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MORPHOMETRY OF TALAR ARTICULAR FACET OF THE BODY OF NAVICULAR BONE .

Anatomy

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ABSTRACT

Background: In the formation of talo calaneo navicular joint ,congruence of articular surfaces of talus, navicular and calcaneum is very important to maintain the stability and in the distribution of body weight to the remaining tarsal bones.

Aim: To prepare morphometric data of talar surfaces (posterior surface) of body of navicular bone, to find if there is any difference between both the sides (right and left) of measurements , range of measurements and it's mean value of measurements in telangana region people.

Material and Methods: The study was conducted on 47 (right 21 left 26) dry Human adult navicular bones of undetermined gender and age separated into right side and left side bones. Each right and left Human navicular bone were assigned a serial number. On the talarsurface (posterior surface) surface, vertical length (height) of talar surface and transverse length (breadth) of talar surface of navicular bones were measured. The Data was tabulated and Analysed.

Results: On the Posterior Articular surface (talarsurface), the range of vertical length (height) of navicular bone were 16mm to 27mm on Right side and 16mmto28 mm on Left side.The range of transverse length (breadth) of navicular bone were 23mm to 30mm on Right side and 24mm to 32mm on Left side.

The mean values of vertical length (height) and transverse length (breadth) of talar surface of navicular bone were 19.7mm and 25.6 mm on Right side respectively.

The mean values of vertical length (height) and transverse length (breadth) of talar surface of navicular bone were 20.0mm and27.3mm on Left side.

Conclusion: The talar articular surface measurements of opposite navicular bone can be used as a control during navicular bone replacement surgery, it may help surgeons to plan pre-operatively to design accurate navicular bone prosthesis and implants.

KEYWORDS:

Articular facets, talar facet , width or transverse length of facet , height or vertical length of facet

INTRODUCTION:

In the formation of talo calaneo navicular joint ,congruence of articular surfaces of talus,navicular and calcaneum is very important to maintain the stability and in the distribution of body weight to the remaining tarsal bones. Aim of this study is to prepare morphometric data of talar surfaces (posterior surface) of body of navicular bone, to find if there is any difference between both the sides (right and left) of measurements ,range of measurements and it's mean value of measurements in telangana region people. Because of very limited availability of the data on the Morphometry of the articular facets on the Body of the dry human navicular bone,that is the reason this study was undertaken.

MATERIAL AND METHODS:

The study was conducted on dry Human adult navicular bones. The 47 (right 21 left 26) Human adult navicular bones were obtained from the bone collection of the Department of Anatomy of Osmania and Kakathiya Medical College in Telangana Region. 47undamaged Human adult navicular bones were selected for the study. These Human adult navicular bones of undetermined gender and age separated into right side and left side navicular bones and were assigned a serial number. Anatomical measurements were taken on human adult navicular bone using a verniercaliper.

On the talarsurface (posterior surface) surface, vertical length (height) of talar surface and transverse length (breadth) of talar surface of navicular bones were measured. The Data was tabulated and Analysed. Range and Mean values of each measurement were calculated. Compare the difference between Right and Left sides of measurements.

RESULTS:

On the Posterior Articular surface (talarsurface), the range of vertical length (height) of talarsurface of navicular bone were 16mm to 27mm on Right side and 16mmto28 mm on Left side(table-1 &2).

On the Posterior Articular surface (talar surface), the range of transverse length (breadth) of talarsurface of navicular bone were 23mm to 30mm on Right side and 24mm to 32mm on Left side.

The mean values of vertical length (height) and transverse length (breadth) of talar surface were 19.7mm and 25.6 mm on Right side respectively.

The mean values of vertical length (height) and transverse length (breadth) of talar surface of navicular bone were 20.0mm and27.3mm on Left side(table-3).

DISCUSSION:

The location and unique impingement during foot strike of the navicular bone predispose it to well-localized stress and remodeling.[1] During foot strike, the navicular bone becomes impinged with maximal effort between the proximal talus and the distal cuneiforms. Biomechanical analysis of navicular motion during stride reveals that most of this impingement force is focused at the central one third of the navicular bone.[2-4] A microangiopathic study[5] of cadaveric feet showed this design leaves the central one third, the area of greatest stress, as an area of relative avascularity.

Tarsal navicular stress fractures were first described in 1958 in a study of racing grey-hounds.[6] The fractures were always seen in the right hind foot and were initially termed “broken hock.” The counterclockwise racing of the greyhounds on a banked track may have predisposed their uphill foot to increased stress. The lesion was first described in humans in a 1970 study.[7] Even then, the difficulty of locating the lesion on plain radiographs was noted. Because of the vertical nature of the fracture, it was understood that diagnosis “may require special views and laminography for detection.”[7] Studies[8-10] in the 1980s projected a navicular fracture incidence of 0.7 to 2.4 percent of all stress fractures. Recent studies[7] reveal an incidence of 14 to 35 percent of all stress fractures. A study11 of elite-level athletes showed that track athletes accounted for 59 percent of all tarsal navicular stress fractures.

Early diagnosis of these lesions and proper management usually yields a favorable outcome5; however, delayed diagnosis may result in inadequate treatment and either delayed union or nonunion healing of the fracture.[13,14] The premonitory symptoms of navicular "bone strain" are generally undetectable by radiographs and computed tomographic (CT) scans. Until a diagnosis is made, there is increased stress and bony resorption focused at the central one third of the navicular bone. A bone scan performed at this phase will be positive. If stressful activity continues, the resorptive changes continue to progress until a fracture line becomes evident on CT scan and plain radiographs.[1,16]

Several authors have attempted to identify persons who are at increased risk of navicular stress fracture. One study[17] used force-plate analysis and proposed calcaneal pitch angle, talometatarsal angle, and pronation velocity as potential risk factors for navicular stress fractures. Other studies[18-20] have shown that the following factors predispose a person to navicular stress fractures: pes cavus, wide-heeled shoes, short first metatarsals, metatarsus adductus, metatarsus hyperostosis, medial narrowing of the talonavicular joint, talar beaking, limited subtalar motion, and limited ankle dorsiflexion. However, no statistically significant risk factors have been demonstrated.

Commonly occurring in track and field athletes [18-23] navicular stress fractures present as vague, aching pain in the dorsal midfoot that may radiate along the medial arch. The pain typically increases with activity such as running and jumping. With continued participation, the pain occurs sooner during activity and lasts longer into postactivity rest periods.[17,24] Symptoms are rarely bilateral.

When suspicion justifies diagnostic studies, the initial step is typically plain radiographs. Unfortunately, only 33 percent of plain radiographs have sensitivity for navicular stress fractures,[25] because the majority of fractures are incomplete.1 In addition, because bony resorption requires 10 days to three weeks to allow visualization of these fractures on plain radiographs, even complete fractures are often not seen on initial films.[26] However, plain films are useful if positive, and they also assist in ruling out other etiologies.[27]

If plain films are negative or inconclusive, triple-phase bone scan is the next recommended diagnostic procedure. Bone scan, unlike plain radiography, is positive at an early stage and is almost 100 percent sensitive for navicular stress fracture.[1] The high negative predictive value of bone scanning essentially excludes the diagnosis with a negative test; however,the positive predictive value is lower. A bone scan may be positive with negative follow-up studies (e.g., CT scan, magnetic resonance imaging [MRI]). This phenomenon is thought to represent "bone strain" or subclinical stress reaction, and it inevitably proceeds to actual fracture if physical activity is continued at the same intensity level.[28]

CT scanning is the gold standard for optimal evaluation of a fracture once bone scan has demonstrated increased uptake in the navicular bone.[24]

MRI is a reasonable choice for imaging navicular stress fractures, particularly if bone scanning is not available, because it is extremely sensitive and provides good spatial resolution.[31] however, in cases of high pre-test probability, MRI offers the attractive profile of almost 100 percent sensitivity as well as good anatomic resolution of the fracture. Bony edema on T_2-weighted images, an early finding, can add useful information regarding the acuity of the injury and delineate associated injury[32].

Surgical intervention also may be indicated in athletes who need quick healing to allow them to return to play. Typically, surgical intervention consists of screw fixation, with possible bone graft inlay. we didn't find any morphometric data of talar articular facet of navicular bone particularly in telangana region that is rhe reason we have taken up this study. However comparison of the measurements taken on the posterior articular surface of the body of navicular bones between right and left were almost similar with little significant difference.

CONCLUSION:

The talar surface of navicular bone, there is no significant difference between right and left sides of measurements. Measurements of opposite navicular bone can be used as a control during talus bone replacement surgery, it may help surgeons to plan pre-operatively to design accurate navicular bone prosthesis and implants.

Left navicular bone		
s.no	Trans verse length in mm	Vertical Length in mm
1	2.8	1.9
2	2.6	1.9
3	2.7	2.0
4	3.0	2.2
5	3.0	2.1
6	2.5	1.6
7	3.0	2.1
8	2.7	1.8
9	2.5	1.6
10	2.8	1.9
11	2.6	1.7
12	3.0	2.6
13	2.4	2.1
14	3.2	2.8
15	2.6	1.9
16	2.7	2.0
17	3.0	1.9
18	2.5	2.5
19	2.7	1.7
20	2.6	1.8
21	2.8	1.7
22	2.7	2.0
23	2.7	2.2
24	2.6	2.0
25	2.5	2.0

Right navicular bone		
s.no	Trans verse length in mm	Vertical length in mm
1	2.5	2.0
2	3.0	2.0
3	2.4	1.8
4	2.8	2.0
5	2.5	1.8
6	2.5	1.6
7	2.5	1.8
8	2.6	1.6
	2.4	1.7
10	2.5	1.6
11	2.5	2.7
12	2.6	2.2
13	2.6	2.0
14	2.3	1.8
15	2.6	2.2
16	2.8	2.1
17	2.6	2.1
18	2.5	2.1
19	2.7	2.0
20	2.4	1.9
21	2.5	2.5

Table -3: showing maximum ,minimum,mean values of transverse length, vertical length and mean values of posterior articular facet of navicular bone.

	Transverse length	Vertical length	Mean values			
	Maximum in mm	minimum in mm	maximum in mm	minimum in mm	Transverse length	Vertical length
Right navicular	30	23	27	16	25.6	19.7
Left navicular	32	24	28	16	27.3	20.0

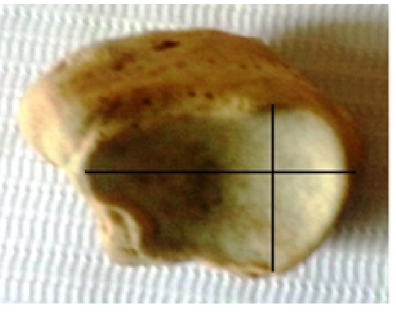

Figure -1 showing measurements of maximum transverse and vertical diameters of Rt. navicular bone

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