

Graying severity score: A useful tool for evaluation of premature canities

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ABSTRACT

Background: There is no uniform grading scale for objective assessment of premature canities that can serve as a reference. The aim of the study was to devise an objective and reproducible scoring system to assess the severity of premature canities. **Materials and Methods:** A cross-sectional study conducted from November 2011 to April 2013 in a tertiary care setup with 52 apparently healthy individuals with onset of premature graying of scalp hair before the age of 20 years. A new scoring system (Graying Severity Score, GSS) was devised to evaluate the extent of graying taking into account five representative sites from the scalp by two independent investigators and analysed for agreement. GSS ranged from 0 to 15 that was further graded as mild, moderate, and severe. **Results:** The highest total GSS attained was 13 and lowest was 4 (mean = 6.6 ± 1.97). Of the 52 patients 17 (32.69%) had mild, 32 (61.54%) moderate, and only 3 (5.77%) had severe GSS. Scores of both investigators were found to have good agreement. The intraclass correlation calculated by the two-way mixed model using the absolute agreement definition for the GSS was 0.967 (CI = 0.944–0.981; $P = 0.000$) and for GSS grade was 0.962 ($P = 0.000$). In the study subjects the frontal and the vertex regions were found to be the worst affected. **Conclusion:** GSS is a novel, numeric, objective, and reproducible tool for evaluation of premature canities that can be used to follow up and assess therapeutic response. Further large scale studies are recommended to optimize its utility.

Key words: Graying severity score, premature canities, scoring system

INTRODUCTION

Hair graying scientifically termed as canities, is a physiological phenomenon that occurs with chronological aging, regardless of the gender or race. When graying begins before the usual age of onset, it is termed as premature graying of hair or premature canities. It is a poorly understood entity, be it the pathogenesis, clinical profile, or the assessment of extent/severity or treatment. Premature graying has been defined as the onset of graying of hair before the age of 20 years in Caucasians and before the age of 30 years in Africans.^[1,2] There are no studies published so far that define premature graying in the Asian population.

To the best of our knowledge, there exists no standardized and objective means of assessing the severity of graying of hair. Here we propose Graying Severity Score (GSS) as a novel, numeric, objective, and reproducible method for assessment of the severity of premature canities.

MATERIALS AND METHODS

This cross-sectional study was carried out in a tertiary care setup. Although premature graying has not been defined for the Asian race, for the purpose of the study we recruited 52 consecutive patients with complaints of onset of graying of hair before 20 years of age. Patients with known systemic disorders such as liver or renal impairment were excluded on the basis of history and baseline biochemical and hematologic tests and so were patients with a history of cigarette smoking or medications including multivitamin

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supplements. Also subjects with conditions known to cause premature graying such as progeria, Rothmund–Thomson syndrome, Werner’s syndrome, and so on were also excluded. The study was approved by institutional ethics committee and a written informed consent was taken from all the study subjects.

The entire scalp surface was divided in 5 zones, that is, frontal region, vertex, right and left temporal regions, and the occipital, as represented in Figure 1. In each of these zones, areas showing maximum graying were identified on visual examination. A 1 cm² area was marked with a skin marker and the hair within this square was cropped to approximately 1 mm above the scalp surface. These five squares were then photographed and projected on the computer screen to count the numbers of white and black hair. The recorded images of two subjects are shown in [Figure 2a and c] with their magnified images on left [Figure 2b and d], respectively.

Based on the hair count, a score was assigned to each zone according to the percentage of gray hair in each square. This was calculated and scored as: Score 1 (assigned to under 10% gray hair/cm²); Score 2 (10%–30% gray hair/cm²); and Score 3 (more than 30% grey hair/cm²)

The GSS was finally calculated for each patient by taking a sum of the scores at the five representative sites. Thus the maximum attainable score for a patient was 15 (3 × 5).

The objective scores were further graded as Mild (a score of 0–5); Moderate (score of 6–10); and Severe (score of 11–15).

The assessment was undertaken by two investigators who were consultant dermatologists, authors AS and CG independently. The intraclass correlation was calculated by the two-way mixed model using the absolute agreement definition with the help of SPSS v. 17

The score assigned to different subjects has been represented in Figure 3. Validation of the scoring system could not be done due to lack of any standardized scoring systems.

RESULT

The highest total GSS attained was 13, whereas the lowest was 4, (mean value of GSS = 6.6 ± 1.97). As represented in Figure 3, 17/52 (32.69%) cases had a mild GSS, 32/52 (61.54%) had moderate GSS, and only 3/52 (5.77%) had severe GSS. The scores calculated by both the investigators were found to be in good agreement. The intraclass correlation calculated by the two-way mixed model using the absolute agreement definition for the GSS was 0.967 (CI = 0.944–0.981; *P* = 0.000) and for GSS grade was 0.962 (*P* = 0.000); suggesting a good reproducibility of the devised scoring system.

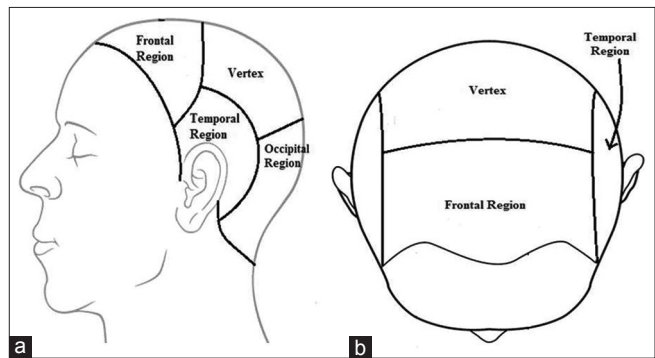


Figure 1: The 5 representative zones of scalp (a) side profile (b) top view

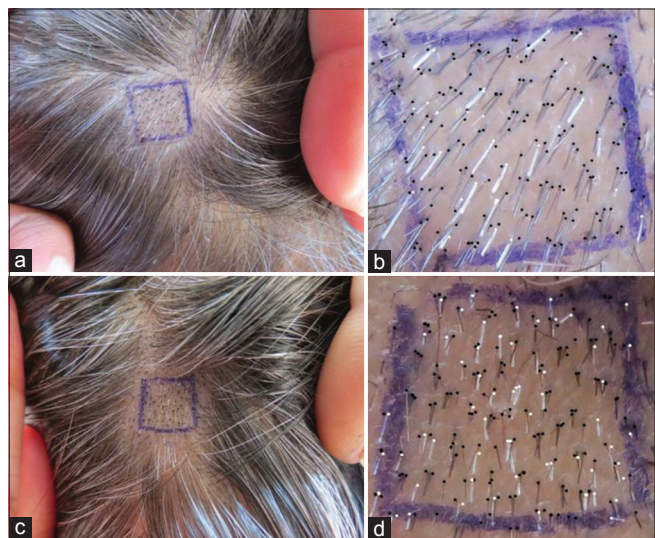


Figure 2: (a and c) Clinical photograph of two study subjects demonstrating a 1 cm² area with maximum graying in the vertex region. (b and d) Magnified view of the photograph on left (white and black dots represent grey and black hair, respectively). The first case (a) had moderate premature canities with graying severity score (GSS) = 6 and the second case (c) had severe premature canities with GSS = 12

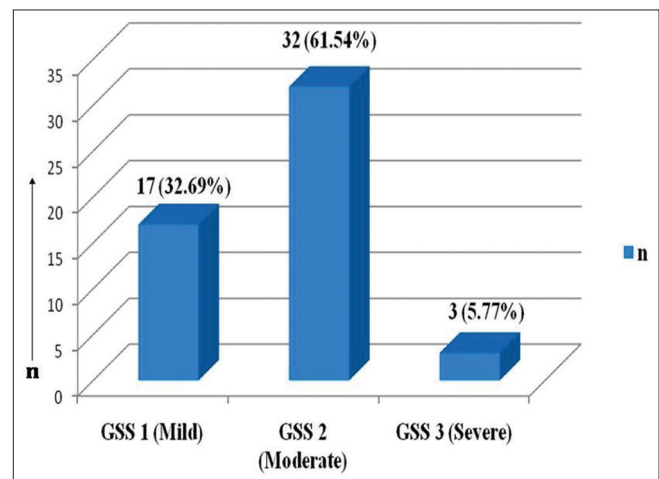


Figure 3: Bar graph representing the graying severity score of premature canities on X-axis and the number of cases with the respective severity score on Y-axis

An analysis of the five representative zones of the scalp revealed that the maximum GSS was noticed in the frontal region of the scalp closely followed by the vertex [Table 1]. The mean number of gray hair was maximum in the frontal region (11%) followed by vertex (9%). The temporal region had similar extent of involvement averaging approximately 8%–8.5%. Occipital region was least affected at 5.3%.

DISCUSSION

Premature canities is a common entity, which clinicians encounter very often but have very little to offer to the patient. There are no standard guidelines for patient evaluation and treatment. This promotes the multimillion dollar business of the pharmaceutical companies, which claim efficacy of their products such as multivitamin supplements that is not evidence based. The condition can be distressing for the young patients, especially in Asian races where even few strands of grey hair tend to become prominent and noticeable amidst normal dark hair. Scoring severity of premature canities may be of great value in guiding therapeutic trials. Blind supplementation with multivitamins is not justified, especially in a developing economy where resources are limited.

To the best of our knowledge there are no widely recognized or standard scales that are used uniformly to assess the extent and severity of premature canities. Various means of scoring have been used previously as tabulated in Table 2. In an epidemiologic and investigative study on premature graying in Indian population, the authors have used a scale format for graying. In this, presence of upto 50 gray hair were graded as mild, 50–100 as moderate, and more than 100 as severe.^[3] In yet another study in Korean population, the severity was graded into five grades. It was a questionnaire-based study and the subjects were asked to estimate the extent of graying by themselves as: Grade 1 (less than 20% of total hair), grade 2 (20%–40%), grade 3 (40%–60%), grade 4 (60%–80%), and grade 5 (more than 80%). This was further supplemented with hair examination and photographic evaluation and both were found to be similar, although there is no mention of the statistical test used to look for the degree of agreement between the two.^[4] Yet another study on Korean men with premature graying (defined as an onset of graying before 30 years of

age), was also questionnaire based and the participants were asked to self-report their gray hair as follows: 0, less than 10, 10–100, and more than 100.^[5]

Most of these grading systems devised are not standardized, might have observer bias, and may not be reproducible. The cutoffs chosen are random and based on convenience, and also entire scalp area is not assessed into different segments. There may be significant interindividual variation in self-reported estimation of graying, as it is difficult to examine one's own scalp in totality. Secondly, it also depends on the individual's perception of the severity and the area of scalp involved. For example, involvement of occipital area may go totally unnoticed, whereas a prominent involvement of visually amenable sites such as frontal region or vertex may be given falsely higher scores.

Another scoring system known as the hair whitening score (HWS) has been used in two consecutive studies by Erdoğan and Kocaman *et al.* HWS was defined according to the percentage of white hair (HWS 1 (Trace): <25%; HWS 2 (Mild): 25%–50%; HWS 3 (Moderate): 50%–75%; HWS 4 (Manifest): 75%–100%; HWS 5 (Complete): 100%). A reference photographic gray-white scale was used to categorize the subjects into the respective group based on visual inspection. These studies were conducted in young and middle-aged patients (<55 years age) without a history of cardiovascular disease^[6] and in patients who underwent coronary angiography with a suspicion of coronary artery disease.^[7] The categorization of the patients was based on visual assessment and comparison with reference photographs, which could again vary depending on the site of scalp involvement and is subject to observer bias. As studies were done on older individuals and not on patients with premature canities, the scale may not be applicable to younger subjects with onset before 20 years of age. Subjects less than 20 years are not expected to gray extensively and are unlikely to have graying beyond 40%–50% scalp involvement. Thus according to this scoring, most of the patients would fit into only two categories, mild or moderate, which restricts further evaluation.

GSS has the advantage of being a numeric, objective, and reproducible scoring system. It gives an objective means of scoring the graying taking into consideration all areas of scalp. Secondly, the data can be maintained in the form of photographic record, for subsequent evaluation. In addition, this data can be helpful in therapeutic trials with pre- and post-treatment scores. The high level of agreement achieved between the observations of two independent investigators suggests that this is a reproducible scoring system. Lastly, the scoring system provides us with an objective measure of severity of premature canities in the different regions of scalp, thus enabling in the assessment of the clinical pattern and extent of graying. In the present study, the subjects

Table 1: Hair density and extent of graying at the five representative zones

Parameter	Frontal	Vertex	Right temporal	Left temporal	Occipital
Mean hair density (hair/cm ²)	180.1	183.3	135.6	130.5	148
Mean no. of white hair (hair/cm ²)	19.1	16.2	11	10.8	7.5
Average percentage of gray hair (%/cm ²)	11	9	8.3	8.4	5.3

Table 2: The scoring system for graying of hair used in different studies

Authors	Year of publication	Place of study	Number of cases	Age group (years)	Scoring system	Method	Remarks
Bhat <i>et al.</i> ^[3]	2013	India	35	<20	Mild-<50 gray hair Moderate- 50–100 Severe->100	Based on clinical examination	Cutoffs taken are arbitrary
Jo <i>et al.</i> ^[4]	2012	Korea	1002	12–91	Grade1-<20% Grade2-20%–40% Grade3-40%–60% Grade4-60%–80% Grade5->80%	Questionnaire based followed by assessment based on photographic scale in 576 subjects who consented	Subjective scoring system, subject to observer bias. Subjects included not confined to premature canities
Shin <i>et al.</i> ^[5]	2014	Korea	6390 men	<30	4 groups - 0; <10; 10-100; >100	Questionnaire based	Subjective scoring system, liable to observer bias, subjects recruited from military unit and included only men
Erdogan <i>et al.</i> ^[6]	2013	Turkey	202 men	<55	Hair whitening score (HWS) 1-(Trace):<25% 2- (Mild):25%–50% 3- (Moderate):50%–75% 4- (Manifest):75%–100% 5- (Complete):100%	Based on photographic scale; assessed by 2 cardiologists	Includes older subjects. Such severe graying is not usually seen in premature canities. Only men were included in the study
Kocaman <i>et al.</i> ^[7]	2013	Turkey	213 men	Not defined	Same as above	Same as above	Same as above and subjects included men undergoing coronary angiograph

were found to have maximum involvement of the frontal region closely followed by the vertex region of the scalp. Also in future this scoring system may be extrapolated for assessment of the extent and severity of physiological canities as well.

The only drawback of this scoring system is that it is time consuming and is difficult to carry out in a busy outpatient department, typical of tertiary care setup in India. In future, a software can be developed, which may help in quick counting of the number of white and black hair in the defined 1 cm², thereby replacing the labor-intensive manual counting. Also only two assessors were involved in evaluation of the scoring, and large scale studies are warranted to reach a definite conclusion. The present study is a pilot attempt at deriving an objective scoring system and could not be validated due to lack of standardized scoring systems for premature canities.

CONCLUSION

In view of lack of a widely recognized standard scoring system for evaluation of premature canities, we propose GSS as a novel, numeric, objective, and reproducible tool. The GSS can be used to follow up and assess therapeutic response as the data can be maintained in the form of photographic record. We recommend further studies on a larger population to optimise the application and utility of this novel scoring system.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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