MAGNETIC RESONANCE IMAGING IN ORTHODONTIC PATIENTS

Guidelines of the Polish Orthodontic Society (PTO), the Polish Medical Radiological Society (PLTR), and the Polish Dental Association (PTS)

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J Stoma 2019; 72, 1: 1–3
DOI: https://doi.org/10.5114/jos.2019.86484

Magnetic resonance imaging (MRI) is a frequently used diagnostic method. Due to doubts concerning the safety of MR examinations in orthodontically treated patients or using fixed retainers, herein we present consensus guidelines of the Polish Orthodontic Society (PTO), the Polish Medical Radiological Society (PLTR), and the Polish Dental Society (PTS) concerning possibilities of performing MRI in these patients. The guidelines apply only to MR devices with magnetic field induction of up to 3 Tesla. The recommendations shall be used in all age groups.

During an MRI examination the magnetic field can significantly affect materials with magnetic properties used for medical purposes (treatment) inside the patient's body or on its surface. This situation occurs in orthodontic patients. During the examination the magnetic field may influence steel elements of an orthodontic device or retainer, such as: brackets, wires, rings, or fixed retainers, but bonding forces of these elements with enamel are not exceeded. When the elements of an orthodontic device are correctly fixed, the risk of their dislocation during an MRI examination is extremely small.

The magnetic field does not have a negative effect on elements made of titanium alloys, NiTi, TMA, Cr-Co, copper, or on ceramic and plastic brackets [4, 5].

Major concerns and controversies are related to the possibility of producing a thermic effect on metals due to the magnetic field. An orthodontic appliance or a retainer may warm up during the examination. According to the most up-do-date research results the increase in temperature of elements of an orthodontic appliance in a magnetic field up to 3 Tesla does not exceed 1°C during examination. An increase in temperature of 1°C does not have negative influence on enamel, dentine, and surrounding soft tissues [3, 6, 7].

Artefacts arising during MRI examination due to the presence of an orthodontic appliance/retainer are a considerable problem because they often make image interpretation difficult or even impossible. The artefacts are most pronounced directly around the orthodontic appliance/retainer in the area of the mandible, hard palate, base of the tongue, nasopharynx, and in some devices, also the frontal lobes of the brain, the area of the sella turcica, and the eyeballs [1].

The degree of distortion caused by the magnetic field depends on the composition of an orthodontic appliance/retainer; titanium alloys, chromium-cobalt, as well as ceramic elements and plastic do not create artefacts in magnetic fields with induction up to 1.5 Tesla [1, 2]. Steel

JOURNAL OF STOMATOLOGY
CZASOPISMO STOMATOLOGICZNE
OFFICIAL JOURNAL OF THE POLISH DENTAL ASSOCIATION | ORGAN POLSKIEGO TOWARZYSTWA STOMATOLOGICZNEGO

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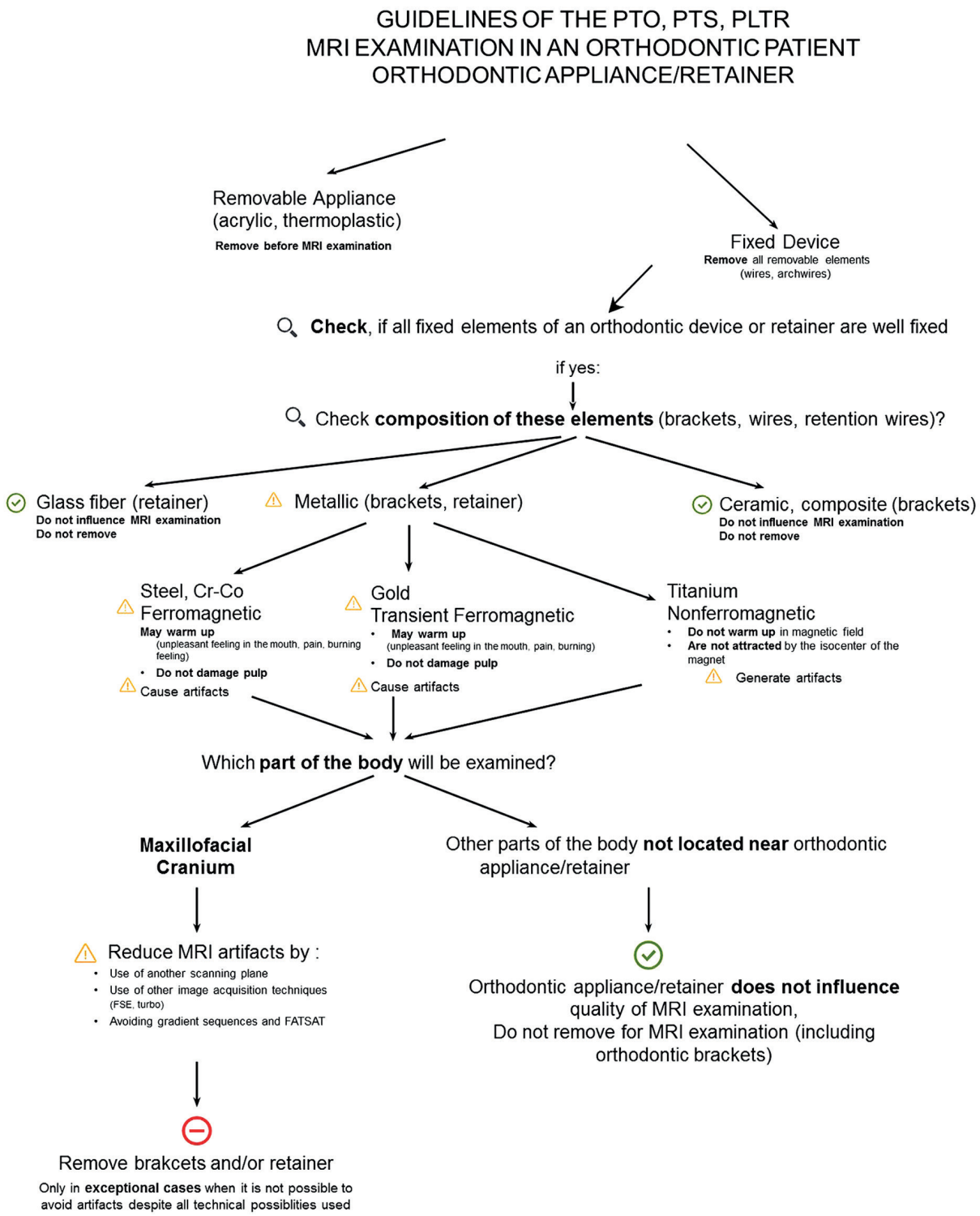

alloys may be a source of artefacts; their intensity depends on the type of steel alloy as well as the induction of the magnetic field (the higher the magnetic field induction, the more intense the artefacts). Steel alloy 18-8 (containing about 18% chromium and 8% nickel) does not have magnetic properties and does not cause artefacts.

Retainers can also influence the MR examination because they are usually made of steel alloys that cause artefacts. Titanium or glass fibre retainers do not affect the quality of the MR image.

CONCLUSIONS

1. Correctly fixed elements of orthodontic appliances/retainers are not dislocated in the magnetic field of MR machines with magnetic field induction up to 3 Tesla.

2. During the MR examination the temperature of an orthodontic appliance/retainer can slightly increase (by 1°C), but this rise is not harmful to the vitality of dental pulp and surrounding tissues.
3. Steel alloys cause local artefacts in MR images (apart from 18-8 alloy). Brackets made of the following alloys: nickel-titanium, titanium, titanium-molybdenum, chromium-cobalt, as well as ceramic and plastic devices, do not cause artefacts in MRI examination up to 1.5 Tesla.
4. Before an MRI examination the orthodontist should remove all removable elements of an orthodontic appliance (wires, ligatures, palatal arch wires) and check whether the remaining elements are secured tightly. There are no absolute indications for removal of the whole orthodontic device/retainer.
5. In exceptional situations when artefacts do not allow correct evaluation of the examined maxillofacial or cerebral area, the whole orthodontic appliance/retainer must be removed.
6. The presence of an orthodontic appliance/retainer does not influence the image quality of MR examinations of distant parts of the body.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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