

# Big Five Personality Domains and their Impact on Problematic Mobile Phone Use among Medical Students in a Rural Tertiary Care Centre in Tamil Nadu India: A Cross-sectional Study

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## ABSTRACT

**Introduction:** The increasing usage of smartphones across the globe has resulted in considerable changes in people's daily lives, especially in terms of personality traits among adults. Research shows that the Big Five personality traits influence Problematic Mobile Phone Use (PMPU).

**Aim:** To estimate the prevalence of PMPU using the Mobile Phone Problem Use Scale (MPPUS-10) and to evaluate the personality predictors of PMPU using the Big Five Inventory (BFI) questionnaire.

**Materials and Methods:** A cross-sectional survey was conducted among 289 medical students at a rural tertiary care centre in Tamil Nadu, India from November 2021 to April 2022. The questionnaire consisted of three sections. The first section collected demographic characteristics, the second section included questions on the MPPUS-10, and the third section contained questions from the BFI questionnaire. Reliability analysis was conducted to assess the internal validity of the MPPUS-10 questionnaire. Exploratory factor analysis using principal component analysis with varimax rotation and Kaiser normalisation was performed to measure the structural

validity of the MPPUS-10 scale. A multiple linear regression model was applied to determine the relationship between PMPU and the personality domains.

**Results:** The prevalence of PMPU among medical students was found to be 106 (36.7%). Spearman's rank correlation revealed a negative correlation between agreeableness personality ( $r=-0.307$ ,  $p$ -value  $<0.001$ ) and conscientiousness personality ( $r=-0.369$ ,  $p$ -value  $<0.001$ ) with PMPU. Additionally, a positive correlation was observed between neurotic personality and PMPU ( $r=0.325$ ,  $p$ -value  $<0.001$ ). Multiple linear regression analysis demonstrated that agreeableness, conscientiousness, and neuroticism significantly predicted 44.4% of the scores on the PMPU ( $F=23.276$ ,  $p$ -value  $<0.001$  at the 1% level). Therefore, individuals with lower levels of agreeableness, conscientiousness, and higher levels of neuroticism scored higher on the MPPUS-10 scale.

**Conclusion:** The prevalence of PMPU among medical students was found to be high, requiring attention. Individuals with lower levels of agreeableness and conscientiousness, as well as higher levels of neuroticism, were more likely to exhibit PMPU.

**Keywords:** Addictive behaviour, Cell phone use, Personality inventory, Technology addiction

## INTRODUCTION

The smartphone's versatility has led to it being heralded as the "Smart Revolution" of the modern period, as it has become an indispensable information and communication tool in daily life [1]. According to the International Telecommunication Union indicator database, nearly 99% of Indians were expected to have access to a mobile cellular network with at least 3G, and nearly 98% were expected to have 4G by 2020 [2]. Mobile phones have been used for a range of purposes, including education, information dissemination, and the development and maintenance of social relationships. While cell phones have made many people's lives easier, they have also had a negative impact on their physical, mental, and interpersonal well-being [3].

Excessive smartphone use that is accompanied by functional impairments in daily life and symptoms comparable to those seen in substance abuse disorders is referred to as "PMPU" [4]. One to fifteen percent of young people and adolescents are said to have problematic mobile phones, spanning a broad range [5]. Researchers have investigated why some adults are far more likely than others to become addicted to cell phones, given the growing popularity of smartphones in society [5]. When looking at PMPU,

it is critical to focus on teenagers and young adults. At this point in their lives, people are more likely to take risks. People in their late teens and early twenties have been found to be more likely to engage in harmful and dangerous behaviours [5]. The source of these concerns is unknown, but it may be due to the user's lack of self-control or their disregard for societal norms [6].

Although no clear diagnostic markers exist, there have been reports of parallels between PMPU and other addictive behaviours, such as smoking, drug and alcohol abuse, internet addiction, and compulsive gambling [7,8]. Extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience are the five major factors for measuring human personality [9], and they can be easily assessed using the BFI [10]. PMPU was linked to the neuroticism and openness-to-experience characteristics of the BFI, according to a study conducted in Poland in 2021 [11]. Similarly, a Japanese study discovered that PMPU was linked to extraversion, neuroticism, and openness to new experiences in BFI types [8]. However, there are only a very few research studies that have looked at these connections [8,11]. With this background, this study aimed to estimate the prevalence of PMPU using the MPPUS-10 scale and to find the personality predictors of PMPU.

## MATERIALS AND METHODS

A cross-sectional study was conducted from November 2021 to April 2022 among medical students studying at a tertiary care centre in Perambalur, Tamil Nadu, India. Ethical clearance for this study was obtained from the Institutional Ethics Committee on Human Subjects (Approval No: IECHS/IRCHS/No: B.138).

**Inclusion criteria:** All medical students undergoing MBBS courses, from the first year to internship, were eligible to participate in the study. Students who owned a mobile phone or used a mobile phone for atleast one hour per day were included in the study.

**Exclusion criteria:** Students who were not available even after three visits were excluded from the study.

**Sample size determination:** The estimated sample size was calculated based on the prevalence of PMPU reported in a systematic review by Sahu M et al., ( $p=6.3\%$ ) with an absolute error (d) of 3% and a 95% Confidence Interval (CI) [12]. The estimated minimum sample size was 252, and a total of 289 students participated in the study.

**Data collection tools:** Data was collected using a semistructured questionnaire administered through one-on-one interviews by the principal investigator. The questionnaire consisted of three sections. The first section collected demographic characteristics, the second section included questions on the MPPUS-10 scale, and the third section comprised questions from the BFI questionnaire. The BFI provides a quick, adaptable, and simple assessment of the five fundamental dimensions of human personality: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness [10]. The BFI questionnaire consisted of 44 items (BFI-44) and used a 5-point Likert scale, with 1 being "strongly disagree" and 5 being "strongly agree," to measure extraversion (8 items), agreeableness (9 items), conscientiousness (9 items), neuroticism (8 items), and openness to experience (10 items). To score the BFI, reverse coding of negatively keyed items in the scale is necessary. The process involves subtraction of the obtained score from 6 for all the negatively keyed items. To calculate scale scores, the items corresponding to each Big Five domain are summed up. The process is outlined below, with reverse-scored items represented by R:

Extraversion: 1, 6R, 11, 16, 21R, 26, 31R, 36

Agreeableness: 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42

Conscientiousness: 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R

Neuroticism: 4, 9R, 14, 19, 24R, 29, 34R, 39

Openness: 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

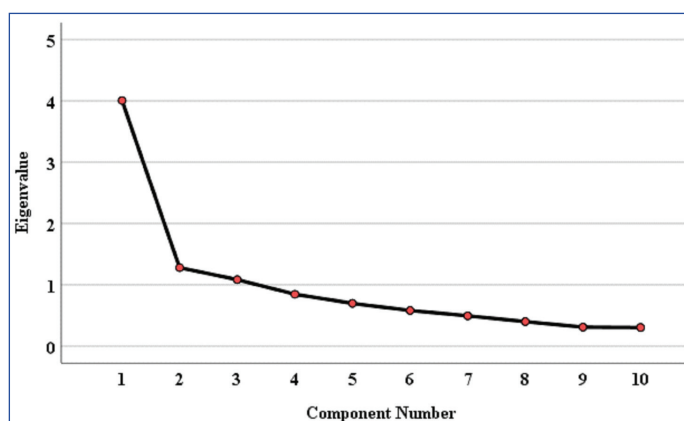
The prevalence of mobile phone addiction using the MPPUS-10 scale was measured. Foerster and colleagues created a shorter version (MPPUS-10) [1,13] that was quite comparable to the original MPPUS-27. The MPPUS-27, comprising 27 items, was initially created for use with adults before being endorsed and validated for use with people of all ages [13-15]. It consisted of only 10 short, easy-to-understand components. The maximum score on the MPPUS-10 scale was 100, with each of its 10 items scoring 10 points. The literature is ambiguous regarding which cut-off score should be used to identify PMPU, although Nahas M et al., proposed that a cut-off score of 59 should be used to identify PMPU for the short version of the measure [1].

## STATISTICAL ANALYSIS

The internal validity of using the MPPUS-10 questionnaire in the present study was explored using reliability analysis by removing any of the items (questions) to obtain Cronbach's  $\alpha$ -value using Statistical Package for Social Sciences (SPSS) version 21.0. In this case, a Cronbach's  $\alpha$ -value of over 0.8 indicated good consistency in internal validity. To measure the structural validity of the MPPUS-10 scale, principal component analysis in conjunction with varimax

rotation and Kaiser normalisation was performed in SPSS. The Bartlett's test of sphericity was used to determine whether the results of factor analysis were worth considering and analysing. Through the rotated component matrix (principal component analysis), the MPPUS-10 scale was divided into three components: dependence, negative life consequences, craving, and peer acceptance. The sampling adequacy of this study was assessed using an index called the Kaiser-Meyer-Olkin (KMO) measure. A value above 0.5 can be considered acceptable and indicates that the data has adequate factorability.

A scree plot was used to identify the key components of the MPPUS-10 scale, which provides the Eigen value. If the value of any item or component was greater than one, then that item was considered an essential component of the scale. The scree plot shows the components on the X-axis and the corresponding Eigen values on the Y-axis [Table/Fig-1]. A multiple linear regression model was applied to determine whether there was a relationship between PMPU and the personality domains. The R-squared value obtained from the above model indicates the strength of the relationship. The goodness-of-fit of the independent variables was explained using an adjusted R-squared value. The Durbin-Watson statistic was used to assess the need for autocorrection.



[Table/Fig-1]: Scree plot illustrating eigen values of the MPPUS-10 items.

## RESULTS

**Socio-demographic characteristics:** The mean age of the medical students was  $20.92 \pm 1.686$  years, ranging from 18 to 25 years. Among the subjects, 140 (48.4%) students were male, and the remaining 149 (51.6%) students were female.

**Problematic Mobile Phone Use (PMPU):** The mean total score of PMPU was  $52.01 \pm 16.235$ . Using the recommended cut-off of 59, 106 participants (36.7%) fell into the category of PMPU.

**Internal validity and factor analysis of MPPUS 10 scale:** The Cronbach's alpha score of the MPPUS 10 scale was 0.822, indicating good consistency. Therefore, the questionnaire was reliable for data collection. [Table/Fig-2] displays the mean for each item and the Cronbach's alpha values of each individual item. All Cronbach's  $\alpha$ -values were equally good, ranging from 0.792 to 0.832.

The exploratory factor analysis was considered to be the most appropriate extraction method, combined with the rotation method, as the correlations between the components resulting from this analysis in the component transformation matrix were all greater than 0.5. The extraction value for question number 4 was 0.443, and it did not fit with any of the three components, so it was not included in the table. The output of the rotated component matrix is shown below in [Table/Fig-3].

The Bartlett's test of sphericity showed a highly significant chi-square value of 948.755 with a degree of freedom of 45 and a p-value of  $<0.001$ , indicating that the results of factor analysis were worth considering in this research work. Through the rotated component matrix (exploratory factor analysis), the MPPUS-10 scale was divided into three components.

Q. No.	Questions	Mean±Standard deviation	Cronbach's Alpha if item deleted
1	I have used my mobile phone to make myself feel better when I was feeling down.	7.09±2.325	0.827
2	When out of range for some time, I become preoccupied with the thought of missing a call.	4.76±2.677	0.807
3	If I don't have a mobile phone, my friends would find it hard to get in touch with me.	5.93±2.899	0.832
4	I feel anxious if I have not checked for messages or switched on my mobile phone for some time.	5.08±2.681	0.798
5	My friends and family complain about my use of the mobile phone.	5.66±2.626	0.800
6	I find myself engaged on the mobile phone for longer periods of time than intended.	6.29±2.501	0.796
7	I am often late for appointments because I'm engaged on the mobile phone when I shouldn't be.	3.90±2.632	0.797
8	I find it difficult to switch off my mobile phone.	4.70±2.721	0.792
9	I have been told that I spend too much time on my mobile phone.	5.49±2.540	0.792
10	I have received mobile phone bills I could not afford to pay.	3.12±2.569	0.809

**[Table/Fig-2]:** Mean score and SD for each question of the MPPUS-10 questionnaire (Cronbach's Alpha=0.822).

Q. No.	Questions	Rotated component matrix		
		Dependence	Negative life consequences	Craving and peer acceptance
9	I have been told that I spend too much time on my mobile phone.	0.842		
5	My friends and family complain about my use of the mobile phone.	0.819		
6	I find myself engaged on the mobile phone for longer periods of time than intended.	0.796		
10	I have received mobile phone bills I could not afford to pay.		0.837	
7	I am often late for appointments because I'm engaged on the mobile phone when I shouldn't be.		0.807	
2	When out of range for some time, I become preoccupied with the thought of missing a call.		0.611	
8	I find it difficult to switch off my mobile phone.		0.563	
1	I have used my mobile phone to make myself feel better when I was feeling down.			0.711
3	If I don't have a mobile phone, my friends would find it hard to get in touch with me.			0.683
4	I feel anxious if I have not checked for messages or switched on my mobile phone for some time.			-

**[Table/Fig-3]:** Exploratory factor analysis of the MPPUS-10 (N=289).

The first component consisted of three items (Questions 5, 6, and 9) and accounted for 40.05% of the variance. This factor was labeled "dependency" as these questions reflected the extent of mobile phone usage from the respondent's perspective.

The second component consisted of four items (Questions 2, 7, 8, and 10) and accounted for 12.79% of the variance. This factor was labeled "negative life consequences" as the answers to these questions demonstrated the impact of chronic mobile phone use on meeting commitments, the cost of bill payment, and the respondent's status when their mobile phone was unavailable or switched off.

The third component consisted of two items (Questions 1 and 3) and accounted for 10.84% of the variance. This factor was labeled "craving and peer acceptance" as these questions reflected the desire to use a mobile phone and the importance of peer bonding.

The KMO test value was 0.828, which was above 0.5, indicating that the data had adequate factorability. According to the Eigen values derived from the scree plot, the three components of the MPPUS-10 scale had values of 4.005, 1.279, and 1.084, which were above one. These three components accounted for 63.68% of the total variance in the current study.

**Association of PMPU with independent variables:** The independent t-test revealed no statistically significant association between age and PMPU (p-value=0.276). The prevalence of PMPU among medical students was higher among 64 (45.7%) males compared to 42 (28.2%) females, and the difference between these two proportions was statistically significant (p-value=0.002). The prevalence of PMPU among medical students was higher among third-year students (44.9%) compared to students in other years, and the difference between these proportions was not statistically significant (p-value=0.473) [Table/Fig-4].

**Big five personality domains:** According to the results obtained through the Big-BFI, the mean and standard deviation of each personality domain for the study participants are as follows: extraversion

Variables	Outcome	Total score of MPPUS 10 scale		p-value
		<59	≥59	
Age in years	Mean±SD	20.84±1.665	21.07±1.720	0.276*
Gender	Male	76 (54.3%)	64 (45.7%)	0.002†
	Female	107 (71.8%)	42 (28.2%)	
Year of study in MBBS	First year	51 (68%)	24 (32)	0.473†
	Second year	40 (64.5%)	22 (35.5%)	
	Third Year	38 (55.1%)	31 (44.9%)	
	Final year	14 (58.3%)	10 (41.7%)	
	Internship	40 (67.8%)	19 (32.2%)	

**[Table/Fig-4]:** Inferential statistics describing the association between Problematic Mobile Phone Use (PMPU) and basic characteristics of the study participants.

\*Independent t-test was applied; †Chi-square test was applied

(24.43±1.907), agreeableness (32.03±16.235), conscientiousness (28.73±4.335), neuroticism (23.59±5.270), and openness to experience (33.34±4.142) [Table/Fig-5].

Big-five personality	Score of each personality domain of the entire study population			Problematic Mobile Phone Use (PMPU) vs big-five personality model	
	Mean±SD	Minimum value	Maximum value	Spearman's rho	p-value
Extraversion	24.43±1.907	12	39	-0.054	0.361
Agreeableness	32.03±16.235	18	45	-0.307	<0.001*
Conscientiousness	28.73±4.335	13	42	-0.369	<0.001*
Neuroticism	23.59±5.270	10	40	0.325	<0.001*
Openness	33.34±4.142	18	46	0.076	0.199

**[Table/Fig-5]:** Spearman's Correlation between Problematic Mobile Phone Use (PMPU) and big-five personality model.

\*Correlation is significant at the 0.001 level (2-tailed)

**PMPU and big five personality domains:** Spearman's rank correlation revealed a negative correlation between agreeableness personality (r=-0.307, p-value=<0.001) and conscientiousness



personality ( $r=-0.369$ ,  $p\text{-value}<0.001$ ) with PMPU. There was a positive correlation between neuroticism personality and PMPU ( $r=0.325$ ,  $p\text{-value}<0.001$ ). These results indicate that higher PMPU is associated with lower levels of agreeableness and conscientiousness, and higher levels of neuroticism [Table/Fig-5].

**Regression analysis:** The multiple linear regression model showed an R-value of 0.444, an R square value of 0.197, and an adjusted R square value of 0.188 (indicating a good fit). This means that the variation in the three personality domains accounts for 20% of the variation in PMPU. The Durbin-Watson statistic was 1.869, indicating no autocorrection. The multiple linear regression analysis revealed that agreeableness, conscientiousness, and neuroticism personality domains could significantly predict 44.4% of the scores on the PMPU ( $F=23.276$ ,  $p\text{-value}<0.001$ , at the 1% level). Therefore, individuals with lower levels of agreeableness and conscientiousness, and higher levels of neuroticism are more likely to score higher on the MPPUS-10 scale [Table/Fig-6].

Big-five personality domain	Standardised co-efficient beta	t-value	p-value
Agreeableness	-0.156	-2.644	0.009
Conscientiousness	-0.238	-3.599	<0.001
Neuroticism	0.211	3.657	<0.001

**[Table/Fig-6]:** Linear Regression analysis describing the predictors of Problematic Mobile Phone Use (PMPU) measured by big-five personality domain.

## DISCUSSION

The present study aimed to estimate the prevalence of PMPU using the MPPUS-10 questionnaire and identify personality predictors of mobile phone problematic use using the BFI questionnaire. The findings showed that individuals with less agreeable personalities, less conscientious personalities, and more neurotic personalities were more likely to have PMPU. In terms of gender distribution among the medical students, the present study found an equal distribution between males and females. However, a study by Mangot A et al., conducted among 93 medical interns in Maharashtra found that about 63% of the participants were females [16]. On the other hand, a study conducted in the same state in 2019 reported an almost equal gender distribution among medical students [17]. Another study by Peterka-Bonetta J et al., conducted in the United States found that males had a higher level of smartphone addiction compared to females, with statistical significance ( $p\text{-value}<0.001$ ) using the Smartphone Addiction Inventory scale (SPAI) [18]. The present study also found a higher prevalence of PMPU among males compared to females, and this difference in proportion was statistically significant ( $p=0.002$ ), indicating the need for further exploration of this concept in the future.

The present study reported a prevalence of 36.7% for PMPU among medical students. A similar finding was reported by Mangot A et al., in Maharashtra among 93 medical interns, where approximately 40% of them had PMPU using the Smartphone Addiction Scale-Short Version (SAS-SV) [16]. Another study conducted among 195 medical students in Maharashtra in 2019 showed a higher prevalence of smartphone addiction (46.15%) using the SAS-SV [17]. The heterogeneity in PMPU prevalence could be attributed to the use of different measurement scales or variations in mobile phone usage patterns. It has been suggested in the literature that internet use for activities such as gambling, chatting, gaming, and pornography may directly contribute to PMPU [19]. Smartphones are believed to make work, education, and leisure activities more convenient.

The present study ensured the reliability of the MPPUS-10 scale, as evidenced by a Cronbach's alpha score of 0.822. This finding was consistent with a study by Takao M in Japan, which reported a Cronbach's alpha value of 0.90 for the MPPUS-10 scale, indicating good consistency [8]. Another study by Mach A et al., in Poland

also assessed the reliability of the MPPUS-10 scale and found a statistically significant correlation between the MPPUS-10 scale and the Mobile Phone Addiction Assessment Questionnaire in their own language. The Cronbach's alpha value in this study was 0.78, further confirming the reliability of the MPPUS-10 scale [15]. A study conducted in Tehran also demonstrated good internal consistency of the MPPUS-10 scale, with a Cronbach's alpha value of 0.91 [20]. Although there is limited research on the reliability of the MPPUS-10 scale in India, the findings of the present study support the existing evidence, suggesting that the scale is reliable for measuring PMPU among students, but further research is needed.

The analysis in the present study indicated that individuals with a less agreeable personality, a less conscientious personality, and a higher neurotic personality were more likely to exhibit higher levels of PMPU as measured by the MPPUS-10 scale. These personality traits are commonly associated with PMPU. The root characteristics of neuroticism often manifest as a strong superego, a sense of rejection, or social anxiety [21]. It has been proposed that individuals with high scores on neuroticism may prefer online communication over offline communication due to social insecurity [22]. The use of problematic mobile phones as a means of escaping social discomfort may explain this finding [23]. Similarly, virtual communication may facilitate simpler interpersonal interactions by lessening the impact of a repressive superego. The present study found a negative and significant relationship between conscientiousness and PMPU. This finding can be explained by the characteristics typically associated with individuals with low conscientiousness, such as low prioritisation of duties and obligations, lack of planning ability, low self-control, susceptibility to temptations, and procrastination. It is worth noting that low conscientiousness was not considered relevant in Billieux's framework [24], as this relationship has only recently been noted in the literature and may be influenced by the increasing "addictiveness" of cell phones due to the availability of freemium games and social media.

On the other hand, agreeableness was found to be a protective factor against developing behavioural addictions such as PMPU. Individuals with high scores in agreeableness are more likely to use problem-focused and socially supportive coping strategies when dealing with daily stressors, and they may be less inclined to use technology, such as smartphones, as an avoidance strategy [25]. This suggests that agreeableness plays a role in avoiding interpersonal conflicts, which may contribute to lower levels of PMPU.

Previous studies have also demonstrated the interrelationship between the "Big Five" personality traits and behavioural addictions. Agreeableness and conscientiousness were found to be negatively correlated with Internet addiction, while neuroticism was positively associated with it [23]. Similarly, neuroticism was positively associated with Internet addiction, while openness to new experiences, conscientiousness, agreeableness, and extraversion were negatively associated with it [19]. The association between neuroticism, lower agreeableness, and Internet addiction has been established in other studies as well [26]. Marengo D et al., also reported associations between conscientiousness, agreeableness, and neuroticism with problematic smartphone use [25].

Consistent with the present study, a study conducted in Poland by Demkow-Jania M et al., found that PMPU was associated with neuroticism and openness-to-experience personalities [11]. Another study conducted in Japan by Takao M found that PMPU was associated with extraversion, neuroticism, and openness-to-experience personalities [8]. These findings highlight the association between the "Big Five" personality traits and PMPU among students, which can aid in the identification of individuals at risk for PMPU.

## Limitation(s)

This study, like other cross-sectional studies, has inherent drawbacks. The lack of a temporal association between personality development

and smartphone addiction is a limitation. Longitudinal studies are needed to investigate these relationships over time, using different personality scales. Additionally, the external validity of the study may be impacted by the reliance on self-reported measures, which are susceptible to social desirability biases and diverse interpretations of item content.

Despite these limitations, the study demonstrates that the MPPUS-10 scale is a reliable tool for measuring PMPU among students. This provides valuable information for early identification of individuals at risk for PMPU, supporting secondary prevention efforts.

## CONCLUSION(S)

The prevalence of PMPU among medical students was found to be high, indicating the need for attention and intervention. Two personality domains, namely agreeableness and conscientiousness, showed a significant negative correlation with MPPUS-10 scale scores, while the neuroticism domain showed a significant positive correlation. It is important to note that this study only focused on medical students. To obtain more generalisable results, future investigations should include larger samples from multiple centres and involve students of different ages. Additionally, it would be beneficial to explore the specific mobile phone activities that individuals engage in, such as social networking, messaging, emails, internet surfing, and gaming. By analysing these activities separately, predictive analytics can be computed for each type of activity, providing a more nuanced understanding of problematic mobile phone use.

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### PLAGIARISM CHECKING METHODS: [Jan H et al.]

- Plagiarism X-checker: Jun 05, 2023
- Manual Googling: Aug 25, 2023
- iThenticate Software: Sep 20, 2023 (11%)

### ETYMOLOGY: Author Origin

### EMENDATIONS: 7

### AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jun 05, 2023**

Date of Peer Review: **Aug 09, 2023**

Date of Acceptance: **Sep 23, 2023**

Date of Publishing: **Nov 01, 2023**