

## Effect of Diagnostic Brain MRI on Depression Score in Patients with Major Depression

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**Abstract:** This study was designed to assess therapeutic effect of exposure to 0.3 tesla magnetic field with 30 min duration during diagnostic brain MRI on major depression. Three hundred patients who were referred consecutively to our MRI imaging center for brain MRI were screened for major depression using Iranian version of PHQ-9 (Patient Health Questionnaire). Screening showed that 23 patients had major depression. As an uncontrolled experimental study patients' depression score was measured before and 2 weeks after diagnostic brain MRI. After exposure to MRI, the score of 17 out of 23 patients (73.9%) decreased to less than 10 which is the level for major depression based on PHQ-9 scoring. Depression score after brain MRI was significantly lower than before exposure ( $p < 0.001$ ). Also score of all nine items of the questionnaire was lower than before exposure ( $P$  value ranged from 0.001 to  $p < 0.03$ ). Our study showed that exposure to magnetic field during a diagnostic brain MRI may improve depressive symptoms. Based on the results, a randomized controlled clinical trial with further follow-up is being designed about patients of psychiatric hospital with resistance to conventional treatments.

**Key words:** Depression score, brain MRI, major depression, magnetic field

### INTRODUCTION

In our MRI imaging center we found few patients with severe and drug-resistant depression who reported dramatic improvement in their symptom after undergoing diagnostic brain MRI. This motivated us to review literature about the therapeutic effect of magnetic field. A considerable portion of depressed patients are resistant to pharmacotherapy. Neurostimulation methods include repetitive Transcranial Magnetic Stimulation (rTMS) as novel intervention for treating depression are currently being studied (Rau and Grossheimrich, 2007; Lisanby *et al.*, 2002; Miniussi and Bonato, 2005; Tredget and Kirov, 2005).

In 1985 Anthony Barker at the University of Sheffield for the first time developed Transcranial Magnetic Stimulation (TMS) (Hasey, 2001). TMS is a neuromodulatory technique which can modulate brain activity, in a noninvasive, painless manner (Fregni and Schachter, 2005; Kirkcaldie and Pridmore, 1997).

Studies comparing TMS with Electroconvulsive Therapy (ECT) in treating affective disorders shows similar effects (Simons and Dierick, 2005). In addition to its potential clinical role of TMS, when TMS is coupled with functional neuroimaging, then it may provide insights into the pathophysiology of depression (Gershon and Dannon, 2003).

We designed this preliminary research to know if exposure to magnetic field during routine diagnostic brain MRI may have a therapeutic effect on patients with major depression.

### MATERIALS AND METHODS

For finding cases with major depression we screened 300 patients who were referred to our MRI center for diagnostic Brain MRI using Iranian version of Patient Health Questionnaire (PHQ-9). Among these patients we found 29 patients with major depression. We excluded 6 patients who were using any anti-depressant medications and/or had organic lesions in their MRI.

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Table 1: Mean (SD) of PHQ-9 and its items, separately by before, after and ratio of difference on before exposure score

Scale	Before	After	P (two-tailed)	(Before-after)/before
PHQ-9	15.48(4.15)	6.48(6.21)	<0.001	0.59(0.33)
1) Little interest or pleasure in doing things	1.96(1.26)	0.74(0.92)	0.002	0.59(0.45)
2) Feeling down, depressed, or hopeless	2.39(0.99)	0.83(1.11)	<0.001	0.66(0.42)
3) Trouble falling or staying asleep, or sleeping too much	2.22(0.9)	1.13(1.10)	0.003	0.39(0.74)
4) Feeling tired or having little energy	2.39(0.84)	1.13(1.14)	0.001	0.53(0.41)
5) Poor appetite or over eating	1.65(1.27)	0.65(1.07)	0.002	0.62(0.46)
6) Feeling bad about yourself-or that you are a failure or have let yourself or your family down.	1.39(1.23)	0.57(0.79)	0.007	0.71(0.35)
7) Trouble concentrating on things, such as reading the newspaper or watching television.	1.52(1.41)	0.74(1.14)	0.012	0.52(0.48)
8) Moving or speaking so slowly that other people could have noticed. Or the opposite-being so fidgety or restless that you have been moving around a lot more than usual.	1.52(1.16)	0.57(0.95)	0.002	0.70(0.43)
9) Thoughts that you would be better off dead or of hurting yourself in some way.	1.00(1.28)	0.39(0.89)	0.033	0.43(0.94)

PHQ-9 is a newly developed questionnaire based on DSM-IV criteria for depression and is used increasingly by researchers in USA for different patients groups for diagnosis of depression. The questionnaire was validated in Iran by third author (Pezeshki, 2006). Comparing with psychiatrist diagnosis the cut point of 10 distinguishes major depression from other type of depressive patients with 87% sensitivity and 89% specificity. The finding is similar to the research was conducted by developer of questionnaire in USA (Kroenke *et al.*, 2001). During our routine diagnostic MRI, patients were exposed to a 0.3 tesla magnetic field with thirty minutes duration. Two weeks after exposure to magnetic field we reassessed the depression score of the patient by completing PHQ-9 again. Non of our patients used any anti-depressant medication between two interviews. The patients were not informed about second interview at their first interview. Wilkocson signed ranks test was used for comparing PHQ-9 score and its nine items before and after exposure to brain MRI. We also wanted to find the items of PHQ-9 with highest and lowest reduction so we calculated (before exposure-after exposure)/before exposure ratio for each items.

## RESULTS AND DISCUSSION

65.2 % of our patients were female and 34.8% were male. The mean (SD) of age was 34.2 (12). After exposure to MRI, the score of 17 out of 23 patients (73.9%) decreased to less than 10 which is the level for major depression based on PHQ-9 scoring. The table shows that the mean (SD) of PHQ-9 score and its 9 items decreased significantly after patients' exposure to magnetic field. Also the Table 1 shows mean (SD) of before-after/before ratio. Items 6 and 8 have the highest mean reduction and item 3 and 9 have the lowest reduction.

The finding of this study is a first preliminary evidence for therapeutic effect of exposure to magnetic field during routine diagnostic MRI on major depression.

Items of PHQ-9 with the highest and lowest reduction after exposure may be a clue for understanding the possible mechanisms for therapeutic effects of exposure to magnetic field.

## CONCLUSION

The main shortage of this study, is lack of randomized controls. Also our patients were not selected from psychiatric hospital and duration of follow-up was short. We are planning a randomized controlled clinical trial with long follow-up about depressive patients of psychiatric department who are resistant to conventional treatments. We also suggest using functional MRI to finding which parts of brain are affected after exposure to magnetic field and correlating this effects with changes in items of PHQ-9 after exposure.

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