Influences of magnetic attachment for implant on MRI scan

Maruo R, Imaizumi N, Muto R, Suzuki Y, Ohkubo C

Depart of Removable Prosthodontics, Tsurumi University School of Dental Medicine

Abstract

【Introduction】

In recent years, due to advances in medical technology, MRI has been frequently used. Along with this, it has been considered that metal artifacts during MRI scanning affect diagnosis. In this time, influences of the magnetic attachment for implants on MRI were discussed.

【Materials and Methods】

Magnetic attachments for implants (Magfit MIP, Magfit IP), cast keeper, and healing abutment were used as samples. Each sample was placed in an acrylic container (150 mm x 150 mm x 150 mm), and filled with an aqueous solution of nickel nitrate using an acrylic jig. Four types of imaging methods were used: spin echo, F spin echo, STIR, and gradient ecoh. The images obtained by shooting were adjusted with ImageJ (NIH) and the area of the artifact was compared.

【Results, Discussion】

The magnetic attachments for implants showed obviously artifacts in all imaging methods, but there were little artifacts in healing abutments. The gradient ecoh method produced the largest artifact among the different imaging methods. The size of the artifact of Magfit IP was larger than for Magfit MIP. The diameters of the artifact were about 15 to 20 mm for Magfit IP and approximately 15 mm for Magfit MIP.

Introduction

In recent years, due to advances in medical technology, MRI has been used frequently. Along with this, it has been considered that metal artifacts during MRI scanning affect diagnosis. In this time, influences of the magnetic attachment for implants on MRI were discussed.

Materials and Methods

Name	Manufacturer	Size	Suction power	Abbreviation
Magfit IP (flat) IDF30	AICHI STEEL	Φ4.7㎜×3.0㎜	750gf	IFD
Magfit IP (dome) IDD30	AICHI STEEL	Φ4.7㎜×3.2㎜	600gf	IDD
Magfit MIP (flat)	AICHI STEEL	Φ3.7㎜×3.1㎜	400gf	MIP-F
Magfit MIP (dome)	AICHI STEEL	Φ3.7㎜×3.3㎜	350gf	MIP-D
Hyper slim (for casting)	NEOMAX	Φ4.8㎜×0.8㎜	980gf	Cast
RN healing cap	Straumann	Φ5.5㎜×3.0㎜	—	Heal

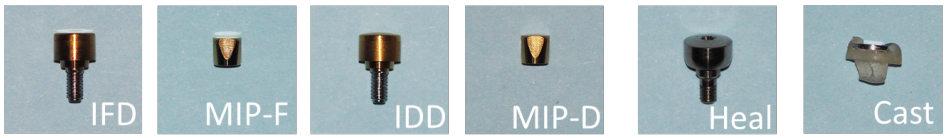
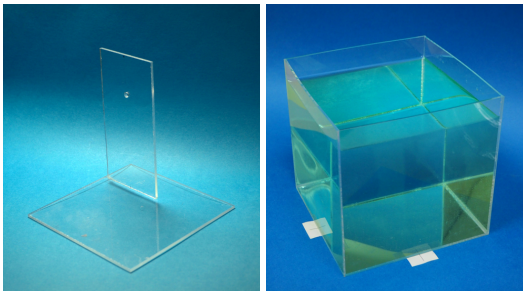


Fig.1 Sample details

Magnetic attachments for implants (Magfit MIP, Magfit IP), keeper for casting and healing abutment were used as samples (Fig.1).



Each sample was placed in an acrylic container (150 mm x 150 mm x 150 mm) filled with an aqueous solution of nickel nitrate. An acrylic jig was used to position the sample in the center of the container. The direction of the sample was the same to actual clinical situation (Fig.2).

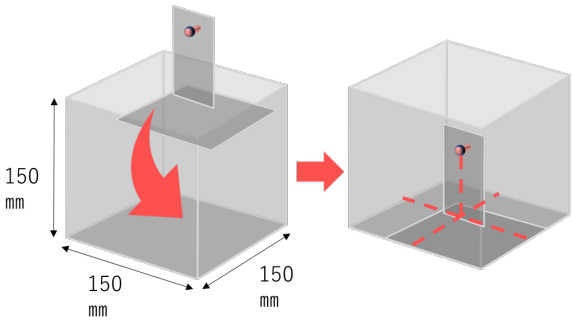


Fig.2 Acrylic container and jig

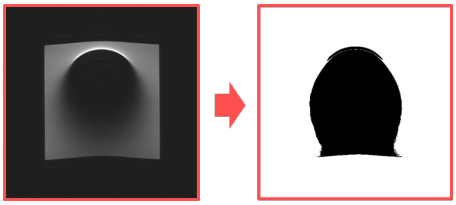


Fig.3 Image processing

The obtained images were compared visually. The images were adjusted with ImageJ (NIH), and the area of the artifact was compared (Fig. 3).

Table.1 Details of imaging method

	SE			GE
	T1	T2	STIR	
FOV	240 mm	240 mm	240 mm	240 mm
Thickness	5.0 mm	5.0 mm	5.0 mm	5.0 mm
TR	500 msec	4900 msec	4000 msec	400 msec
TE	10.7 msec	120.0 msec	20.0 msec	14.0 msec
matrix	256 × 192	256 × 224	288 × 256	256 × 192
NSA	2	3	2	3

Four types of imaging methods were used: spin echo(SE) (T1-weighted image (T1), T2-weighted image (T2), STIR) and gradient echo(GE) (Table.1).

Results, Discussion

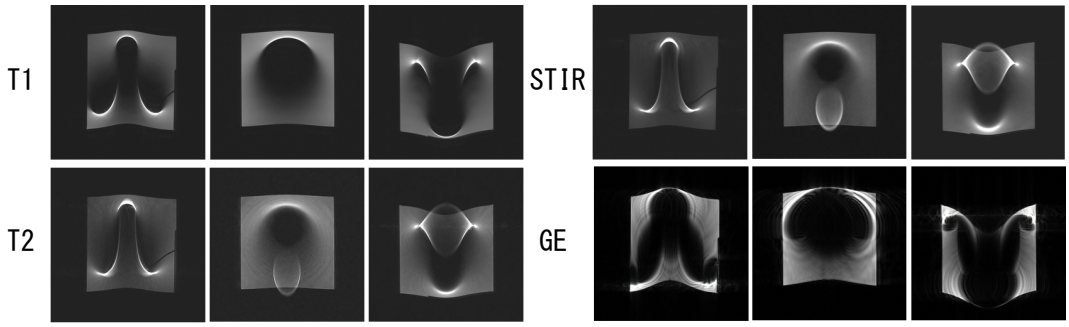


Fig.4 Imaging results (IDD)

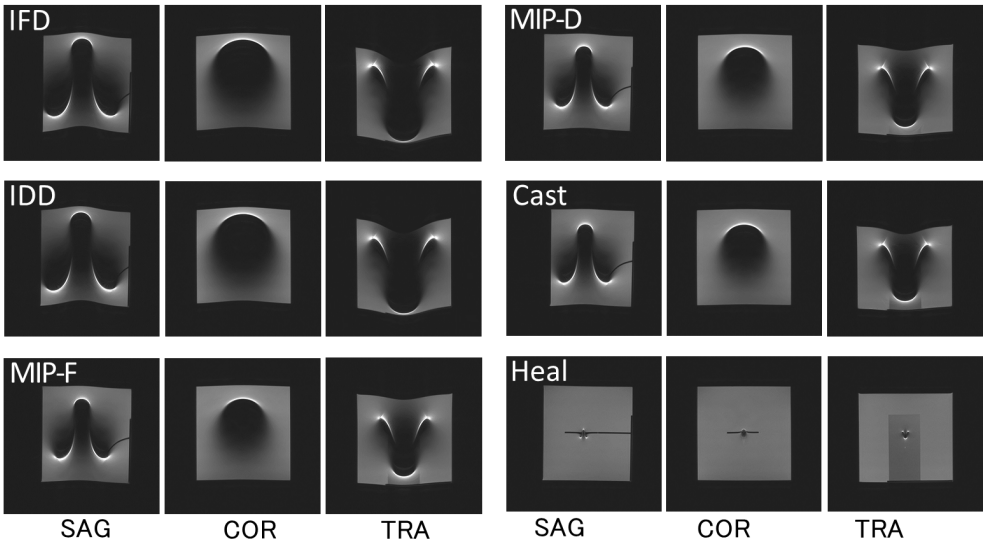


Fig.5 Imaging results of each sample (T1)

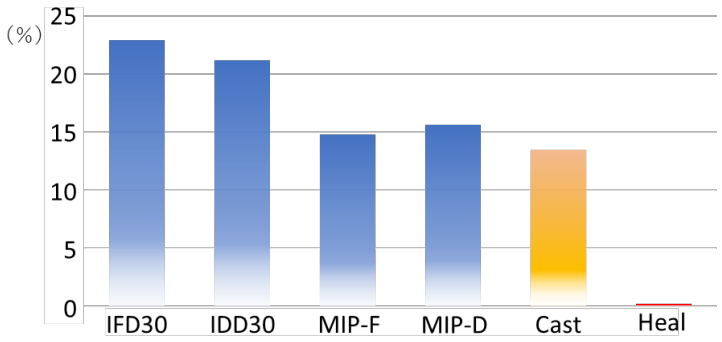


Fig.6 Artifact area (area ratio)

The magnetic attachments for implants showed obvious artifacts in all imaging methods, but there were little artifacts in healing abutments. The gradient ecoh method produced the largest artifact among the different imaging methods. The size of the artifact of Magfit IP was larger than for Magfit MIP. The diameters of the artifact were about 15 to 20 mm for Magfit IP and approximately 15 mm for Magfit MIP.

In this study, the volume of samples greatly affected to the size of artifact compared to the diameter of the keeper and the strength of the attachment. There fore, replacement of the keeper on the implant to the healing abutment during MRI scan would be necessary.