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The 'Scalp Coordinate System': A New Tool to Accurately Describe Cutaneous Lesions on the Scalp- A Pilot Study

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Introduction

Skin cancers are extremely common and the incidence increases with age. Care for patients with multiple or complicated skin cancers often requires multidisciplinary input involving a general practitioner, dermatologist, plastic surgeon and/or radiation oncologist. Timely, efficient care of these patients relies on precise and effective communication between all parties. Until now, descriptions regarding the location of lesions on the scalp have been inaccurate, which can lead to error with the incorrect lesion being excised or biopsied.

Methods

A novel technique for accurately and efficiently describing the location of lesions on the scalp, using a coordinate system, is described (the “Scalp Coordinate System”). This method was tested in a pilot study by clinicians typically involved in the care of patients with cutaneous malignancies. A mannequin scalp was used in the study.

Results

The Scalp Coordinate System significantly improved the accuracy in the ability to both describe and locate lesions on the scalp. This improved accuracy comes at a minor time cost.

Discussion

The direct and indirect costs arising from poor communication between medical subspecialties (particularly relevant in surgical procedures) are immense. An effective tool used by all involved clinicians is long overdue particularly in patients with scalps with extensive actinic damage, scarring or innocuous biopsy sites. The scalp coordinate system provides the opportunity to improve outcomes for both the patient and healthcare system.

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Introduction

Accurate identification and appropriate treatment of malignant and pre-malignant skin lesions are key steps in preventing progression of disease and thus more complicated and expensive treatment algorithms. Skin cancer management frequently involves multiple health care providers and good communication between them ensures timely and efficient care of the patient. A breakdown in communication between the general practitioner, dermatologist, surgeon, and/or radiation oncologist can have significant consequences for both the patient and the healthcare system.

Currently, referencing the precise location of a scalp lesion can be troublesome for several reasons. Unlike other areas on the body, scalp lesions are often described using

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ambiguous terms that can lead to confusion when the patient is referred between health professionals. It is also an area that the patient cannot readily see and thus their ability to assist the practitioner in finding the offending lesion is somewhat limited. Finally, there is an absence of reliable landmarks on the scalp against which the location of a lesion can be referenced.

The importance of correct site surgery has been highlighted by the World Health Organisation in recent years with the introduction of the 'Universal Protocol' and 'Surgical Safety Checklist' [1]. The issue was further highlighted by the 'Patient Safety Taskforce' from the American College of Dermatology in 2009 [2]. Paull et al indicated that incorrect skin lesion excision may even be somewhat immune to the "Universal Protocol", particularly in the 'classic' patient: a poor historian with multiple suspicious lesions and previous surgical and biopsy sites. Clinical photography often helps, but in practice photographs are often missing, of poor quality, not standardized, or not taken. Referring general practitioners are often reluctant to include photographs taken on personal mobile phones given issues around confidentiality. The Australian Medical Association recommends stringent security measures and also that clinical photographs taken on a personal device be stored in the patient's health records for a defined period of time, which can make photography of skin lesions difficult for general practitioners [3].

Traditionally, lesions on the scalp have been described and located with prose terms, in relation to the underlying skull bones (i.e. 'left parietal'). Unfortunately, the terms employed are often inaccurately used by the referring doctor or misinterpreted by the accepting practitioner. Other times lesions are described by terms that are too broad (i.e. 'left scalp', or simply 'scalp lesion'). In a patient with an otherwise clear scalp this may not be an issue, but a greater proportion of patients now present with generalised actinic change and signs of previous surgery on the scalp. In these patients, the use of broad terms can make locating the most recent lesion (or a particular biopsy site) extremely difficult potentially leading to error. With a population that is aging, the incidence of these 'battle-scarred' scalps is increasing, and this elderly cohort may not be able to describe or remember the whereabouts of the latest concerning lesion.

Inaccurate descriptions can affect both the patient and the health care system. The patient may suffer wasted time and money being sent back to their referring practitioner to clarify the problem (i.e. 'which of the biopsied lesions on the scalp has confirmed malignant disease?'); during which time, the disease may have progressed. Or worse, the wrong lesion may be excised. The experienced surgeon will be familiar with the undeniable queasiness that accompanies the receipt of a 'nil residual malignancy' pathology report, having just excised what they believed to be a biopsy-proven lesion. The health care system suffers with time wasted clarifying these issues in the clinic or the theatre holding bay, extra procedures (including repeating biopsy tests), and possible litigation.

There are precedents within medicine where numbering systems have been used in preference to purely descriptive terms, in order to improve the accuracy and efficiency of communication between health professionals. The international dental numbering system [4, 5] is an example. With regards to localising a position on the scalp, the available coordinate systems used on spherical objects rely on the presence measurements from fixed points.

The aim of this study was to design and pilot an improved system for the description and localisation of lesions of the scalp. We hypothesized that the coordinate system presented would improve the accuracy of lesion description. The secondary outcome measure was the time taken to use the system compared to standard descriptive terms.

Methods

A thorough review of the literature revealed no previous publications pertaining to systems used to describe or accurately locate lesions on the scalp.

A 'Scalp Coordinate System' (SCS) was devised to enable referrers to describe, and proceduralists to subsequently find, lesions on the scalp. The system relies on measuring

the distance of a lesion from three fixed points. The fixed points are the left superior helical root (termed 'L'), the right superior helical root (termed 'R'), and the nasal radix (termed 'N'). Measurements are undertaken with a flexible measuring tape over the shortest distance between the fixed point and the lesion. The unit of measurement is the centimetre (cm). The lesion can then be described accurately with a coordinate. Figure 1 describes how to use the system.

To determine the accuracy of the system we used a mannequin scalp and implemented a four-part questionnaire. Practitioners were initially asked to describe the location of six lesions using both standard descriptive terms and then the SCS [see Questionnaire]. They were then asked to mark the location of a lesion based on general descriptive terms (for instance, "left frontal") then using the SCS. We provided a measuring tape and verbal instructions on how to use the SCS. We also measured the time taken to complete each step of the task. The task was performed individually, with any markings on the scalp removed before the next participant was introduced to the task.

To replicate real practice the subjects tested were from both the referring and 'receiving' specialties and included training and qualified specialists from the fields of general practice, dermatology, plastic surgery, and radiation oncology.

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To analyse the responses we collated the terms that had been used to describe the lesion location in the initial section of the questionnaire. For those questions that required the subject to mark a position on the scalp, we measured the marked position using the SCS and compared it to the other participant's responses and also the pre-determined reference point.

The data collected was collated and for the descriptive terms the number of different terms used and the most popular term were recorded. Where a point was marked on the scalp, these points were plotted on a graph using the three coordinates, and their degree of variance noted. Where a marked point on the scalp was measured using the coordinate system, these coordinates were, likewise, plotted graphically and the degree of variance noted.

The time taken to complete each task was measured in seconds, and compared between the descriptive and the coordinate systems.

Frequency data was reported with medians and interquartile ranges. Repeated measures two way analysis of variance was used to investigate the two reporting systems and inter-observer reliability was assessed with an intraclass correlation coefficient, with two way agreement. Statistical analysis was performed with the R Statistical package[6].

Results-

We enrolled 18 medical practitioners to complete the questionnaire. Of the 18 participants 14 were specialist consultants and the remaining 4 were training registrars.

For all 18 participants, we used the same standardised mannequin scalp with standardised locations marked for the questions. Measurements were recorded independently by two of the authors.

Part 1 – Variability using Descriptive terminology.:

For part one of the questionnaire we had six standardised marked locations (1-6) on the mannequin scalp. The participants were asked to record the location of the lesions using descriptive terms they would normally use in practice. Participants used between five and eight different terms to describe each location, and there was no location where all subjects use the same term in every case. The results show the variety of terms that are used for the same location on the scalp.

Part 2 – Variability using the Scalp Coordinate System (SCS):

Part two entailed the practitioners describing the same standardised marked locations as in part one (1-6), this time using the SCS. The results are tabulated to show the range in centimetres that were recorded for each coordinate and the standard deviation for each. The results show a low variability in the majority of responses. One participant made a transcription error between left and right sided coordinates, and their affected result was

removed from analysis. The measurements for lesions 3 and 6 were less accurate compared to the other lesions.

Table 1: Results of questionnaire part 2

Part 3 – Accuracy of Descriptive terminology:

In part three the practitioners were asked to mark dots on the mannequin where they felt the descriptive terms referred to. The results of all five locations are displayed in scatterplot below. The following five terms were used: “Left frontal”, “Scalp vertex”, “Right occiput”, “Left temporal”, “Right parietal”. The average time taken for this part of the questionnaire was 13 seconds per lesion.

Figure 2: Scatterplot of results for Part 3

Part 4 – Accuracy of SCS

In part four, the practitioners were asked to mark on the mannequin scalp the location of a lesion after being given SCS coordinates. The results of all five locations are displayed in scatterplot below. The average time taken to complete this part of the questionnaire was 75 seconds per lesion.

Figure 3: Scatterplot of results for part 4

SCS versus Descriptive terminology

The accuracy of the SCS can be appreciated when comparing the results from part three and four. The scatter plots provide a visual appreciation of improved accuracy when using the SCS. The measured deviation was significantly smaller (median 1.0, interquartile range 0-1.41) using the SCS compared to the descriptive system (median 2.55, interquartile range 1.80-3.64) (2 way repeated ANOVA $P = 0.008$). Individually the SCS and descriptive measurements were not appreciably different for each of the six locations. Agreement between the assessors for the SCS task was confirmed (intraclass correlation coefficient, two way with agreement 0.0579, 95% CI -0.025 – 0.0, $P = 0.456$).

The average time was longer using the SCS (median 360 sec, interquartile range 262-420 sec) compared to the descriptive prose (median 72.5 sec, interquartile range 55-90 sec) by an average of 311 seconds. This equates to approximately one minute extra per lesion using the SCS.

Discussion

In this pilot study, the proposed 'Scalp Coordinate System' (SCS) proved to be significantly more accurate than traditional descriptive systems and at an acceptable time

cost. The accuracy of traditional descriptive terms was surprisingly poor, highlighting the overdue need for such a replacement system, particularly given our aging population with markedly sun-damaged skin. The authors concede this pilot study is limited by its design. The tasks undertaken by the participants in the study do not mimic the clinical scenario we have described. We feel that if this system was adopted it could reduce problematic communication regarding scalp lesions from occurring.

The SCS is vulnerable to errors. Transcription error was experienced once in this small pilot study. A participant confused the left and right sides when taking measurements. We eliminated this result from our statistical analysis. By using a structured routine when measuring the coordinates this could be minimised. We suggest always writing the coordinates in the order “Left”, “Right”, “Nose” and measuring these figures in this order each time the system is used. The clinician should develop a habit to always stand on the same side of the patient in order to trigger this systematic order of taking measurements. We noted table 1 showed some wide measurement ranges for lesions 3 and 6. These lesions were a long distance from the radix of the nose and both were lateral. The reduced accuracy for these 2 lesions may reflect a higher propensity for error in longer measurements over the convex scalp. Measuring techniques can detour around the scalp rather than as the crow flies. To minimise this error we recommend measuring the lesion in a direct line from the point of reference (as illustrated in figure 1).

When using the SCS, our participants were able to identify and describe lesions significantly more accurately as can be seen in figure 3. Marked improvement in the accuracy of describing locations can be seen between part three and part four of the questionnaire results (P value = 0.047). On one occasion, a participant confused left and right values with the opposite side. This created significantly inaccurate responses that can be seen in figure 3. This illustrates a limitation with the use of the SCS, as it is subject to human error. It emphasises the importance clear instructions and methodical documentation with the SCS.

The time taken to use the SCS was 62 seconds longer (per lesion) than when using traditional descriptive terms. This small immediate investment in time is justifiable given the potential errors that the accurately communicated information will potentially avoid. Furthermore, we postulate that this time discrepancy will reduce with experience. Also, in the clinical setting, there would be some form of lesion or biopsy site at the point indicated by the SCS (rather than a bare mannequin scalp), and this would aid the speed of locating lesions with the SCS.

The authors concede this pilot study is limited by a lack of real patients, and this will be the next step for our institution. We are planning to implement this system as protocol for communication between practitioners within our tertiary cancer centre in the future. Training for clinicians will also be provided. In the longer term, we aim to train our referring clinicians in the community (general practitioners and dermatologists most commonly) in

the use of the SCS. Some foreseeable obstacles include partial uptake in the community given the extra time incurred by the referring clinician when initially using the SCS.

However, it is hoped that the benefit attributable to the receiving specialist, the health care system, and patient will be an incentive.

We recognise that there are situations where the SCS may not seem appropriate. In a cognizant patient with an isolated, easily identifiable lesion on the scalp without marked actinic damage, it may seem like the SCS would complicate the communication regarding this lesion. If, however, this patient were to suffer further scalp malignancies in the future, knowledge of the precise location of the prior lesion may help delineate new versus recurrent tumour, and thus guide subsequent management. This is not an unrealistic scenario; Marcil et al. found that those with an index lesion (basal or squamous cell carcinoma) had a 10-fold increased risk of further malignancies [7].

Occasionally, particularly in a tertiary cancer centre environment, a patient will not have a helical root due to oncologic auriculectomy. The SCS could not be used for this type of patient.

In conclusion, the SCS is an easily learnt and effective tool aimed at improving the ability to accurately describe and locate a scalp lesion. Better communication between

health professionals can thus lessen surgical site errors and improve the quality of care for patients.

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Legend of Tables

Table 1: Results of questionnaire part 2 – This table represents the results of all the participants measurements of dots placed on the mannequin scalp. The range and standard deviation of the three measurements (“L”, “R”, “N”) for each of the 6 specified lesions are given in centimetres (cm).

Legend of Figures

Figure 1: Diagram illustrating how to use the Scalp Coordinate System and the three measurements required to produce an “LRN” coordinate.

Figure 2: Scatterplot of results of questionnaire part 3 – The accuracy of coordinates marked on the mannequin by participants using descriptive terminology. The plotted points represent the error in parasagittal (y-axis) and coronal (x-axis) planes in centimetres.

Figure 3: Scatterplot of results of questionnaire part 4 - The accuracy of coordinates marked on the mannequin by participants using the SCS. The plotted points represent the error in parasagittal (y-axis) and coronal (x-axis) planes in centimetres.

Figure 1.tiff

Figure 2: Scatterplot of results for Part 3

Average deviation from $(x,y: 0,0) = 3.3\text{cm}$

Figure 2 Scalp SCS Revised.tiff

Figure 3: Scatterplot of results for part 4

Average deviation from x,y: 0,0 = 0.79cm

Figure 3 Scalp SCS revised.tiff

Table 1: Results of questionnaire part 2 – This table represents the results of all the participants measurements of dots placed on the mannequin scalp. The range and standard deviation of the three measurements (“L”, “R”, “N”) for each of the 6 specified lesions are given in centimetres (cm).

Lesion 1	L (cm)	R (cm)	N (cm)
Range	1	1.5	1.5
Std Deviation	0.49	0.53	0.51
Lesion 2			
Range	1.5	1.5	2
Std Deviation	0.52	0.33	0.45
Lesion 3			
Range	10	1	6.5
Std Deviation	4.46	0.38	2.10
Lesion 4			
Range	3.5	2.5	3
Std Deviation	1.38	0.74	0.71
Lesion 5			
Range	1.5	1.5	6.5
Std Deviation	0.39	0.42	1.59
Lesion 6			
Range	7.5	6	9.7
Std Deviation	1.77	1.96	2.36

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