Review article

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Assessment of Most Definite Reference Point on Tragus to Mark the Ala Tragus Line for Orientation of Occlusal Plane: A Systematic Review and Meta Analysis

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ABSTRACT:

Objective: This systematic review and meta-analysis aimed to establish the most appropriate posterior reference point on the tragus of the ear for orienting the occlusal plane in complete denture prosthesis, addressing the existing confusion regarding this crucial anatomical landmark.

Methods: A comprehensive literature search identified 20 relevant articles, with 12 meeting the inclusion criteria as original clinical experimental studies. Statistical analysis was performed to assess the preferred location on the tragus for aligning with the Fox plane.

Results: Among the reviewed studies, 72.72% favored the inferior or lower border of the tragus as the optimal posterior reference point for aligning with the Fox plane. This choice was in contrast to the tip or middle point (18.18%) and the superior border (9.09%) of the tragus, which showed less tendency to parallel with the occlusal plane.

Conclusion: Based on the findings of this systematic review and meta-analysis, it is concluded that the inferior border of the tragus is the most definitive posterior reference point for establishing the Ala-Tragus line during complete denture prosthesis. This consensus can guide clinicians in achieving accurate occlusal plane orientation and enhance the quality of complete denture prostheses.

KEY WORDS: Ala tragus line; Complete denture; Occlusal plane; Reference point

INTRODUCTION

In prosthetic rehabilitation, esthetics, phonetics, mastication and comfort are very essential requirements to accomplish the full expectation level.[1] That's why the exact orientation of the artificial occlusal plane in the upper occlusal rim during jaw registration procedures play a significant role to achieve the ultimate goal.[2] Moreover, the establishment of the occlusal plane impact physiologic activities of the oral cavity and the appropriate height and width of the occlusal plane is fundamental requirement for the sufficient bucco-lingual exchange, control of food, speech, buccal soft tissue support, tongue space and esthetics.[3]

Furthermore, in case of complete denture prosthesis, the orientation of occlusal plane is one of the most essential clinical steps. As denture stability depends on the reconstruction of the occlusal plane, so it should be as similar as possible to occlusal plane of lost natural teeth.[4] It is also mandatory to precisely mark the occlusal plane to orient dental casts on the articulator during processing the clinical and laboratory procedures.[5]

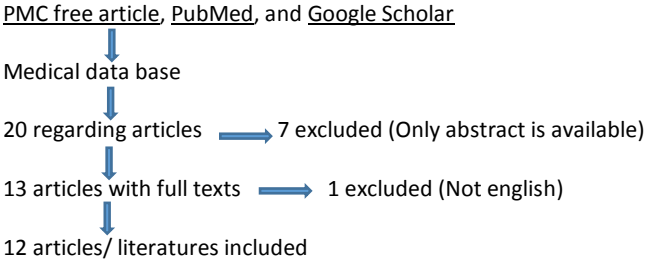
Though, several landmarks and methods have been used by dental practitioners and researchers for the orientation of occlusal plane and the ala tragus line is considered as mostly documented technique but there is many controversial opinions over whether to take the superior border, the tip/middle point, or the lower/inferior border of the tragus of the ear as posterior landmark to describe ala tragus line.[6]

In addition, morphologic features are varied among various ethnic groups.[7] Therefore, there is a question arisen that what's the definite and recommended location of the point on tragus and what's the scientific evidence for and against its recommendation.[8] With the several opinions of thoughts of different authors, this systematic review and meta analysis was undertaken to decide the most appropriate point on tragus to be used as posterior reference point of the ala-tragus line. This review is conducted on the basis of previous study results, conclusions and recommendations.

MATERIALS AND METHODS

A comprehensive searching strategy was applied to review the published literatures for assessment and evaluation the exact reference point of ala tragus line. Total 20 literatures were reviewed from which 12 articles were included to fulfill the objective of the review article. PMC free article, PubMed, and Google Scholar were searched to review published original articles regarding camper's line or ala tragus line (ATL) as a guide for OP orientation. Full texted articles in english language were considered as inclusion criteria for searching the literatures. The search dates for all databases were up to 26th November, 2020. Study parameters were categorized into three points on tragus of the ear such as superior border, tip or middle point and inferior border. Independently two reviewers reviewed the relevant studies using predetermined keywords. Then we developed the full article with all potentially relevant citations.

Flow chart of literature searching



RESULTS

The table 1 (Next page) illustrates the distribution of author's name, publication date, study design, type of study, methods of clinical evaluation and results/ conclusions/ recommendations of the published literatures regards appropriate position or location point on tragus of ala tragus line. Out of 12 studies, 8 studies illustrated that mean angle value between fox plane and inferior ala tragus line was the lowest and the line joining from ala of the nose to the lower border of the tragus was parallel to the occlusal plane, 2 studies also recommended that the line extending from the inferior border of the ala of the nose to the tip/middle point on tragus of the ear presented the closest relationship to the occlusal plane, 1 study stated that the superior border of the tragus was the posterior reference point for ala-tragus line and 1 study concluded that the ala-tragus line and the occlusal plane line were parallel for all practical purposes.

Table 2: Distribution frequency of reference point on tragus of the ala tragus line with the study number (n = 11)

Reference point on tragus of the ear	Study number (n)	Frequency (%)
Superior border of tragus of the ear	1	9.09%
Tip or middle point of tragus of the ear	2	18.18%
Inferior or lower border of tragus of the ear	8	72.72%

The table 2 reveals that most of the reviewed studies (72.72%) reported the inferior or lower border of tragus of the ear had most tendency to parallel with the fox plane compared to tip or middle point (18.18%) and superior border (9.09%) of tragus of the ear.

DISCUSSION

Occlusal plane is the mislaid feature in case of edentulous patients, so that establishment of occlusal plane with the help of ala-tragus line is being run-through during jaw registration for making a compete denture.[4] To make occlusal plane parallel to ala-tragus line is considered as a most useful approach of establishment of the occlusal plane. Literally ala-tragus line is a line starting from the inferior border of the ala of the nose to some defined point on the tragus of the ear and this line is assumed to be parallel to the occlusal plane.[5]

In this review study, the aim of study was to determine the most precise or definite point on tragus of the ear among the three points on tragus such as superior border, tip or middle point and inferior border. With the statistical analysis, the current study reveals that ATL extending from the inferior border of the ala of the nose to the inferior border of the tragus of the ear showed most parallelism to the prosthetic occlusal plane compared to tip or superior border of the tragus. This result is similar with the several previous published articles such as Hindocha et al. (2010), Ghosn et al. (2012), Gandhi et al. (2017), Chaturvedi and Thombare (2013), Nayar (2015), Kumar et al. (2013), Kusumadewi et al. (2019), Raza et al. (2020) and their studies illustrated that the inferior border or lower border marked on tragus of the ear was the most appropriate point of ala-tragus line for establishing orientation of the occlusal plane.[4, 5, 8-13]

Furthermore, Ghosn et al. (2014) and Rathee and Bhoria (2014) conducted another studies. In their study results, lowest mean angle was noted in between OP and tip/middle reference point on tragus of the ear of the ala tragus line and the middle point or tip of the ala tragus line of the ear had most tendency to be parallel to the occlusal plane.[6,7]

In contrast, Sadr and Sadr (2009) enrolled another clinical experimental study and illustrated that the superior border of ala-tragus line had the lowest mean angle (1.80°) and was almost parallel to the occlusal plane. According to their study results, the superior border of the tragus was considered as the posterior landmark for ala-tragus line.[15]

Although, there are variations with the different methods of orientation of occlusal plane but occlusal plane act as a significant part of the concept of balanced articulation.[9, 10] It is also evident from this review that ala tragus line is mostly considered as landmark for orientation of the missing occlusal plane during jaw registration in complete denture prosthesis and the parallelism of ala tragus line is beneficial in the establishment of occlusal plane for complete denture of edentulous patients.[14, 15]

CONCLUSION

With the systematic review and meta analysis, this review study reveals that mean angle value between fox plane and inferior border on tragus of ala tragus line was the lowest and the line running from ala of the nose to the inferior border of the tragus was mostly parallel to the occlusal plane. So, it is concluded that the inferior border of tragus of ala-tragus line can be considered as definite demarcation for orientation of occlusal plane.

Table 1: Distribution of studies regards the ala tragus line with the author's name, publication date, study design and results/ conclusions/ recommendations (n = 12)

Author's name	Publication date	Study design	Type of study	Method of clinical evaluation	Results, Conclusions and Recommendations
Hindocha et al	2010	Clinical experimental study	Original article	Lateral cephalometric radiographs	The mostly found tragal reference point for orientation of occlusal plane was obtained in below inferior in case of 30.48% of study subjects. That's why the establishment of the plane of occlusion according to the superior point of tragus of the ear as a posterior landmark (based on widely recommended definition of ala tragus line or camper's line) need to be further assessment or reviewed.
Ghosn et al	2012	Clinical experimental study	Original article	Lateral cephalometric radiographs	Angle 9.35 degrees in between OP and ATL-S, 5.00 degrees in between OP and ATL-M, 4.90 degrees in between OP and ATL-I. Significant difference was found among the three mean angles (p = 0.001). The results of their study concluded that ATL extending from the inferior border of the ala of the nose to the inferior border of the tragus represent the nearest relationship to the prosthetic occlusal plane.
Ghosn et al	2014	Clinical experimental study	Original article	Lateral cephalometric radiographs	The angle between occlusal plane and ala tragus line-superior was 6.12 degrees, angle between occlusal plane and ala tragus line- middle was 3.27 degrees, and angle between occlusal plane and ala tragus line- inferior was 4.67 degrees. This study concluded that ATL extending from the inferior border of the ala of the nose to the tip of the tragus of the ear represent the nearest relationship to the prosthetic occlusal plane.
Gandhi et al	2017	Clinical experimental study	Original study	Digital lateral cephalographs	Among 62% of study population, IFH had the nearest angular measurement to COP and ala tragus line passing through the inferior part of the tragus were the most parallel line to OP among punjab population. In 53% participants, the inferior point marked on tragus was the most appropriate point to mark the ala tragus line for establishing orientation of the occlusal plane.
Chaturvedi and Thombare	2013	Clinical experimental study	Original study	Lateral cephalographs	The mean angle of cant of occlusal plane as 9.76°, angle between IA plane and FH plane as 10.40° and 10.56° in dentulous and edentulous subjects respectively which were the nearest value to the angle of COO. The inferior point located on tragus of the ear was the most parallel to occlusal plane in edentulous subjects.
Woelfel et al	2014	Clinical experimental study	Original study	A vernier caliper was used to measure	The measured distance from ala tragus line to occlusal plane was 29.9 mm at the tragus and 31.3 mm near the ala. This study also concluded that the ala tragus line and the fox plane line were parallel for all practical purposes.
Nayar	2015	Clinical pilot study	Original study	Photographs tracing	In both male and female, the inferior border of the ala tragus line had the lowest mean value and almost parallel to the fox plane. There were mean angle values ATS 5.75 degrees, ATM 4.78 degrees and ATI 3.91 degrees. In this study, the inferior border of the tragus is suggested as the posterior reference for the ala tragus line.
Kumar et al	2013	Clinical experimental study	Original study	Photographs tracing	The line running from ala of the nose to the inferior border of the tragus was parallel to the fox plane among 53.3% of the subjects and the study also concluded that both sexes revealed the occlusal plane parallel to the line running from the ala to the inferior border of tragus of the ear.
Kusumadewi et al	2019	Clinical experimental study	Original article	Photographs tracing	In people with down syndrome, the mean angle value was 5.852° that was greater than that of normal individuals (mean angle value 2.169°). The study results also concluded that the parallelism of the ala-tragus line to the occlusal plane in people with down syndrome was different from that of normal individuals. In normal individuals, the lower border of tragus showed more tendency to parallel with the occlusal plane compared to that of people with down syndrome.
Raza et al	2020	Clinical experimental study	Original article	Digimizer Image Analysis software	The study results illustrate that on right side of the study subjects, mean angles value between FxP to three reference points ATs, ATm, ATi were 3.261°, 2.720° and 2.245° and on the left side, mean angle values were 2.347°, 2.558° and 2.029° respectively. Though, there was no parallelism (angle value zero) of FxP to ala tragus line but major findings indicate mean value between fox plane to inferior ala tragus line was the lowest.
Rathee and Bhoria	2014	Clinical experimental study	Original article	Digimizer Image Analysis software	In case of lateral view, exact parallelism was not obtained in among OP and with three posterior reference points of ala tragus line. The results also showed that lowest mean angle was noted in between OP and middle reference point of the ala tragus line and the middle point or tip of the tragus of the ear had mostly tendency to be parallel to the occlusal plane.
Sadr and Sadr	2009	Clinical experimental study	Original article	Photographs tracing	This study did not found parallelism between the occlusal plane and three different posterior points of ala tragus line and their study results showed that angles between them were significantly different from zero (P < 0.05). They also illustrated that the superior border of ala-tragus line had the lowest mean angle (1.80°) and was almost parallel to the occlusal plane. According to their study results, the superior border of the tragus is considered as the posterior landmark for ala-tragus line.

CONFLICT OF INTEREST: The authors declare no conflict of interest.

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