Evaluation of temporomandibular (tmj) and atlanto-axial (aaj) joints with open gantry low field mr without contrast in patients with early and long rheumatoid arthritis.

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Aims and objectives

Rheumatoid Arthritis (RA) is a common systemic, chronic autoimmune disease characterized by an uncontrolled proliferation of synovial tissue and multisystem comorbidities, associated with progressive disability, multi-organ complications, early mortality and significant socio-economic impact [1-4]. The temporomandibular joint (TMJ) is involved in more than 50% of cases, often in a symmetrical way, with an evolution characterized by thinning of the disc, joint effusion, disc fractures, bone edema, synovial cloth formation, flattening condyle, erosion of the condyle, reducible and/or irreducible dislocation and destruction of the periarticular soft tissues. These changes can cause pre-auricular pain, which increases with mastication, morning stiffness, reduction of the masticatory force and progressive functional limitation [5-9]. The involvement of the atlanto-axial joint (AAJ) certainly is the most severe joint RA localization; a synovial pannus can form, which is the typical lesion, and consequently a subluxation of the AEE can occur, with the risk of secondary myelopathy [10,11]. Therefore, the purpose of this study was to searching for a correlation between the early and long RA and alterations of TMJ and AAJ with an open gantry low field MR without contrast, in relation to its greater diffusion on the territory and to its greater possibility of use, in order to collaborate in the management of these patients and to better orient themselves towards the therapeutic choices [12-15].

Methods and materials

Patient population: Eighty adult patients (mean age=55.65 years, 64 females and 16 males) were enrolled with RA diagnosis according to the criteria ACR/EULAR 2010 [16] and were divided into 2 groups: Early group (RA with onset <1 year) consisting of 32 patients, diagnosed between 2 months and 1 year (average: 9.75 months) and Long Group (RA with onset> 1 year) consisting of 48 patients, diagnosed between 2 years and 49 years (average: 13 years).

In both groups we evaluated the autoantibodies typical of RA, ACPAs (anti-peptide citrullinated antibodies), RF (rheumatoid factor) and ANAs (anti-nucleus antibodies) [17,18], ESR (sedimentation rate of erythrocytes) and CRP (C-reactive protein). We evaluated the presence of TMJ symptomatology correlated to the articular involvement in the course of RA (TMJ pain, mandibular block, functional limitation, morning stiffness, joint click, signs of inflammation) [19], the presence of cervical symptomatology correlated to RA (cervical pain, morning stiffness, signs of inflammation) and the presence of RA manifestations of other joints (wrist and/or hand and/or elbow and/or foot and/or ankle and/or knee and/or shoulder and/or pelvic girdle uni/bilaterally). Furthermore, we considered extra-articular manifestations of AR and the type of therapy in place, if exclusively conventional therapy or even biological therapy [20, 21].

Data acquision: The radiological evaluation of the alterations of the TMJ and the AAJ was done by open gantry low field (0.28T) MRI without contrast (Esaote S-Scan) [22]. For the temporomandibular joint examination, the TMJ coil 15 (acquisition field with a length of about 200mm and a width of about 110mm) was used, provided with six pairs of connectors and a central hole which allows the correct centering of the region to be analyzed; we used sequences: Proton Density (PD) in opening and closing [23], Fast Spin Echo (FSE) T2 in closing (all the sequences were acquired on the sagittal and oblique planes). The TMJ findings considered were: erosion of the condylar profile, thinning of the articular disk, joint effusion, bone edema, flattening of the condyle, reducible and/or irreducible dislocation, the fracture of the disk, the presence of synovial pannus. For the AAJ examination, a specific linear coil was used (acquisition field with a length of about 200mm along the spine and a width of about 110mm) with six pairs of connectors inside it; we used sequences: sagittal Spin Echo (SE) T1 and FSE T2, coronal SE T1, FSE T2 and Short Tau Inversion Recovery (STIR), axial X-Bone and 3D HYCE [24]. The AAJ findings considered were: the presence of synovial pannus, erosions, joint effusion, bone edema, subluxation, dislocation, rupture of the alar ligaments, medullary compression.

Statistical Analysis: Data were analyzed by multivariate analysis using 2 x 2 contingency tables, SPSS 10 (IBM Statistics). All the parameters considered in the study were considered as "non-parametric values", comparing the parameters of radiological relevance with the parameters of clinical and laboratory relevance.

Results

MR alterations of the TMJ: The evalutation of the TMJ showed (**figure 1**): 20 PT with erosions of the condyle (**figures 2, 3**): 12 unilaterally (Long RA) and 8 bilaterally (Long RA); 24 PT with thinning of the disk (**figure 4**): 12 unilaterally (Long RA) and 12 bilaterally (Long RA); 32 PT with a flattening of the condyle (**figure 4)**: 20 unilaterally (12 Long RA and 8 Early RA) and 12 bilaterally (Long RA); 4 PT with joint effusion (Long RA); 12 PT with condylar bone edema: 8 unilaterally (Long RA) and 4 bilaterally (Early RA); 12 PT with monolateral reducible anterior dislocation (8 Long RA and 4 Early RA); 16 PT with non-reducible anterior dislocation (**figure 4**): 12 unilaterally (8 Long RA and 4 Early RA) and 4 bilaterally (Long RA); No PT with evidence of fracture of the disc or synovial pannus.

MR alterations of the AAJ: The evaluation of the AAJ by out method showed (**Figure 5**): 8 PT with synovial pannus (Long RA); 4 PT with erosions (Long RA), 4 PT with subluxation (**figures 6, 7**), belonging to the Long RA group; No PT with joint effusion, bone edema, dislocation, alar ligament rupture and medullary compression. Of the 56 patients with TMJ symptomatology (40 Long RA and 16 Early RA), in 8 patients (14%, 4 Long RA and 4 Early RA) no alterations of the joint were found with our method. The remaining patients (48, 86%) showed the following alterations: erosions (16 PT, 33%), thinning of the disc: (16 PT, 33%), bone edema (12 PT, 25%), flattening of the condyle (28 PT, 58%), reducible dislocation (12 PT, 25%), irreducible dislocation (16 PT, 33%). They were symptomatic: 80% of the patients with erosions, 65% of the patients with thinning of the disk, 100% of the patients with bone edema, 87% of the patients with flattening of the condyle, 100% of the patients with dislocation (reducible and/or irreducible). 52 patients presented cervical pain and/or morning stiffness: only 2 patients (15%), belonging of the Long RA group, had synovial pannus (1 associated with subluxation and 1 associated with erosions).

Statistical correlations: Significantly correlated correlations were observed (Chi-square test and Fischer's exact test) between the alterations of the TMJ and the Long RA: between the autoantibody positivity and flattening the disk (p=0.018); between the positivity of acute phase reactants of inflammation and condylar bone edema (p = 0.018) and irreducible disk dislocation (p = 0.018).

The flattening of the disk is associated with TMJ symptomatology (p=0.043); the inflammation indices seem to be correlated, at the limits of statistical significance (p=0.057), with the anterior dislocation; TMJ symptomatology seems to be correlated, to the limits of statistical significance, with the reducible dislocation (p 0.057); the long AR is associated with condylar edema at the limits of statistical significance (p=0.06). No correlations between Early RA and organic changes of the two joints were found.

Images for this section:

	EARLY	LONG
EROSIONS OF THE CONDYLE		
MONOLATERAL	0	12 (25%)
BILATERAL	0	8 (16.6%)
THINNING OF DISK		
MONOLATERAL	0	16 (33.3%)
BILATERAL	0	8 (16.6%)
FLATTENING OF CONDYLE		
MONOLATERAL	8 (16.6%)	12 (25%)
BILATERAL	0	12 (25%)
CONDYLAR BONE EDEMA		
MONOLATERAL	4 (12.5%)	8 (16.6%)
BILATERAL	0	0
REDUCIBLE ANTERIOR DISLOCATION		
MONOLATERAL	4 (12.5%)	8 (16.6%)
BILATERAL	0	4 (12.5%)
NON-REDUCIBLE ANTERIOR DISLOCATION		
MONOLATERAL	4 (12.5%)	8 (16.6%)
BILATERAL	0	0

Fig. 1: Table: MR alterations of the TMJ

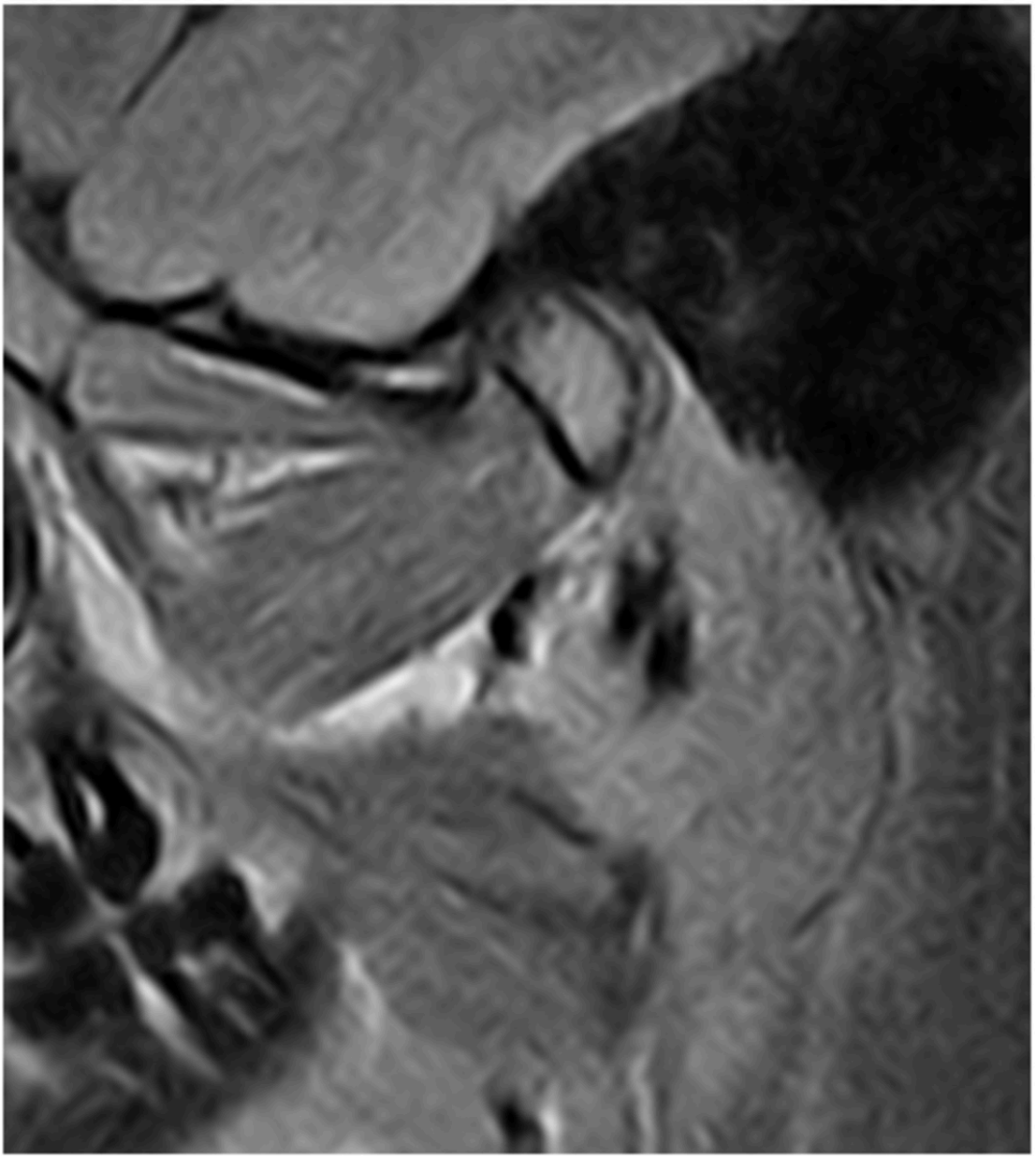

Fig. 2: PD-w image in sagittal plane: presence of two focal subchondral erosions of the mandibular condyle

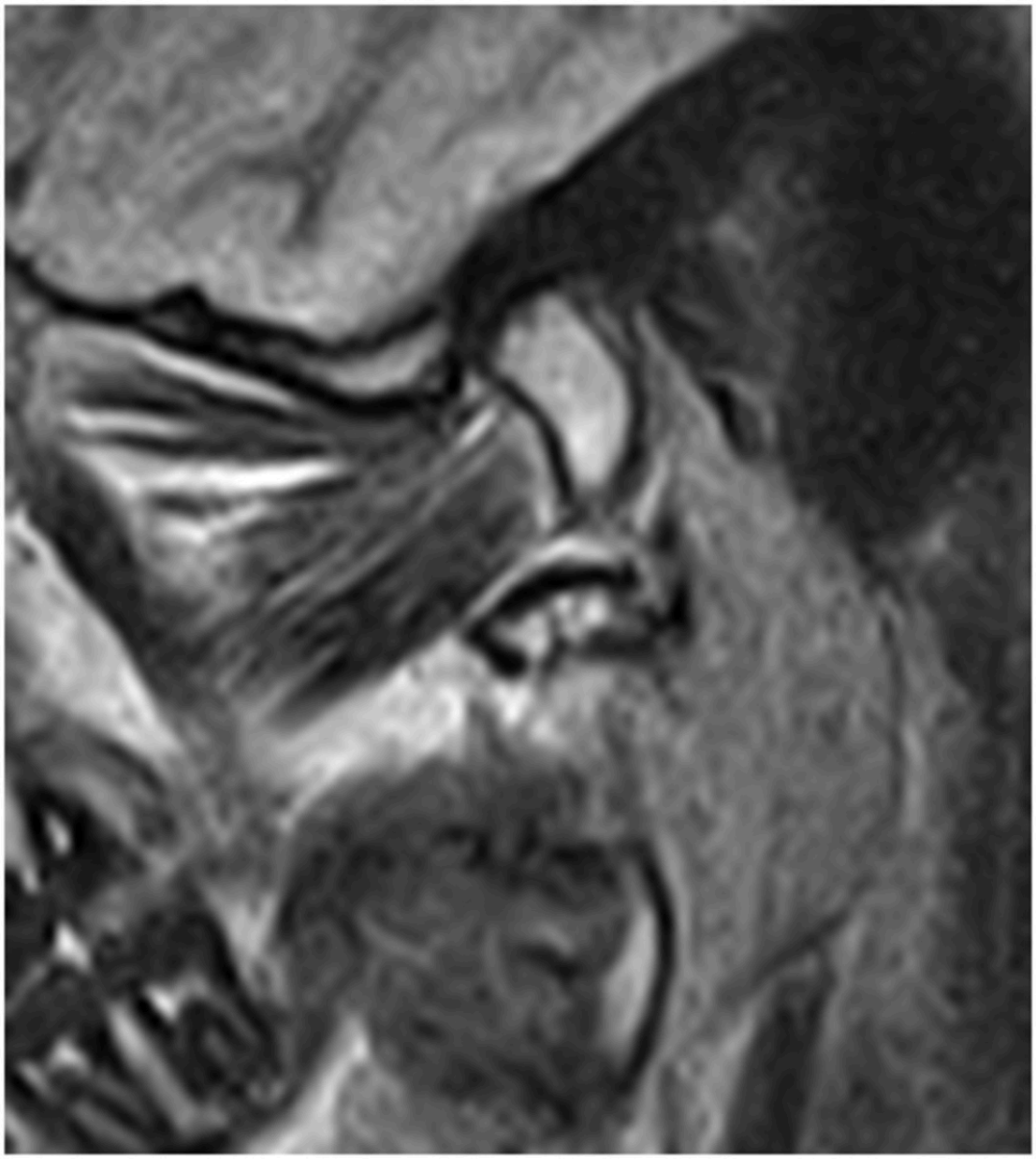

Fig. 3: T2-w image in sagittal plane: presence of two focal subchondral erosions of the mandibular condyle

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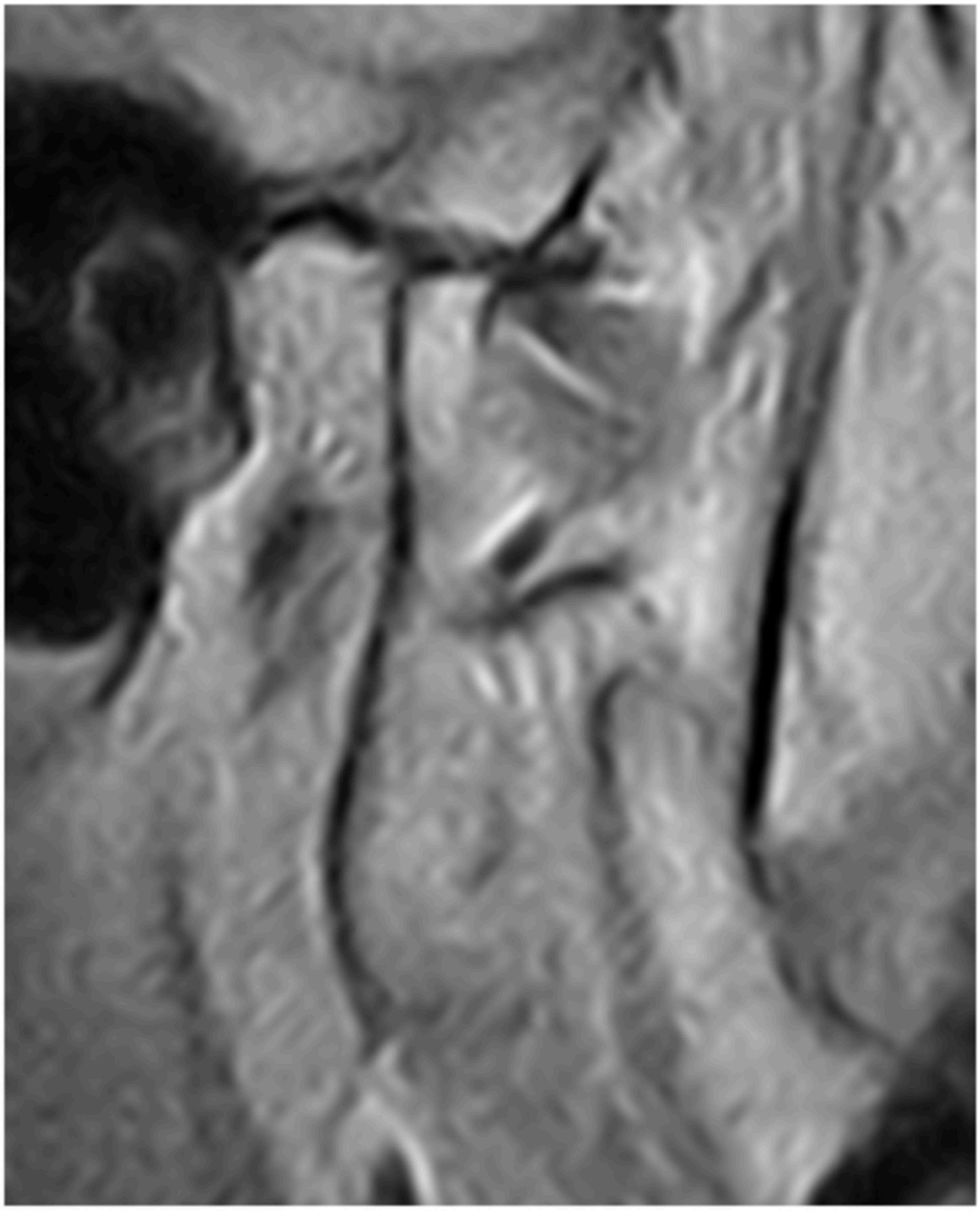

Fig. 4: PD-w image in sagittal plane: thinning of the disk, flattening of the condyle and non-reducible anterior dislocation

	EARLY	LONG
SYNOVIAL PANNUS	0	8 (16.6%)
EROSIONS	0	4 (8.3%)
SUBLUXATION	0	4 (8.3%)

Fig. 5: Table: MR alterations of the AAJ

Fig. 6: T1-w imagine in sagittal plane: AAJ subluxation

Fig. 7: T2-w imagine in sagittal plane: AAJ subluxation

Conclusion

In conclusion, the presence of symptomatology, even more if associated with positive autoantibodies and inflammatory indices, is related to organic alterations evident with our method (open gantry 0.28 T MRI scan without contrast with dedicated coils), such as the flattening of the disc, the erosions of the mandibular condyle and the altered articular relationships. These alterations are very important from the clinical and prognostic point of view, especially in relation to the quality of life of patients with RA, and are also the subject of pharmacological and maxillofacial targeted therapies [20]. No statistically significant correlations were found for patients with early RA; in this group, no sufficient radiological alterations were found to allow a more detailed statistical analysis. There was no correlation with the flattening of the articular condyle, probably due to the limited study sample or to the greater importance of degenerative rather than inflammatory phenomena, at the base of the development of this alteration. Also the AAJ alterations showed little incidence; therefore a more accurate judgment can not be expressed. Another limitation of the study was represented by the non-use of the contrast agent, which is perhaps the reason for the poor identification of the synovial pannus even in patients who presented pain associated with different organic alterations evident on the MRI examination.

It would be interesting to evaluate data concerning a larger series, and possibly studies comparing the diagnostic results between high-field and low-field MRI scans.

Therefore, the study and monitoring of TMJ by this MRI method can be considered useful in patients with long RA and with positive laboratory tests and may be subject to future studies.

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References

1) McInnes IB, Schett G. The Pathogenesis of Rheumatoid Arthritis. New England Journal Medicine 2011 Dec; 365:2205-19.

2) Kumar V, Abbas AK, Fausto N, Asher JC. Robbins e Cotran. Le basi patologiche delle malattie. 8° edizione. Elsevier. 2015

3) Menard HA, Lapointe E, Rochd MD., Zhou ZJ. Insight into rheumatoid arthritis derived from the SA Immune system. Arthrits Res 2000. Aug; 2:429-32

4) Pincus T, Callahan LF. What is the natural history of rheumatoid arthritis? Rheum Dis Clin North Am. 1993 Feb; 19(1): 123-51.

5) Gasbarrini G, Cricelli C et al; Trattato di medicina interna; Verducci editore, 2010-2011

6) Y#ld#zer Keri# E, Yaman SD, Demira# MD, Haznedaro#lu #. Temporomandibular joint findings in patients with rheumatoid arthritis, ankylosing spondylitis, and primary Sjögren's syndrome. J Investig Clin Dent. 2016 Dec.

7) Aliko A, Ciancaglini R, Alushi A, Tafaj A, et al. Temporomandibular joint involvement in rheumatoid arthritis, systemic lupus erythematosus and systemic sclerosis. Int J Oral Maxillofac Surg. 2011 Jul;40(7):704-9.

8) Sodhi A, Naik S, Pai A, Anuradha A. Rheumatoid arthritis affecting temporomandibular joint. Contemp Clin Dent. 2015 Jan-Mar;6(1):124-7.

9) Zoli A, Bosello S, Magarelli N, D'Antona G, et al. Atlantoepistrophic Magnetic Resonace. Imaging involvement in early Rheumatoid Arthritis: an aggressive tight control therapy not fully arresting the disease. Arthritis Care Res (Hoboken). 2011 Nov;63(11):1629-33

10) Colosimo C. Neuroradiologia; edra 2013

11) Del Grande M, Del Grande F, Carrino J, Bingham CO 3rd, et al. Cervical spine involvement early in the course of rheumatoid arthritis. Semin Arthritis Rheum. 2014 Jun. 43(6): 738-44.

12) Larheim TA. Role of magnetic resonance imaging in the clinical diagnosis of the temporomandibular joint. Cells Tissues Organs. 2005;180(1):6-21.

13) Amjadi-Begvand S, Khanna D, Park GS, Bulpitt KJ, et al. Dating the "window of therapeutic opportunity" in early rheumatoid arthritis: accuracy of patient recall of arthritis symptom onset. J Rheumatol 2004 Sep; 31(9): 1686-92

14) Quinn MA, Cox S. The evidence for early intervention. Rheum Dis Clin North Am. 2005; 31(4): 575-89.

15) Heidari B. Rheumatoid Arthritis: Early diagnosis and treatment outcomes. Caspian J Intern Med. 2011 Winter; 2(1): 161-170.

16) Aletaha D, Neogi T, Silman AJ, Funovits J, et al. 2010 Rheumatoid Arthritis Classification Criteria. Arthritis and Rheumatism. 2010 Sep; 62(9): 2569-2581.

17) De Rychie L, Peene I, Hoffman IEA, Kruithof E, Union A, Meheus L, et al. Rheumatoid factor and anticitrullinated protein antibodies in rheumatoid arthritis: diagnosis value, association with radiological progression rate and extra-articular manifestations. Ann Rheum Dis 2004; 63: 1587-93.

18) Tamai M, Kawakami A, Uetani M, Takao S, Rashid H, Tanaka F, et al. Early prediction of rheumatoid arthritis by serological variables and magnetic resonance imaging of the wrists and finger joints: results from prospective clinical examination. Ann Rheum Dis. 2006; 65: 134-5.

19) Ahmed N, Mustafa HM, Catrina AI, Alstergren P. Impact of temporomandibular joint pain in rheumatoid arthritis. Mediators Inflamm.2013:597419.

20) Ozcan I, Ozcan KM, Keskin D, Bahar S, et al. Temporomandibular joint involvement in rheumatoid arthritis: correlation of clinical, laboratory and magnetic resonance imaging findings.B-ENT. 2008;4(1):19-24.

21) Edwards JP, Peterson EJ, Durham J, Nixdorf DR. Methotrexate pharmacotherapy for implant-related temporomandibular joint pain: a case report. Oral Surg Oral Med Oral Pathol Oral Radiol. 2014 Aug;118(2):44-7.

22) S.Scan Manuale Utente, Esaote SpA

23) Kretapirom K, Okochi K, Nakamura S, Tetsumura A, et al. MRI characteristics of rheumatoid arthritis in the temporomandibular joint. Dentomaxillofac Radiol. 2013 Apr;42 (4).

24) Yilmaz HH, Yildirim D, Ugan Y, Tunc SE, et al. Clinical and magnetic resonance imaging findings of the temporomandibular joint and masticatory muscles in patients with rheumatoid arthritis.. Rheumatol Int. 2012 May;32(5):1171-8.

25) Atsü SS, Ayhan-Ardic F. Temporomandibular disorders seen in rheumatology practices: A review. Rheumatol Int. 2006 Jul;26(9):781-7.