Original Article

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DIGITAL PANORAMIC RADIOGRAPHY IN DETERMINING THE PREVALENCE OF HALLER'S CELLS: A RETROSPECTIVE RADIOGRAPHIC STUDY

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ABSTRACT:

Purpose: Haller's cells are anatomical variations seen in the paranasal sinus region.. Identification of Haller's cells on radiographs will provide a differential diagnosis in patients with intractable orofacial pain.. The purpose of this retrospective study was to determine the prevalence of Haller's cells using panoramic radiography in North Karnataka population

Materials and Methods: A total of 1000 panoramic radiographs were retrieved from the radiology department and interpreted for the presence of Haller's cells with respect to side, shape and number by two observers who were blinded to patient's details. Results were subjected to statistical analysis using Chi square and descriptive statistics using windows SPSS software.

Results: Haller's cells were observed in 29% of the radiographs interpreted. The unilateral pattern showed predominance (51.7%) as compared to bilateral. Oval shape was the most common shape observed and the cells were seen most commonly in younger age group (18-29 years).

Conclusions: Though CT scan is the accepted method for identifying the presence of Haller's cells, the results of this study showed that the prevalence of Haller's cells was within the range previously reported on CT examination. Thus panoramic radiography can also be employed as a tool to determine the prevalence of Haller's cells.

Keywords:,Panoramic radiography, Orofacial pain, Paranasal sinus, Intraoperative complication

INTRODUCTION:

The region of paranasal sinus is subjected to a great diversity of lesions. Advancements in instrumentation and surgical techniques, imaging tools and better appreciation of the regional anatomy have enabled the diagnosticians and surgeons to enhance their diagnostic skills, and perform surgical techniques in the paranasal sinus regions with lesser complications. Variations in the normal anatomy, though rare in this region, are significant because of their pathological consequences and they also might be a source of intraoperative risk during surgery. [1]

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There is a considerable range of anatomical variation in this area which has been implicated in the aetiology of sinus infection.[2] This includes the presence of Haller's cells. They are infraorbital ethmoid cells, which have been named after Albrecht von Haller who discovered (1708-1777) these cells in the year 1743. The incidence with which they are seen in a normal population may appear to be less frequent than in those individuals with chronic rhinosinusitis.

Haller's cells are defined as air cells situated beneath the ethmoid bulla along the roof of the maxillary sinus and the most inferior portion of the lamina papyracea, including air cells located within the ethmoid infundibulum. [3]. They are associated with a variety of patient's symptoms such as recurrent maxillary sinusitis as they exert negative influence on the ventilation of maxillary sinus by narrowing the infundibulum and ostium. They are also related with headache, mucoceles and impaired nasal breathing.[4] Even if not diseased there mere presence might narrow the ethmoid ostium, thus resulting in unremitting rhinosinusitis. They might also restrict the entry into the maxillary sinus during endonsal procedures thus making it imperative for the surgeon to be aware of the variations in the normal anatomy of the paranasal sinus, so as to avoid any untoward complication during surgery. As these cells are situated in the infra-medial orbital rim, there is an increased probability of eye injury during endoscopic ethmoidectomy.

They may be visualized by various imaging modalities which show a view of the maxillary air sinus. CT is commonly used for imaging Haller's cells, although maxillary sinus endoscopy may also reveal this structure.[3]A wide range of prevalence of these cells has been reported in CT studies (4.7-45.1%). [4] This wide range might be due to the differences in image acquisition protocol of CT machines. Some studies have proved the usefulness of panoramic radiography in determining the prevalence of Haller's cells. [4,5,6]

This study has been undertaken with a view to determine if digital panoramic radiographs can be used to assess the presence and characteristics of Haller's Cells and if the range of prevalence falls within the previous range described by CT studies. Also the differences in prevalence based on age and sex were evaluated. In addition to these, variations in shape and number of Haller's cells with respect to gender were identified.

MATERIALS AND METHODS:

A total of 1000 digital panoramic radiographs were interpreted for the presence of Haller's cells . The study was carried out in the depattment of Oral Medicine and Radiology and all the radiographs were retrieved from Kodak 8000C digital panoramic machine and were standardised at 8-10mA, 70kVp and 14sec. The presence of Haller's cells was confirmed by a criteria previously used by Ahmed et al in their study [6].

1) Well-defined round, oval, or tear-drop shaped radiolucency, single or multiple, unilocular or multilocular, with a smooth border, which may or may not appear corticated.

2) Located medial to infraorbital foramen.

3) Entire or most of the border of the entity in the panoramic section is visible.

4) The inferior border of the orbit lacks cortication or remains indistinguishable in areas superimposed by this entity.

The cells were confirmed only when they met the above four criteria.

The radiographs with good resolution and showing the margins of the Haller's cells clearly were included while the ones with poor resolution were excluded.

Also the radiographs showing evidence of trauma or surgery involving the orofacial region and developmental anomalies/pathologies affecting the maxillofacial region were excluded from the study. Shapes were evaluated according to a recently published article into heart, pyramidal, teardrop, round, oval and combination (more than one type of shape)categories. [5]. (Fig. 1-6)

The radiographs were provided by a senior radiologists. after deleting all the demographic details of the patient. Two observers who were blinded too the patient's details viewed the radiographs twice for the presence of Haller's cells at an interval of one week. The presence of cells was confirmed only when both the interobserver and intraobserver results matched. Interobserver reliability test was done using kappa statistics which was found to be 0.70 (good). The data pertaining to the cells was inserted into a tabulated proforma which consisted of details pertaining to date, presence or absence of Haller's cell, side, shape and number of cells.

All the data, was then tabulated and subjected to Chi square and descriptive statistics using windows SPSS software.

RESULTS:

Out of the total 1000 OPGs interpreted, 520 were that of males while 480 were females. Patients in the age range of 18-80 years were included in the study and they were divided into 6 groups as follows (Fig. 7):-

18-28 years- Group I

29-38 years- Group II

39-48 years- Group III

49-58 years- Group IV

59-68 years- Group V

69-80 years- Group VI

The Haller's Cells showed a prevalence of 29% (Fig. 8) and were predominantly seen in females (58.62%) as compared to males (41.37%) (Fig. 9). The cells showed more predilection towards younger age group in the age range of 18-28 years (44.82%) (Table 1)Amongst the six types of shapes observed, oval shape was most frequently observed (51.7%) and a significant association was observed between the sex and shape of cells with a p value=0.00

(Table 2). Unilateral pattern was more commonly seen (79.3%) in both the genders (28.1% in females and 18.3 % in males) as compared to bilateral pattern (20.6%) (7.3% in females and 4.8% in males) (Table 3). Out of the total number of prevalent Haller's cells (29%), 68.96% were single in number, while 31.03% were multiple in number (Table 4).

Chi square test was used to determine the association between the sex and pattern of cells and a strong association was seen between the two (p value=0.00).A significant association was also seen between the age and number of cells (p value=0.00). The association between the shape and number of cells was also found to be statistically significant (p value=0.00) (Table 5)

DISCUSSION:

Haller's cells are an anatomic variation of the paranasal sinus region. Several investigators have studied the prevalence of Haller's cells using panoramic radiography, computed tomography and CBCT. Kenedy and Zinreich reported a prevalence of 10% using coronal CT scan. [7] . The present study showed a prevalence of 29% which is much higher than that reported by Kenedy and Zinreich, and in the range of previous studies performed by Raina *et al* (22.9%), Solanki *et al* (19.2%) and Khayam et al (32.5%) using panoramic radiography. [4,5,6,8]

There is a very wide range of prevalence ranging from 4.7%-45.1%, which may be due to the differences in image acquisition protocol as well as the population studied, sample size and bias. Prevalence as high as 38.2% has been reported on OPGs. [6]

In the present study, cells were seen predominantly in female population with more predilection towards younger age group, which is in accordance with the study performed by Solanki *et al*. These findings were consistent with that of Ahmad M et al 40.3%in males and 30.77% in females. Among a total of 290 Haller's cells studied, 174 cells were present in the age range of 18-28 years. A case report by H.H. Wanamaker showed that even on CT scan the presence of Haller's cells can be missed due to a wide variability in image acquisition protocol. [9] Unilateral cells (79.3%) were commonly seen in the present study as compared to bilateral which is similar to the results obtained by Raina *et al.* [4] who observed unilateral pattern in 77.1% individuals. Oval shape was seen with highest prevalence of 51.7%, which was in accordance with Solanki *et al* who observed 41.4% of oval shaped Haller's cells. No significant correlation was seen between the sex and left and right side of the individual. Similar results were obtained by A Raina *et al* and Solanki *et al*.

Since Haller's cells are an anatomical variation, the need to confirm the findings with CT scan was not felt.

A delineation of Haller's cells on routine panoramic radiographs will provide the clinician with a differential diagnosis in patients suffering from intractable orofacial pain, persistent rhinosinusitis

and headache as the cells might get infected giving rise to patient's symptoms. Digital panoramic radiographs are a much more cost effective means of identifying these cells so as to rule out any symptoms associated with it and the heavy expenses endured by the patient for undergoing computed tomography can be avoided. Also the radiation dosage delivered to the patient is much lower as compared to CT scan.

CONCLUSION:

Though CT is the preferred modality for determining Haller's Cells, the results of the present study clearly show that digital panoramic radiography can depict the presence of these cells by providing a clear delineation of the margins and the prevalence (29%) lies within the range of previous CT studies (4.7%-45.1%). Thus it can be applied as a tool to determine the presence of Haller's cells at it is a cheaper method and the radiation dosage delivered is comparatively much lower as compared to CT scan. The recognition of this anatomical variation will not only provide a differential diagnosis in patients suffering from chronic orofacial pain, headache and recurrent rhinosinusitis but will also help avoid any untoward complication during endonasal procedures.

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TABLES:

Age Group	No. of subjects with Haller's cells	Percentage %
18-28 years	130	44.82
29-38 years	80	27.58
39-48 years	20	6.89
49-58 years	30	10.34
59-68 years	20	6.89
69- 80 years	10	3.44

Table 1. Distribution of Haller's Cells with respect to Age group

Shape of cell	No. of subjects with Haller's Cells (male)	No. of subjects with Haller's Cells (female)	Total No. of subjects with Haller's Cells	%	P value
Heart	10	20	30	10.34	
Oval	75	75	150	51.72	
Pyramidal	5	15	20	6.89	0.00
Round	5	15	20	6.89	
Teardrop	10	20	30	10.34	
Combination	15	25	40	13.79	

Table 2. Distribution of Haller's Cells with respect to shape in male and female population and association between sex and shape of cells

Sex	No. of subjects with unilateral pattern of Haller's Cells	Percentage %	No. of subjects with bilateral pattern of Haller's Cells	Percentage %	P value
Male	95	18.3	25	4.8	
Female	135	28.1	35	7.3	0.00
Total	230	23	60	6	

Table 3. Association between sex and pattern of Haller's Cells distribution

Total no. of Haller's Cells	No. of single cells	Percentage %	No. of multiple cells	Percentage %
290	200	68.96	90	31.03

Table 4. Prevalence of single and multiple cells in the study population

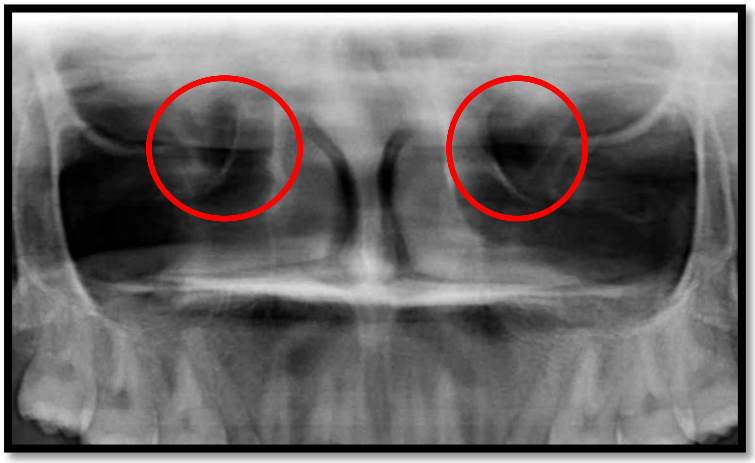
Shape	No. of single cells	Percentage %	No. of multiple cells	Percentage %	P-Value
Heart	20	10	10	5	0.00
Oval	130	65	15	7.5	
Pyramidal	10	5	10	5	
Round	15	7.5	05	2.5	
Tear drop	25	12.5	10	5	
Combination	0	0	40	20	
Total	200		90		

Table 5. Association between shape and number of cells

Study	No. of subjects	Prevalence%
Basic et al [2]	212	21.2
Earwaker et al [4]	800	20.00
Bolger et al [12]	202	45.1
Kayalioglu et al [7]	172	4.7
Kantarci et al [6]	512	18
Stackpole et al [14]	154	34.4
Milczuk et al [11]	114	5.3
Tonai et al. [16]	75	38.9
Tatli et al [15]	42	9.5
Wanamaker [5]	100	20.00

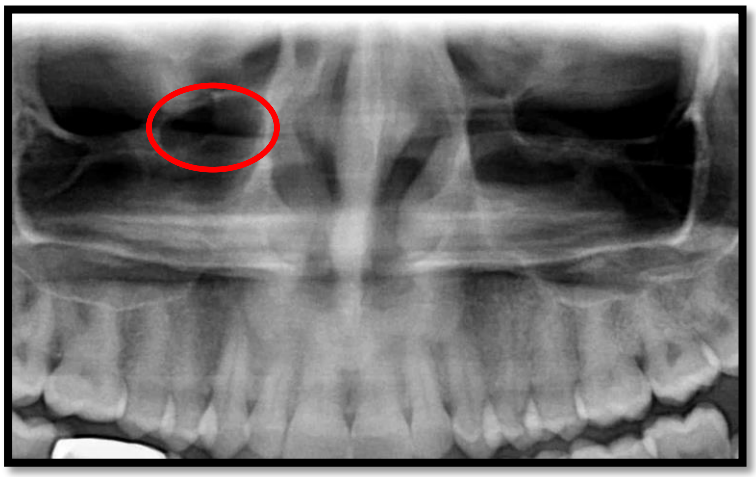
Table 6. Prevalence of Haller's Cells reported in Various CT studies (6)

FIGURES:



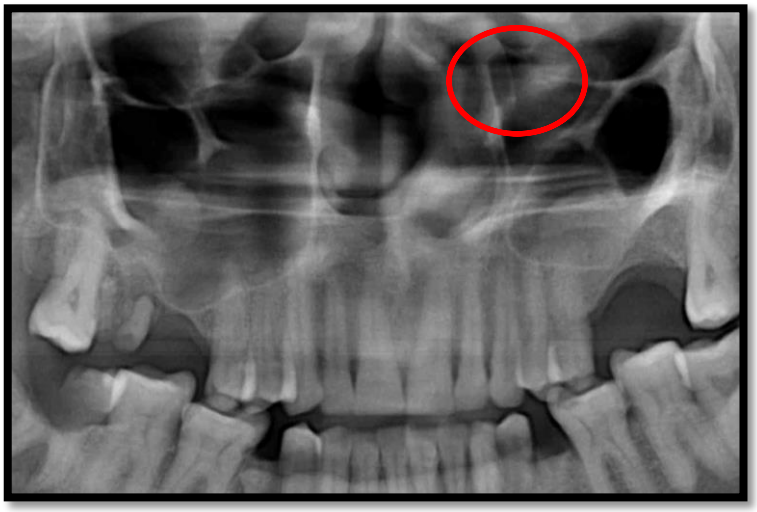
Bilateral Heart shaped Haller's Cells

Fig 1



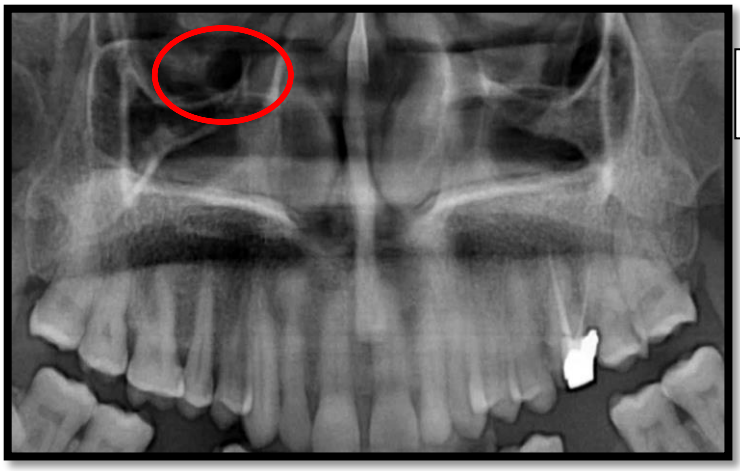
Oval Shaped Haller's Cells

Fig 2



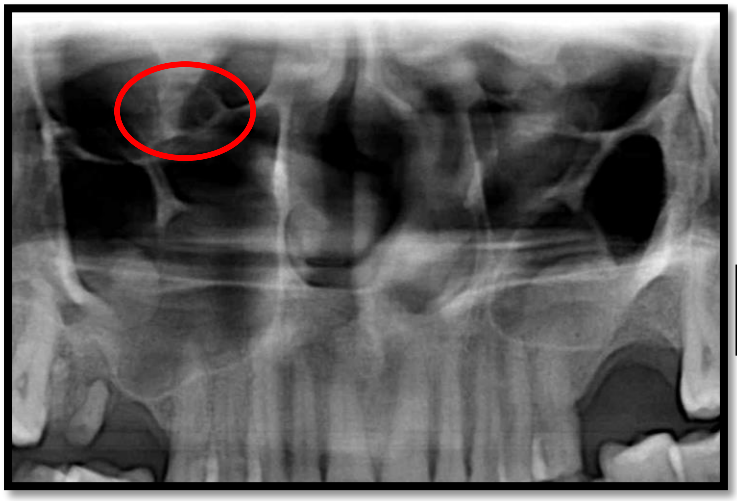
Pyramidal shaped Haller's Cell

Fig 3



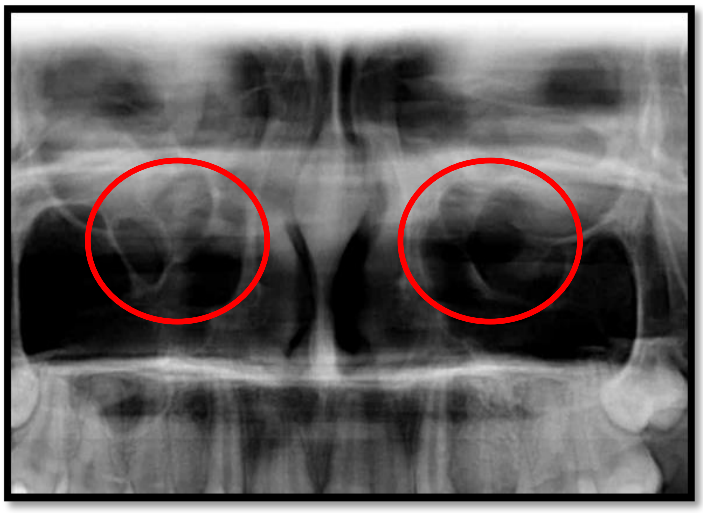
Round Shaped Haller's Cells

Fig 4



Tear Drop shaped Haller's Cell

Fig 5



Combination of heart and oval shaped Haller's Cells

Fig 6

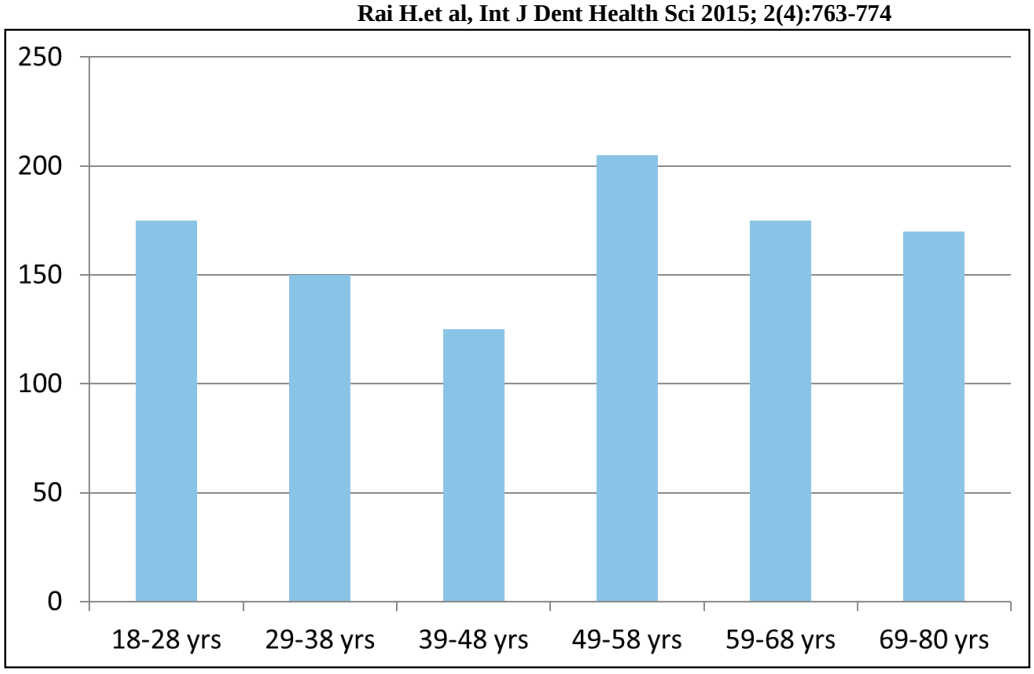


Fig. 7. Distribution of Study subjects with respect to age

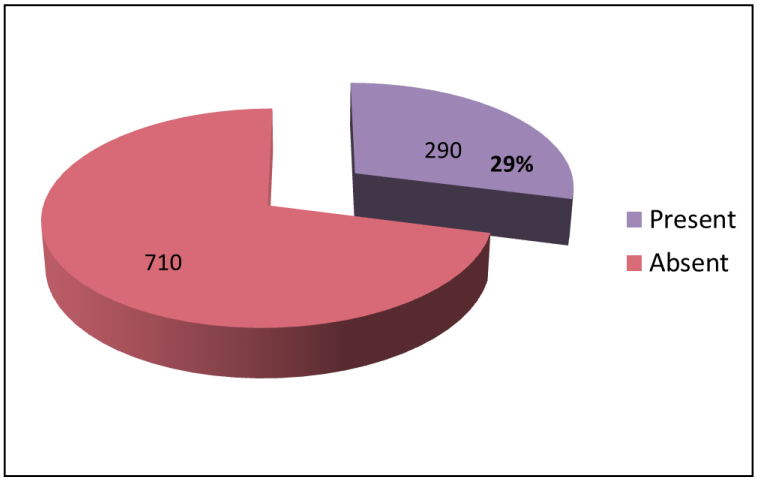


Fig 8. Prevalence of Haller's Cells in Belgavi Population

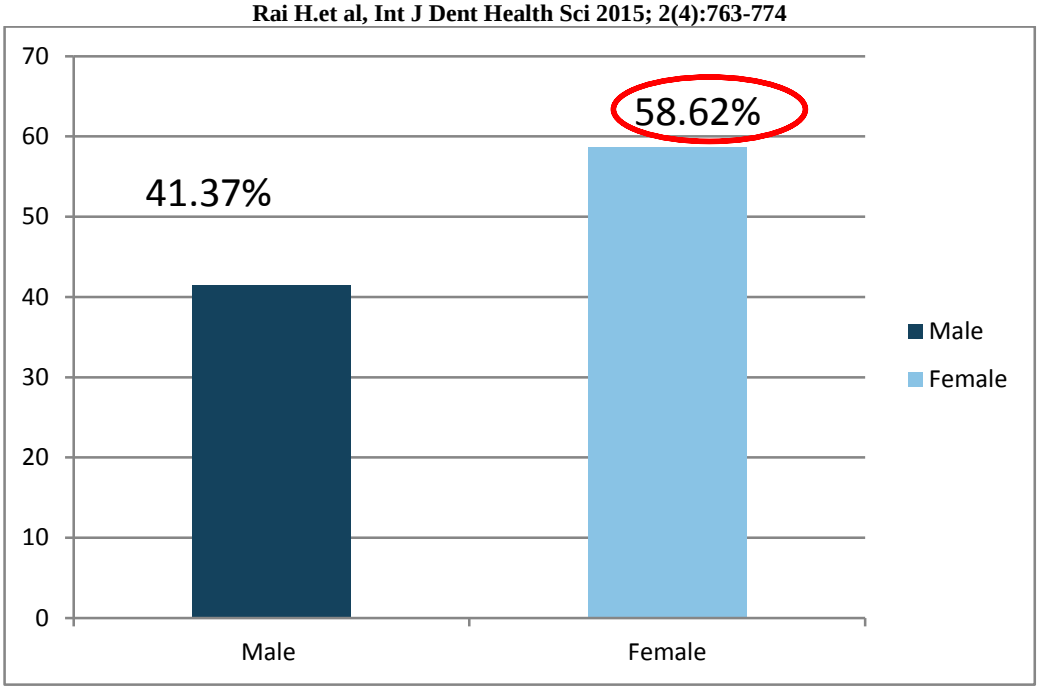


Fig 9. Prevalence of Haller's cells with respect to Gender