Atlantoaksiyal eklemin konik ışınlı bilgisayarlı tomografi (KIBT) ile değerlendirilmesi

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ABSTRACT

The evaluation of atlanto-axial joint with cone beam computed tomography (CBCT)

Background: This study aimed to show the osteoarthritic changes of atlanto-axial joint by aging in asymptomatic subjects with CBCT as first in literature.

Methods: Study group of 120 patients randomly selected and grouped according to six age categories. In images atlanto-dental joint interval was measured and decreasing of joint space, ankylosis, subchondral sclerosis and cyst, erosion, osteophyte, ligament calcification findings were recorded. Measurements and evaluations were made on software of CBCT system (Romexis 4.3.0V). Data were analyzed with IBM SPSS Statistics 21.0 package programme. For statistical significance, $p < 0.05$ was accepted.

Results: Mean atlanto-dental interval (ADI) values were significantly different between age groups ($p < 0.001$). The presence of the decreasing of joint space, ankylosis, subchondral sclerosis and cyst, erosion, osteophyte findings were found significantly different between age groups (for each $p < 0.05$). The mean interval values of patients with ankylosis, subchondral cyst, erosion and ligament calcification were statistically different from patients without these findings (for each, $p < 0.05$).

Conclusion: Our study showed increase of osteoarthritic changes and decrease of ADI with age. CBCT provides useful information on the evaluation of hard tissue changes in the cervical spine.

KEYWORDS

Atlanto-Axial Joint, osteoarthritis, cone-beam computerized tomography, computed tomography, X-Ray

ÖZ

Atlantoaksiyal eklemin konik ışınlı bilgisayarlı tomografi (KIBT) ile değerlendirilmesi

Amaç: Bu çalışmada literatürde ilk kez KIBT ile asemptomatik bireylerde yaşlanmayla birlikte atlanto-aksiyel eklemde meydana gelen osteoartritik değişimlerin gösterilmesi amaçlanmıştır.

Gereç ve Yöntemler: Çalışma grubunu oluşturmak üzere 120 hasta rastgele seçildi ve altı farklı yaş kategorisine göre gruplandırıldı. İmajlarda atlanto-dental eklem aralığı ölçüldü ve eklem boşluğunda azalma, ankiloz, subkondral skleroz ve kist, erozyon, osteofit, ligament kalsifikasyonu bulguları kaydedildi. Ölçümler ve değerlendirmeler KIBT sistemine ait program üzerinde yapıldı (Romexis 4.3.0V). Veriler IBM SPSS Statistics 21.0 paket program analiz edildi. İstatistiksel anlamlılık için $p < 0.05$ kabul edildi.

Bulgular: Ortalama atlanto-dental aralık (ADI) değerleri yaş grupları arasında anlamlı derecede farklı idi ($p < 0.001$). Eklem boşluğunda azalma, ankiloz, subkondral skleroz ve kist, erozyon, osteofit bulgularının varlığı yaş grupları arasında anlamlı derecede farklı bulundu (her biri için $p < 0.05$). Anklioz, subkondral kist, erozyon ve ligament kalsifikasyonu olan hastaların ortalama eklem aralığı değerleri bu bulguları olmayanlardan istatistiksel olarak farklı bulundu (her biri için $p < 0.05$).

Sonuç: Çalışmamız yaşla birlikte osteoartrik değişimlerin arttığını ve ADI'nın azaldığını gösterdi. KIBT servikal spinada sert doku değişimlerinin değerlendirilmesinde yararlı bilgiler sağlamaktadır.

ANAHTAR KELİMELER

Atlanto-aksiyel eklem, osteoartrit, konik ışınlı bilgisayarlı tomografi, bilgisayarlı tomografi, X ışını

INTRODUCTION

The integration of 3D imaging systems to oral and maxillofacial radiology enables not only visualization of bimaxillary anatomical structures but also surrounding ones such as cervical region with low dose radiation. Cervical maturation was used in orthodontic treatment procedures in teenage groups.[1] Like this, osteoarthritic changes of vertebraes can also be visualized on CBCT images. Arthritis of atlanto-axial joint has been documented as a potential risk for dens fractures in older age group and generally studied with computed tomography. [2,3] This study aimed to show osteoarthritic changes by aging in asymptomatic patients with CBCT as first in literature.

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MATERIALS AND METHODS

This retrospective study was approved by the institutional review board (No: 25.12.18/19). CBCT images were selected from archive of Oral and Maxillofacial Radiology Department. Study group of 120 patients consisted according to six age categories (20-29, 30-39, 40-49, 50-59, 60-69 and older than 70) at equal numbers. Patients had no congenital and metabolic bone disease, connective tissue disease, torticollis and trauma recorded in patient management system. Age and genders of patients were documented. CBCT images were in high image quality, without artefact, 20.0 x 20.0 x 10.2 cm FOV and 0.400 mm voxel size (Planmeca Promax 3D Mid; Helsinki FİNLAND). In images;

1. Atlanto-dental joint interval (ADI) was measured as distance intercepted from the segment line linking the center of atlas tubercule with that of posterior tubercule.[4]

2. Decreasing of joint space, ankylosis, subchondral sclerosis and cyst, erosion, osteophyte and ligament calcification findings were recorded.

Measurement and evaluations were made on software of CBCT system (Romexis 4.3.0V).

Statistical Analysis;

Description of continuous data/categoric data expressed in means±SD/frequency and percentages. After Shapiro Wilk, Kruskal Wallis H test were performed. The analysis of osteoarthritic degenerative findings and genders according age groups were tested with Pearson and Pearson Exact Data were analyzed with IBM SPSS Statistics 21.0 package programme. For statistical significance, $p < 0.05$ was accepted.

RESULTS

Measurement value; Mean atlanto-dental interval values were significantly different between age groups ($p < 0.001$). Values decreased from youngest to oldest age groups (Table 1).

Table 1. The differences of atlanto-dental interval values between age groups

			Measurement Values Mean ± SD Median (Q1 – Q3)	p	Multiple Comparison
Age Groups	**20-29 (1)**	20	1.36 ± 0.30		3-6: 0.015
	30-39 (2)	20	1.28 ± 0.30		2-6: <0.001
	40-49 (3)	20	1.10 ± 0.42		1-6: <0.001
	50-59 (4)	20	0.88 ± 0.30	<0.001	5-2: 0.015
	60-69 (5)	20	0.84 ± 0.36		5-1: 0.001
	70+ (6)	20	0.60 ± 0.37		4-2: 0.016
					4-1: 0.002

Osteoarthritic changes; The presence of the decreasing of joint space, ankylosis, subchondral sclerosis and cyst, erosion, osteophyte findings were found significantly different between age groups (for each $p < 0.05$). Ankylosis was observed after fifth decade. The presence of subchondral cyst and erosion increased at 40 and older ages. The increase of osteophyte cases was seen after fourth decade. Subchondral sclerosis and the presence of decreasing of joint space were not associated to increase of age. All age groups had different risk for them (Table 2). The mean

interval values of patients with ankylosis, subchondral cyst, erosion and ligament calcification were statistically different from patients without these findings (for each, p<0.05) (Table 3).

Table 2. The osteoarthritic changes between age groups

		Age Groups						p
		20-29	30-39	40-49	50-59	60-69	70+	
Gender	**Male**	10 (%50.0)	10 (%50.0)	10 (%50.0)	10 (%50.0)	10 (%50.0)	10 (%50.0)	1.000
	Female	10 (%50.0)	10 (%50.0)	10 (%50.0)	10 (%50.0)	10 (%50.0)	10 (%50.0)	
Ankylosis	**Absent**	20 (%100.0)	20 (%100.0)	19 (%95.0)	17 (%85.0)	19 (%95.0)	14 (%70.0)	0.005
	Present	0 (%0.0)	0 (%0.0)	1 (%5.0)	3 (%15.0)	1 (%5.0)	6 (%30.0)	
Subchondral Sclerosis	**Absent**	11 (%55.0)	4 (%20.0)	5 (%25.0)	10 (%50.0)	3 (%15.0)	4 (%20.0)	0.017
	Present	9 (%45.0)	16 (%80.0)	15 (%75.0)	10 (%50.0)	17 (%85.0)	16 (%80.0)	
Subchondral Cyst	**Absent**	14 (%70.0)	17 (%85.0)	10 (%50.0)	9 (%45.0)	9 (%45.0)	7 (%35.0)	0.015
	Present	6 (%30.0)	3 (%15.0)	10 (%50.0)	11 (%55.0)	11 (%55.0)	13 (%65.0)	
Erosion	**Absent**	11 (%55.0)	11 (%55.0)	5 (%25.0)	4 (%20.0)	2 (%10.0)	4 (%20.0)	0.004
	Present	9 (%45.0)	9 (%45.0)	15 (%75.0)	16 (%80.0)	18 (%90.0)	16 (%80.0)	
Osteophyte	**Absent**	10 (%50.0)	4 (%20.0)	4 (%20.0)	4 (%20.0)	1 (%5.0)	5 (%25.0)	0.033
	Present	10 (%50.0)	16 (%80.0)	16 (%80.0)	16 (%80.0)	19 (%95.0)	15 (%75.0)	
Ligament Calcification	**Absent**	20 (%100.0)	20 (%100.0)	20 (%100.0)	18 (%90.0)	18 (%90.0)	19 (%95.0)	0.421
	Present	0 (%0.0)	0 (%0.0)	0 (%0.0)	2 (%10.0)	2 (%10.0)	1 (%5.0)	
Decreasing Joint Space	**Absent**	18 (%90.0)	13 (%65.0)	14 (%70.0)	15 (%75.0)	10 (%50.0)	9 (%45.0)	0.032
	Present	2 (%10.0)	7 (%35.0)	6 (%30.0)	5 (%25.0)	10 (%50.0)	11 (%55.0)	

Table 3. The differences of mean interval values in osteoarthritic changes

Measurement Values	Mean ± SD Median (Q1 – Q3)		p
	Absence	**Presence**	
Ankylosis	1.07 ± 0.39 1.20(0.80-1.20)	0.40 ± 0.35 0.40(0.00-0.80)	<0.001
Subchondral Sclerosis	1.11 ± 0.35 1.20(0.80-1.20)	0.96 ± 0.45 0.80(0.80-1.20)	0.078
Subchondral Cyst	1.12 ± 0.46 1.20(0.80-1.60)	0.87 ± 0.35 0.80(0.80-1.20)	0.002
Erosion	1.13 ± 0.35 1.20(0.80-1.40)	0.95 ± 0.45 0.80(0.80-1.20)	0.017
Osteophyte	1.11 ± 0.35 1.20(0.80-1.20)	0.97 ± 0.45 0.80(0.80-1.20)	0.107
Ligament Calcification	1.02 ± 0.43 1.20(0.80-1.20)	0.64 ± 0.21 0.80(0.40-0.80)	0.024
Decreasing Joint Space	1.07 ± 0.39 1.20(0.80-1.20)	0.88 ± 0.48 0.80(0.60-1.20)	0.080

Figure 1. ADI measurement

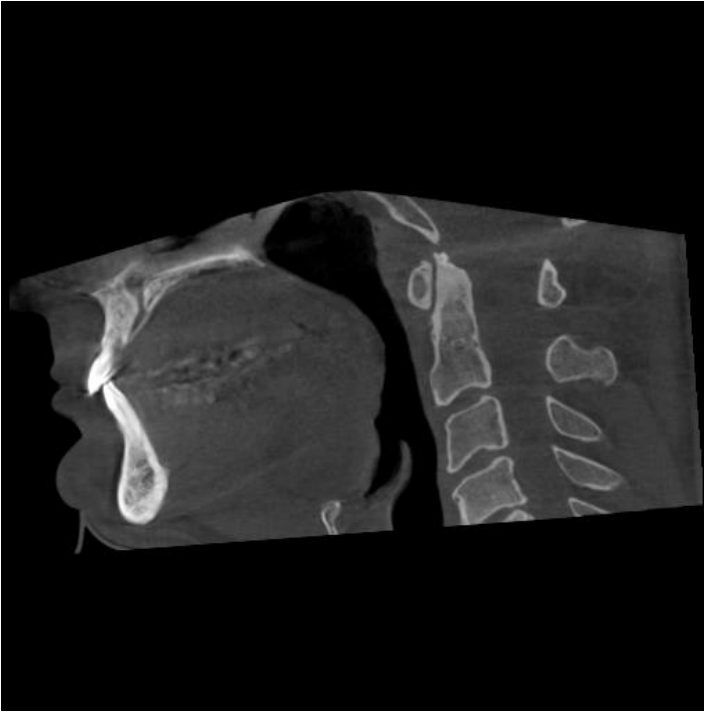**Figure 2.** Subchondral Cyst-Osteophyte

Figure 3. Subchondral Osteosclerosis

DISCUSSION

Osteoarthritic changes of cervical spine are associated with aging process, long-lasting, low-level lifelong trauma and postural instability. Due to the unbalanced distribution of these charges to the spine; joint space narrowing, cortical thickening, subchondral sclerosis and cyst formation, ligament calcification occurs. People with atlanto-axial arthritis complaint of increased head and neck pain with head movements.[5,6,7]

Computed tomography (CT) is usually used in the examination of the osteoarthritic changes of cervical spine.[5,6] However, recently CBCT provides useful information equivalent to CT in various studies.[8,9] In this study, CBCT was chosen for the evaluation of osteoarthritic changes in atlanto-dental joints, low cost and radiation dose. The joint space narrowing is one of the radiographic signs of osteoarthritis. Several studies have shown that joint space decreases with age in the literature.[4,6,7]

Liu et al.[4] and Betsch et al.[3] reported that ADI measurements decreased with increasing age. In this study, ADI was observed to decrease with age in accordance with their work. Betsch et al.[3] reported that subchondral cyst formation usually started in the fifth and sixth year of life, and synovitis began in the second and third decades of life. They also found that the prevalence of intraosseous cysts and calcific synovitis increased with age.

Liu et al.[4] reported that mild osteoarthritis appeared at the earliest at age 19.6 years, moderate osteoarthritis in at earliest at age 24.2 years and severe osteoarthritis at the earliest at age 48.5 years. We have found that the presence of subchondral cyst and erosion increased at 40 and older ages. The increase of osteophyte cases was seen after fourth decade.

CONCLUSION

To our knowledge, this is the first study about CBCT and atlanto-axial joint in literature. Osteoarthritic changes increase and ADI decreases with age. CBCT provides useful information for evaluation of osteoarthritic changes in atlanto-axial joint. In the view of these findings, we recommended that;

*Oral and maxillofacial radiologists have to examine and report radiologic changes of this region even if patients have no complaint,

*Oral and maxillofacial radiologists must take into consideration osteoarthritic changes of atlanto-axial joint in patients who have referred cervical pain for differential diagnosis of temporomandibular joint and related muscle disorders.

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