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Anterior Maxillary Wall and Lacrimal Duct Distance in a Single-Center Sample of Filipinos: CT Analysis for Prelacrimal Window Access to the Maxillary Sinus

ABSTRACT

Objective: To determine if the prelacrimal window approach is feasible in a Filipino population by measuring the distance between the anterior maxillary wall and lacrimal duct in paranasal sinus CT scans, classifying them into prelacrimal window approach levels of difficulty.

Methods:

Design: Retrospective Review of Records
Setting: Tertiary Private University Hospital
Participants: PNS CT scans of Filipino patients 18 years old or above

Results: A total of 169 PNS CT scans were reviewed, measuring the right and left sides for a total of 338 sides. The mean prelacrimal window distance for males was 5.70mm (± 1.79), while for females it was 4.94 (± 1.75), with a combined mean distance of 5.32mm. Ten percent (10%) of CT scans (34) were classified as Type 1; 73.7% (249) were classified as Type 2, and 16.3% (55) were classified as Type 3.

Conclusion: The prelacrimal window approach may be anatomically feasible in the Filipino population studied, with 90% of the PNS CT scan sides reviewed falling into the Type 2; and Type 3 categories, opening more potential avenues in the management of anterior maxillary lesions in the Philippines.

Keywords: *prelacrimal window; paranasal sinus; endoscopic sinus surgery; maxillary sinus; paranasal sinus neoplasms*



One of the more challenging cases in the sinus surgery is providing access for lesions found in the anterior maxillary wall or floor of the maxillary sinus. Maxillary antrostomy or medial maxillectomy can be used to expose the anterior wall using an endoscope, but the subsequent use of instruments is next to impossible. Some other techniques that can be used to access the anterior maxillary wall are open approaches such as the Caldwell–Luc, lateral rhinotomy or midfacial degloving approaches,¹ but these procedures are known to have more morbidities.²

The pre-lacrimal window approach first described by Zhou *et al.*^{3,4} is a seldom used technique in sinus surgery that provides good access for lesions in the anterior maxillary wall or floor of the maxillary sinus; where such pathologies are difficult to access endoscopically.⁵ The pre-lacrimal window approach (PLWA) can only be done when a pre-lacrimal recess is present. Simmen *et al.*⁶ proposed a system wherein the difficulty level corresponds with the distance between the anterior maxillary wall and lacrimal duct. According to their classification, for **Type I** (distance between 0 and 3 mm), a prelacrimal approach is only possible with tear sac dislocation and significant amount of bone removal, which allows only limited access to the anterior maxillary wall. **Type II** (distance of >3mm – 7mm), provides a larger window but still makes surgical access more demanding, **Type III** (distance of >7mm) is the ideal, with little to no bone needed to be removed, and exposure of the maxillary sinus achieved easily.

Our study aims to determine if the pre-lacrimal window approach is feasible for the access of anterior maxillary lesions in a sample of Filipinos by measuring the distance between the anterior maxillary wall and lacrimal duct in paranasal sinus CT scans, classifying our findings into prelacrimal window approach levels of difficulty.

METHODS

With University of Santo Tomas Hospital Research Ethics Committee approval (REC-2022-02-031-TR), this retrospective review of paranasal sinus (PNS) CT scans from 2015 to 2019 serially considered for inclusion PNS CT scans of adult Filipino patients 18 years old and above that had normal bony landmarks. Scans with changes in anatomy secondary to trauma, extensive underlying pathology, or previous surgery were excluded.

Paranasal Sinus CT scans were previously acquired using a GE Revolution™ Maxima 128-Slice Computed Tomography Machine (GE Hangwei Medical Systems, Co., Ltd., Beijing, China), and CT scan slices were 0.625mm for both axial and coronal cuts. Images stored as Digital Imaging and Communications in Medicine (DICOM) files were serially retrieved and viewed by the radiology Chief Resident using the

RadiAnt™ DICOM Viewer (Version 2024.1, Medixant, Poland) to screen for inclusion in our study.

A minimum of 100 CT scans was required to compare our findings with those of Lock *et al.*¹ and Simmen *et al.*⁶ Lock *et al.*¹ conducted their study in Singapore among Chinese and other East Asians, representing a typical Oriental population. In contrast, Simmen *et al.*⁶ performed their study in Switzerland among a predominantly Western population. These studies were selected because they applied a standardized classification system developed by Simmen *et al.*⁶, and our measurement protocols were adapted from their methodology.

The sample size of 100 CT scans was not determined using a statistical formula but was instead chosen as a benchmark for comparability with the studies of Lock *et al.* and Simmen *et al.*^{1,6} both of which analyzed 100 scans. By adopting this number, we aimed for methodological alignment and enabled direct comparisons across populations. During the retrospective review period (2015–2019), however, more CT scans met the inclusion and exclusion criteria. Rather than discarding valid data, we included all eligible scans, resulting in a total of 169 CT scans (338 sides). This approach preserved comparability while enhancing the precision of estimates and the statistical power of the study, thereby making the findings more robust and potentially representative of the larger Filipino population.

These measurements were obtained over a period of one week by the radiology chief resident. Measurements were taken at the level of the anterior insertion of the inferior turbinate into the frontal process of the maxilla, in the coronal plane. (*Figure 1*) After identifying the coronal plane, the subsequent axial plane of each selected image was measured by placing a parallel line at the anterior maxillary wall (line A), and another parallel line at anterior border of the lacrimal duct (line B), The distance between line A and line B corresponded to the prelacrimal window. (*Figure 2*)

Data Analysis

Data were collated and tabulated using Microsoft® Excel for Mac version 16.98 (Microsoft Corp., Redmond, WA, USA). Descriptive data were reported using means and standard deviations for continuous variables such as prelacrimal window distance and lacrimal duct width, and frequencies and percentages for categorical variables including classifications based on Simmen's criteria (Types 1, 2, and 3).⁶ To determine whether there were statistically significant differences between the right and left prelacrimal window measurements across both sexes, Mann-Whitney U tests were performed. A p-value < .05 was considered statistically significant.



Figure 1. Paranasal Sinus CT scan, coronal view, at the level of the attachment of the inferior turbinate into the frontal process of the maxilla (encircled)

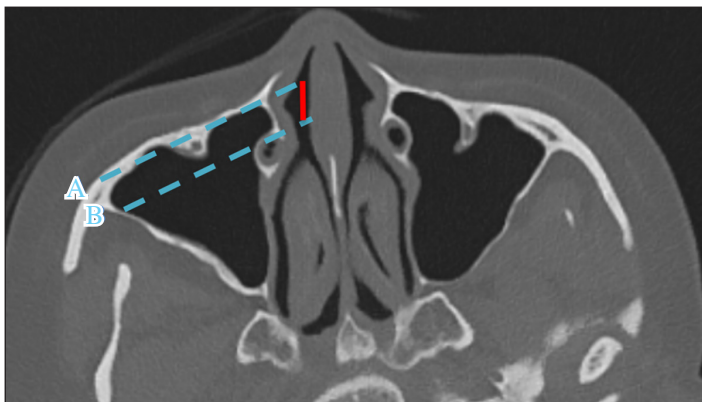


Figure 2. Paranasal Sinus CT scan, axial view. Line A corresponds to the anterior maxillary wall and Line B corresponds to the anterior border of the lacrimal duct. The solid vertical line corresponds to the prelacrima window.

Table 1. Classification of Prelacrima Window Distances Among the Sample of Filipino Patients

Sex	Type 1 (0–3mm)	Type 2 (>3–7mm)	Type 3 (>7mm)	Total	% Eligible (Types 2 & 3)
Male	9	134	41	184	95.1
Female	25	115	14	154	83.8
Total	34 (10%)	249 (73.7%)	55 (16.3%)	338	90.0

RESULTS

A total of 169 paranasal sinus CT scans of patients (92 males and 77 females) met inclusion and exclusion criteria and were included in our study, yielding a total of 338 sides analyzed. Among males, the mean of distance A or the prelacrima window was 5.70mm (± 1.79), while for females it was 4.94 (± 1.75), with a combined mean distance of 5.32mm. The lacrimal duct width for males on average was 8.03mm, while for

females it was 7.76mm, with a combined average of 7.9mm. The Mann–Whitney U test was performed to compare the right and left prelacrima window measurements. A two-sided *p* value of $< .05$ was considered statistically significant. There was no statistical difference between the right and left sides ($U = 2809, p = .575$). Therefore, data from both sides were combined for further analysis.

To assess for the feasibility of the prelacrima approach in our study population, the PNS CT scans were divided into three types according to the classification system proposed by Simmen *et al.*⁶ Patients whose PNS CT scans were classified into Type 1 (0–3mm) were not considered eligible for the prelacrima approach, while those classified into Type 2 (>3–7mm) were considered moderately eligible for the prelacrima approach, and those classified into Type 3 (> 7mm) were considered fully eligible for the prelacrima approach. Only 10% were classified as type 1, and 16.3% were classified as type 3, with the majority 73.7% classified as type 2.

For our purposes, those whose scans were classified into Type 2 (>3mm–7mm) and type 3 (>7mm) were considered potential candidates for the procedure. Thus, the majority of patients whose scans were included in the study were considered eligible for the procedure, with 90% being classified into Type 2 (moderately eligible) and Type 3 (fully eligible). In terms of sex, 95.1% of males (Type 2: 72.8%, Type 3: 22.3%) and 83.8% of females (Type 2: 74.7%, Type 3: 9.1%) in our sample were considered eligible for the prelacrima window approach. (Table 1)

DISCUSSION

This study aimed to determine the feasibility of the PLWA approach in a Filipino population by measuring the distance between the anterior maxillary wall and the lacrimal duct on PNS CT scans. Our findings showed that 90% of patients fell within the Type 2 and Type 3 categories of the Simmen *et al.* classification, suggesting that the majority of our patients were potential candidates for this procedure, although the 73.7% Type 2 majority would pose moderate difficulty with more demanding surgical access, while only the 16.3% with Type 3 classification were good candidates for straightforward PLWA.

Our results are similar to those of Lock *et al.*,¹ who reported that 93.5% of their patients (Chinese and East Asian Orientals) were classified as type 2 or 3, but differ from those of Simmen *et al.*⁶ who reported only 68.5% of their population (Westerners) fell in the type 2 and 3 category. Our studies are comparable as we used the same anatomical landmarks and classification criteria as the studies of Lock *et al.* and Simmen *et al.*^{1,6} Our findings may suggest that the anatomy of the Filipino population studied aligns more closely with that of East Asian populations.



The prevalence of Types 2 and 3 in both the Filipino and East Asian cohorts suggests that these populations may share similar anatomical dimensions that could reflect ethnically influenced morphologic patterns of the sinonasal anatomy. In contrast, the lower feasibility rate observed by Simmen *et al.*⁶ in a Western population may be due to structural differences between populations of different ethnic backgrounds. In East Asian populations, have broad midfacial dimensions that are associated with wider nasolacrimal ducts. Moreover, East Asian specimens more frequently demonstrate ethmoidal air cell extension into the lacrimal sac fossa which are less commonly observed in Caucasian populations.⁷⁻¹⁰

Our study has several limitations. First, the sample was derived through convenience sampling from a single tertiary center which limits generalizability to the broader Filipino population. Second, measurements were performed by a single radiology resident,

introducing potential observer bias. Third, although anatomical feasibility was demonstrated, we did not evaluate surgical outcomes in patients undergoing PLWA, which would provide stronger clinical relevance.

We recommend that future studies include multi-center datasets to enhance generalizability. Employing multiple, blinded radiologists for measurement could also improve reliability. Clinical correlation studies investigating outcomes, complications, and surgeon experience using PLWA among Filipino patients are also recommended.

In conclusion, our findings suggest that the prelacrima window approach may be anatomically feasible in a majority (90%) of the Filipino population studied. This opens more potential avenues for the broader application of this minimally invasive technique in managing anterior maxillary sinus lesions in the Philippines.

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