic field and switching magnetic field gradients with a radio frequency magnetic field pulse. Magnetic resonance imaging creates metallic artefacts.

An artefact may be defined as a distortion of signal intensity or void that does not have any anatomic basis in the plane being imaged [1]. It can also be defined as the pixels that do not exactly represent the tissue components. Metal artefacts, also known as susceptibility artefacts, are caused by differences in susceptibility between the prosthesis and surrounding tissues, resulting in inhomogeneity within a magnetic field.

Metallic prostheses might distort images during MRI investigations. The main concerns that may arise during the MRI of a patient with a dental prosthesis include artefact creation, heat production, and/or the risk of displacement. Dental materials can be classified based on their magnetic

permeability properties as Diamagnetic, Paramagnetic and Ferromagnetic. Diamagnetic materials have a Magnetic susceptibility or $\chi=0$, which are relatively inert objects in an external magnetic field, e.g. precious metal alloys (Au, Pt, Ag, Ir, and Pd), titanium and amalgam. Paramagnetic materials have $\chi > 0$, e.g. Base metal alloys [2,3]. Ferromagnetic substances have a magnetic susceptibility of $\chi >> 1$, e.g. a composite containing ferric oxide. This case report discussed the selection of appropriate crown material for the purpose of present and future Magnetic resonance imaging.

2. Case report

A 33-year-old female patient reported to the Department of Prosthodontics and Crown & Bridge, Government Dental College and Hospital, Cuddalore district, with a request to remove the crown in relation to 11 for the purpose of taking an MRI scan. She was referred by her physician. The patient's medical history revealed complaints of dizziness and neck pain persisting for the past six months. Dental history indicated that root canal treatment had been completed on tooth 11 two years ago,

followed by placement of a metal-ceramic crown. Intraoral examination confirmed the presence of a root canal-treated maxillary right central incisor (11) restored with a metal-ceramic crown. Intraoral periapical Radiographs (Figure 1) were done before the metal ceramic crown removal.

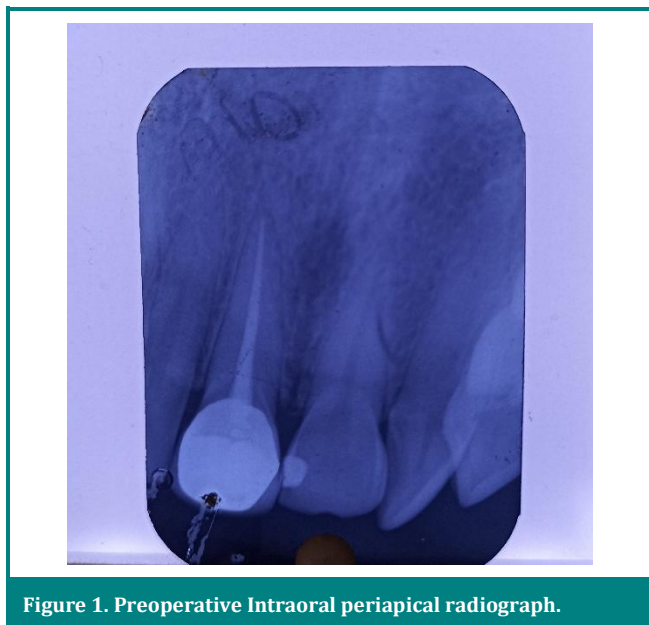


Figure 1. Preoperative Intraoral periapical radiograph.

3. Treatment plan

Considering the patient's medical requirement for an MRI scan and the presence of a metal-ceramic crown on tooth 11, a phased treatment approach was planned.

Step 1: Removal of the existing crown on tooth 11.

Step 2: Following the MRI scanning (Figure 2), the patient was advised to have the crown replaced with a glass-ceramic crown, as this material produces minimal artefacts on MRI and would be more suitable for any future imaging procedures.

3.1 Prosthodontic treatment procedure

The existing tooth preparation on 11 was redefined (Figure 3a). Maxillary and mandibular impressions were made using addition silicone putty and light-body materials (Flexceed addition silicone putty /light body, GC corporation, India). Shade selection was carried out with the Vitapan classic shade guide. The dental laboratory was instructed to fabricate a lithium disilicate crown (E-max, Ivoclar Vivadent), selected specifically to minimise the risk of metal artefacts in future MRI scans. Once the crown was received, it was cemented (Figure 3b) using a dual-cure resin cement (Fusion Ultra D/C, Prevest Dentpro, India). Light curing was performed on all surfaces to achieve uniform

polymerisation. Following cementation, an intra-oral periapical radiograph was obtained (Figure 4).

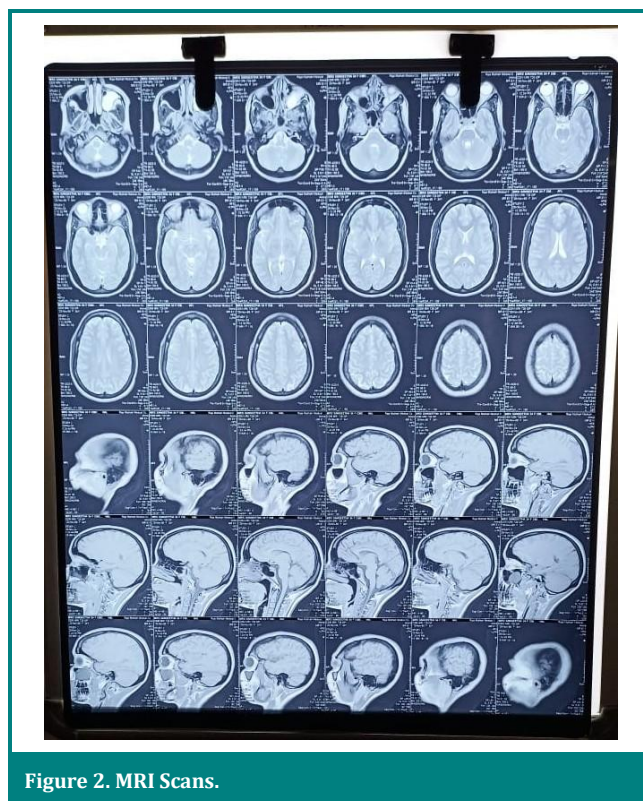


Figure 2. MRI Scans.

4. Discussion

Resin, zirconia, ceramic, and precious metal-ceramic crowns produce minimal susceptibility artefacts when replaced on prepared teeth. In contrast, nonprecious metal-ceramic crowns tend to cause signal loss on the lingual aspect and signal intensification on the buccal side, with artefacts extending into the buccal mucosa and tongue [1,4,5]. Similarly, crowns fabricated from Resin, zirconia, Au-Pt meta-ceramic, Ag-Pd metal-ceramic and all-ceramic systems showed negligible susceptibility artefacts ($p > 0.999$). However, metal-ceramic crowns made from pure Titanium, Titanium alloys, Co-Cr alloys, and Ni-Cr alloys generated significantly larger artefacts around the teeth, ranging from 31.833 mm² to 44.616 mm² ($p < 0.001$) [4-6].

Hence, the usage of nonprecious metal ceramic crowns in patients who anticipate MRI scans in the future should be avoided, and all-ceramic /zirconia crowns should be advised for those patients. In the present study, no metallic artefacts were evident after the MRI scans were taken after removal of the metallic ceramic crowns. In the present case report, metal-ceramic crowns were replaced with lithium disilicate crowns as suggested by Gao *et al.* [1]. The

postoperative intraoral periapical radiographs, in contrast to preoperative intraoral periapical radiographs, reveal practically nil radio-opacity due

to the absence of any metallic component in the lithium disilicate crown (Figures 1 and 4).

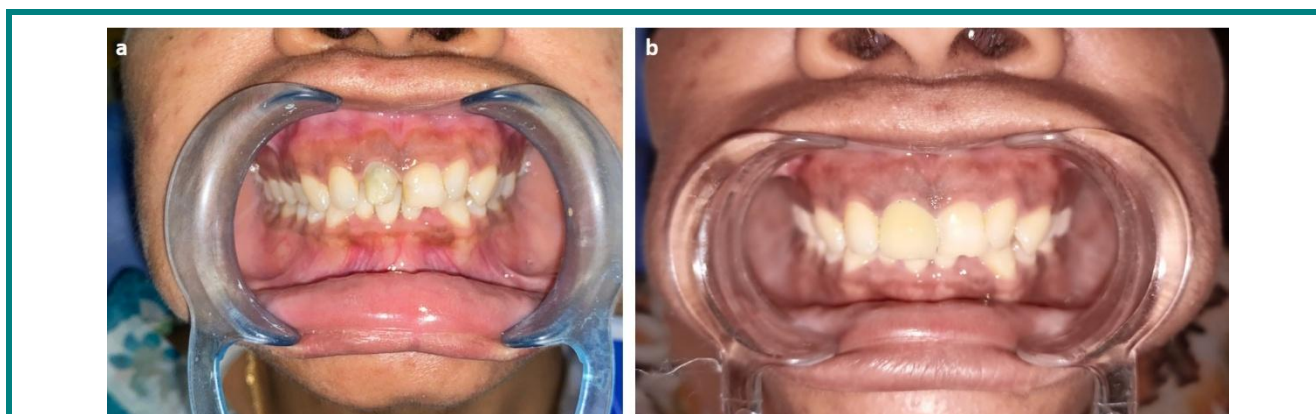


Figure 3. a. Tooth preparation post modification, and b. Cemented crown.



Figure 4. Postoperative Intraoral periapical radiograph.

5. Conclusion

The use of a lithium disilicate crown offers a suitable alternative to prevent metallic artefacts during future MRI examinations. However, the magnetic susceptibility of lithium disilicate restorations in MRI imaging still requires further evaluation. The patient has been advised to share any upcoming MRI scans so that potential imaging

artefacts related to the paramagnetic properties of lithium disilicate crowns can be assessed.

Conflicts of interest: The Authors declared no conflicts of interest.

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References

1. Gao X, Wan Q, Gao Q. Susceptibility artifacts induced by crowns of different materials with prepared teeth and titanium implants in magnetic resonance imaging. *Sci Rep.* 2022;12(1):428. <https://doi.org/10.1038/s41598-021-03962-w>
2. Sumner O, Goldsmith R, Heath N, Taylor GD. The interaction and interference of preformed metal crowns on magnetic resonance imaging: a scoping review with a systematic methodology. *Eur Arch Paediatr Dent.* 2021;22(6):1023-1031. <https://doi.org/10.1007/s40368-021-00644-z>
3. Vineeth G, Alla RK, D SR, M C SS, A V R, Yeleti H. Casting alloys: the saga of their existence and the recipe of their blend. *Int J Dent Mater.* 2019;1(1):25-3. <http://dx.doi.org/10.37983/IJDM.2019.1104>
4. Kajima Y, Takaichi A, Tsutsumi Y, Hanawa T, Wakabayashi N, Kawasaki A. Influence of magnetic susceptibility and volume on MRI artifacts produced by low magnetic susceptibility Zr-14Nb alloy and dental alloys. *Dent Mater J.* 2020;39(2):256-261. <https://doi.org/10.4012/dmj.2018-426>
5. Eggers G, Rieker M, Kress B, Fiebach J, Dickhaus H, Hassfeld S. Artefacts in magnetic resonance imaging caused by dental material. *MAGMA.* 2005;18(2):103-11. <https://doi.org/10.1007/s10334-005-0101-0>
6. Costa AL, Appenzeller S, Yasuda CL, Pereira FR, Zanardi VA, Cendes F. Artifacts in brain magnetic resonance imaging due to metallic dental objects. *Med Oral Patol Oral Cir Bucal.* 2009;14(6):E278-82.