سامية محمد مصطفى

شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

سامية محمد مصطفى

شبكة المعلومات الجامعية

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

سامية محمد مصطفى

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

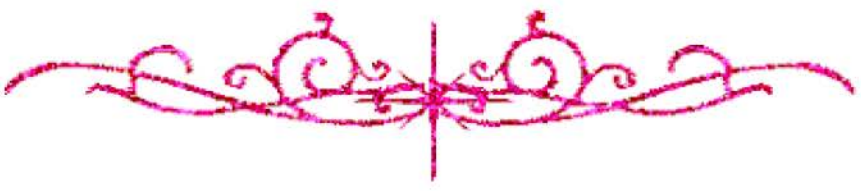
يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

سامية محمد مصطفى

شبكة المعلومات الجامعية

بعض الوثائق الأصلية تالفة



سامية محمد مصطفى

شبكة المعلومات الجامعية

بالرسالة صفحات لم ترد بالأصل

قـالـوا سبحا نـك

لاَ عِلمَ لنا إلا ماَ علَمتنا إنكَ أَنت العَليمُ الحَكيم

سورة البقرة آية ٢٢ صدق الله العظيم

MAGNETIC RESONANCE IMAGING OF THE NORMAL TMJ: ANATOMY AND TECHNIQUES (REVIEW OF LITERATURE)

Thesis

Submitted to the Faculty of Medicine
University of Alexandria
In partial fulfilment of the
Requirements of the degree of

Master of Radiology

By

Sherif Salah El Dine Ibrahim
MBBCh, Alexandria
Resident of Radiodiagnosis
Alexandria University Hospital

Department of Radiodiagnosis,
Faculty of Medicine,
University of Alexandria

1997

SUPERVISORS

Prof. Dr. Mohamed Abd El-Kader El Deeb

Professor of Radiodiagnosis
Faculty of Medicine,
University of Alexandria

Dr. Yasser Mazloum Zakaria

Lecturer of Radiodiagnosis,
Faculty of Medicine,
University of Alexandria,

ACKNOWLEDGEMENT

After giving all thanks to my God.

A word of great appreciation and thankfulness should be deeply expressed to Prof. Dr. Mohamed Abd El-Kader El-Deeb. Professor of Radiodiagnosis, Faculty of Medicine, Alexandria University of his close supervision, support and valuable advice. His own activity and generous participation have helped me so much to complete this work.

I would like to sincerely express my intense gratitude to Dr. Yasser Mazloum Zakaria, Lecturer of Radiodiagnosis, Faculty of Medicine, Alexandria University for his help and generosity with time, effort and valuable guidance.

Contents

- Basic physical aspects of MR imaging	1
- Gross anatomy of the normal TMJ	8
- The biomechanics of TMJ	18
- Certain pathological conditions that can affect the TMJ	23
- Different imaging modalities for the TMJ	34
- Normal MRI anatomy and techniques	52
- MRI diagnostic criteria of certain pathological conditions that can affect the TMJ	83
- Summary	107
- Conclusion	111
- References	112
- Arabic Summary	----

Basic Physical Aspects of MR Imaging

INTRODUCTION

BASIC PHYSICAL ASPECTS OF MR IMAGING

MR imaging is based on magnetic properties of protons that respond to an external magnetic field by aligning with or against it.(1)

The number of nuclei aligned with the magnetic field (which are of lower energy state) is slightly greater than that aligned against it (higher energy state).(2)

Charged particles which move through space generate a magnetic field. The hydrogen nucleus is composed of a single proton, thus has a positive charge. This proton spin on its axis so it generates a magnetic field described as vector (or magnetic moment) which is randomly directed under normal circumstances.(2)

The magnetization vector is oriented in the direction of the magnetic field which is designated the longitudinal magnetization.(1)

When the nuclear magnetic vectors are under the influence of an external magnetic field they will precess around that magnetic field that is the vector will circle around the B_0 direction with a particular frequency called "Larmor frequency".

$$F = K B_0$$

This equation shows the relationship between the frequency of precession and the applied external magnetic field.

B_0 is the magnitude of the external magnetic field.

K is a constant for each different nucleus called the gyromagnetic ratio constant.[2]

Excitation:

The direction of the magnetization vector may be altered by the addition of energy in the form of a radio frequency (RF) pulse.

In the most common type of MR imaging RF pulse of enough amplitude and duration to rotate the magnetization vector 90° from the static field direction is applied.

This 90° pulse changes the direction of the vector from the longitudinal plane into the transverse plane thus creating transverse magnetization.[2]

Relaxation:

When the RF pulse is terminated, the transverse magnetization will eventually decay to zero. While the spins will begin to realign in the

direction of the external magnetic field thus the longitudinal magnetization grows back to its equilibrium value, these two processes are summarized under the term of "relaxation".[2]

T_1 Relaxation Time:

The time required for 63% of the magnetization vector to return to the initial longitudinal direction is called T_1 or the longitudinal relaxation time or spin lattice time.

It depends upon the rate that the added energy is dissipated to the surrounding environment. Water with relatively widely dispersed molecules has long T_1 whereas fat with more compact and complex environments allowing rapid energy dissipation has short T_1.

T_1 is tissue specific and field dependant.[3]

T_2 Relaxation Time:

The time required for 63% of the transverse magnetization to decay is called T_2, the transverse relaxation time.

It depends upon the rate at which coherence between the different rotating protons is lost. Solid tissues (ex. liver parenchyma) lose coherence rapidly thus having short T_2, while water with sparse molecular density loses coherence relatively more slowly thus has a long T_2.

Repetition Time (TR):

It is the time to repeat a pulse sequence. A TR less than 500 msec is considered to be short, a TR more than 1500 msec is considered to be long.[3]

Echo Time (TE):

It is the time between the 90° pulse and the perception of a signal. A TE of less than 30 msec is considered to be short, a TE greater than 80 msec is considered to be long.[3]

T_1 Weighted Images:

They are those with a predominant T_1 contrast they can be obtained with a short TR and short TE.[4]

T_2 Weighted Images:

They are those with predominant T_2 contrast. They can be obtained with a long TR and long TE.[4]

Signal Intensity:

On T_1 Weighted Sequences:

Where T_1 contrast predominates, tissues with a short T_1 (ex. fat) allowing rapid longitudinal relaxation will have high intensity. On the