Original article

The Correlation Between Duration of Complete Scab Extraction and Size of Graze

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Abstract

Currently, evaluating the duration of graze healing is only roughly estimated by using the size of wound as criterion. However, criterion is not clear on how big or small the wound should be. Furthermore, it does not specify the “size” of the wound by width, length, or area. The aim of this study was to consider the correlation between duration of complete scab extraction, which is the time taken for the graze to heal, and size of graze distinguished by width, length and area. The result showed that both length and width had positive correlation with the duration of graze healing, but the length had a stronger correlation. The most appropriate function for calculating the duration of wound healing is Y=9.092+0.105L+1.288W. For evaluating the healing in proximation, length can be used as a criterion, i.e. if the length of the wound does not exceed 3 cm, it will take approximately 9 to 13 days to heal, but if the graze is more than 3 cm in length, it will take approximately 13 to 15 days to heal. However, caution must be taken when using the result of this study in daily practice because of uncontrollable factors and variation of wounds. Further study should be done in order to obtain more information. Chiang Mai Medical Journal 2011;50(3):81-88.

Keywords: graze, duration of healing, scab extraction, size, correlation, estimation

Evaluation of wound healing time is a major task in forensic work, since it provides important information in cases of assault or negligence in the criminal justice system.

Grazes are commonly found in victims of assault. They are an injury to the skin, which removes the epidermis and/or upper dermis caused by friction or impact with rough, blunt objects. One to two days after the injury, tissue fluid that oozed from the skin dries out and forms a scab. Then epithelization occurs under the scab, starting from the rim into the center of the wound. When epithelization is complete, the wound is considered healed. The scab that covers the wound eventually falls off, therefore, the duration of graze healing is from the time of injury to scab extraction.
In general, forensic doctors determine the healing time of a graze by relying on the size of the wound, but this is a rough estimation, i.e., if the wound is small it would take about one week to heal, and about two weeks if the size is big. However, until now, there has been no clear criteria of what size wounds are to be considered “big” or “small”. There is not even a specification of “size”, which is an important factor for healing the width, length, or area of wound. For these reasons, this study aimed to find concrete criteria for an approximate time of graze healing.

**MATERIAL AND METHOD**

This was a prospective study, in which 30 cases of graze came to Maharaj Nakorn Chaing Mai Hospital, Faculty of Medicine, Chiang Mai University.

The inclusion criteria comprised 3 parts: 1) the injured person, 2) the wound, and 3) the time the wound took place.

Subjects chosen for this study had to be between 18 and 40 years old, healthy with no disease that affects wound healing, and not receiving anti-inflammatory medication including steroids and non-steroidal anti-inflammatory medicine.

Graze characteristics for this study needed to have uneven width and length, depthness through the upper dermis layer, branding all over the wound, no epidermis what so ever, no infection, and no pre-scratching of the scab. The wound should be in the extremities, which were considered as the arm counting from the acromion process or leg counting from the greater trochanter, but not including the hands or feet. Most importantly, the exact time of when the injury occurred must be known.

The process of study began with collecting data on the wound by taking digital pictures with a measuring tape five times per sample, then choosing the three clearest images to evaluate the three parameters, which included length of the longest part along the long axis, width of the widest part of the vertical axis, and size of the area using the AutoCAD 2009 program developed by Autodesk Inc. USA. Follow up for each individual wound began on the third day after the injury and then every day until the scab was extracted completely.

After that, the correlation between duration of complete scab extraction and the three parameters of the wound, which included width, length, and area, was analyzed by regression analysis.

All grazes were categorized into three groups according to the time the scab was extracted completely. Wounds with a scab that had all fallen off in 5 to 10 days will be grouped as the 1-week-recovery-group (1 wk). The 2-week-recovery-group (2 wk) consisted of wounds that took between 11 and 17 days for complete scab extraction. The more than 2-week-recovery-group (>2 wk) was the last which consisted of wounds that took more than 17 days for complete extraction. Afterwards, the differences of length, width, and area were compared between each group by using the Krusal Wallis test and 95% confidence interval (95% CI) for the mean of parameters, which was different.

**RESULT**

The study consisted of 30 participants; 18 males and 12 females in the age range of 19 to 38 years old (average 23.5 years).
number of wounds collected was 45, all of which had widths of between 0.9 and 9.73 cm (average 2.46 cm), lengths of between 1.84 and 27.81 cm (average 5.79 cm), and areas of between 1.63 and 129.71 cm² (average 14.97 cm²).

The study of relationship between width, length and area of all grazes, with duration of complete scab extraction by simple regression analysis (Table 1), showed that every parameter had a positive linear correlation with the duration mentioned. The length of the wound had the highest correlation coefficient (r), i.e. 0.62, while the width was r=0.4 and area r=0.05. Single regression models for predicting duration of complete scab extraction by length, width, and area of wound was Y=9.829+0.569L (r²=0.38), Y=9.954+1.131W (r²=0.16) and Y=11.166+0.138A (r²=0.24) respectively. There were two multi-variable regression models such as Y=9.092+0.105L+1.288W (r²=0.14) and Y=7.992+0.266L+1.677W-0.052A (r²=0.42).

After grouping the wounds into the 3 recovery groups (1 wk, 2 wks and more than 2 wks) according to duration of complete scab extraction, it was found that 12 wounds (26.7%) had complete scab extraction in one week, 28 (62.2%) in about 2 weeks and five (11.1%) in more than 2 weeks. Distribution of each parameter is shown in Figures 1 to 3.

The differences in length, width, and area of the wounds in each group were analyzed by the Kruska Wallis test. The result of the test showed that the length in the 1wk group was significantly different from that in the 2wk and >2wk group (p=0.001 and 0.02). The area of the 1wk group was also different from that in the other two groups (p=0.001 and 0.027). Both length and area in the 2wk and >2wk group had no statistical difference. For width, there was no difference between the groups.

Mean of wound length in the 1wk group was 2.65±0.87 cm (95% CI = 2.09-3.20), whereas, mean of the length in wounds that healed in over more than 1 week was 6.93±5.83 cm (95%CI = 4.80-8.99), as shown in Figure 4.

When the wounds were separated into two groups by using a wound length of 3 cm as the criterion (Figure 5), it was found that the group with wounds up to 3 cm had of complete scab extraction after at least 6 days, and not more than 18 days, at an average of 10.88±3.34 days (95% confidence interval=

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Regression model</th>
<th>(r)</th>
<th>(r²)</th>
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<tbody>
<tr>
<td>Length</td>
<td>Y = 9.829+0.569L</td>
<td>0.62</td>
<td>0.38</td>
</tr>
<tr>
<td>Width</td>
<td>Y = 9.954+1.131W</td>
<td>0.40</td>
<td>0.16</td>
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<tr>
<td>Area</td>
<td>Y = 11.166+0.138A</td>
<td>0.50</td>
<td>0.24</td>
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<tr>
<td>Length and width</td>
<td>Y = 9.092+0.105L+1.288W</td>
<td>0.64</td>
<td>0.41</td>
</tr>
<tr>
<td>Length, width and area</td>
<td>Y = 7.992+0.266L+1.677W-0.052A</td>
<td>0.65</td>
<td>0.42</td>
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r: correlation coefficient; r²: coefficient of determination; L length (cm)
W: width (cm); A: area (cm)
Figure 1. Length distribution of wounds that healed at different times.

Figure 2. Width distribution of wounds that healed at different times.

Figure 3. Area distribution of wounds that healed at different times.
The correlation between duration of healing and size of graze

Figure 4. The 95% confidence interval of the mean of wound length. The left interval is the 1-week-recovery group and the right is the 2-week and more-than-2-week-recovery group.

Figure 5. The 95% CI of complete scab extraction period in a wound length \( \leq 3 \) and \( > 3 \) cm.

9.09-12.66). The group with a wound length of more than 3 cm had complete scab extraction after at least 7 days, and not more than 27 days, at an average of 13.97±3.68 days (95% confidence interval=12.47-15.36).
DISCUSSION

It is already known that epithelization starts from the edge of the wound and works towards the center.\(^{(3,5,6)}\) Therefore, the speed of graze healing manifested by complete scab extraction, depends on wound size.\(^{(1-3,6,7)}\) Knight B mentioned that in healing a graze, epithelization will be complete in 10-15 days if the wound is small.\(^{(1)}\) Keast D mentioned that epithelization will be complete in about 4-21 days.\(^{(8)}\) These two authors did not mention whether the size definition was width, length or area or what was considered as small. The authors reviewed many articles and found no substantial criteria for estimating graze wound healing.

This study found which parameters between widths, lengths or areas had effect on the duration of graze healing, and how they affected the time as mentioned by using correlation and regression analysis.

It also found that every width, length, and area of the graze had a positive correlation with the duration of complete scab extraction, in which the length of the wound was the parameter with the most positive correlation \((r=0.62)\). Area and width had the least positive correlation \((r=0.50, 0.40)\).

When using regression analysis to find the most appropriate model to calculate duration of healing, it was found that the two- and-three variable regression model had a coefficient of determination \((r^2)\) higher than that in single variable models. However because both models, with or without area as a variable, had a value of \(r^2\) close to each other \((0.42\) and \(0.41)\), calculation of the area may not be necessary and the best model for calculating duration of healing was \(Y=9.092+0.105L+1.288W\). Although the length variable value or \(r^2\) \((0.38)\) of the single variable model was lower than that in the two-variable regression model, the variable mentioned was not so low. Therefore, in the case of having only length measurement of graze when using the regression model, and length being the only variable, \(Y=9.829+0.569L\) is acceptable.

Since weeks are the units commonly used in estimating wound healing time in medico-legal reports, this study used them to classify scab extraction into three groups. Then, comparison between graze parameters found that the length and area of the wound differed in scabs that had fallen in 1 week from those that took more than 1 week to fall. However, there was no difference in widths between groups. Since length and width constitute the area of the wound, it is possible to conclude that only the length affects the time in which the scab has fallen, which is the duration of wound healing.

This study found that grazes with a length of no longer than 3 cm had an average time of 10.88 days \((95\% \text{ confidence interval}=9.09-12.66)\) before the scab completely fell off, and grazes with a length of more than 3 cm had an average time of 13.97 days \((95\% \text{ confidence interval}=12.57-15.39)\) before the same event. The result of this study gave ideas for analyzing wound healing duration, such as wounds with a length of less than 3 cm have a high chance of its healing duration being between 9 and 13 days, and wounds with a length of more than 3 cm have a high chance of its healing duration being between 13 and 15 days.

Since this study is one of the human body, and not laboratory animals, there was detailed tracking of complete scab extraction: the results of which can be used probably in analyzing duration of graze wound healing. However, due to because of
uncontrollable factors such as taking care of the wound, axis of the wound against Langer’s line and variation between individuals, the results of this study may have some errors. Furthermore, the variation of severity, position and morphology of the wound in practical work may play a role in the victim’s graze by not conforming with the criteria of this study. Therefore, the estimation of wound healing duration must rely not only on the results of this study, but also all factors.

In conclusion, this study found that both the width and length of the graze correlate with the time it takes for the scab to fall off completely, with the length being the parameter with the highest correlation. From regression analysis, it was found that the most appropriate model for evaluating the healing time of a graze was \( Y = 9.092 + 0.105L + 1.288W \). For approximate evaluation of wound healing duration, the length of the wound is useful. If the wound length is less than or equal to 3 cm, it would take about 9 to 13 days to heal, and for a larger wound, 13 to 15 days. However, because of uncontrollable factors and variation of wounds, caution must be taken in using the result of this study in daily practice. Further study should be carried out in order to obtain more information.

**Ethics**

The study was approved by The Research Ethic Committee 3, Faculty of Medicine, Chiang Mai University on February 28, 2010 [study code: 10FEB010956, Certificate of approval Number 073/2010].

**ACKNOWLEDGEMENT**

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ความสัมพันธ์ระหว่างระยะเวลาการลอกหลุดหมดของสะเก็ด กับขนาดของบาดแผลถลอกถูครูด

แสงระวี, วงศ์พุฒ, พ.บ., กาชาด วิชัยรัตน์, พ.บ.
ภาควิชานิติเวชศาสตร์ คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

บทคัดย่อ

ในปัจจุบัน การประเมินระยะเวลาการหายของบาดแผลถลอกถูครูดเป็นเพียงการประเมินกว้างๆ โดยอาศัยขนาดของบาดแผลเป็นเกณฑ์ แต่ยังไม่มีเกณฑ์ที่ชัดเจนว่าบาดแผลขนาดใดหรือเท่าใดและบาดแผลขนาดเล็กต้องทำไข่ต่ำหรือเพาะ paz ไม่ชัดเจนเฉพาะเจาะจงว่า “ขนาด” ของบาดแผลหมายถึงความกว้าง ความยาว หรือพื้นที่ การศึกษาที่ศึกษาความสัมพันธ์ระหว่างระยะเวลาการหายกับขนาดของบาดแผลถลอกถูครูดจึงจำเป็น ความกว้าง ความยาว และพื้นที่ ผลการศึกษาพบว่าความกว้างและความยาวมีอิทธิพลต่อระยะเวลาการหายของบาดแผลถลอกถูครูดแต่ความยาวมีอิทธิพลมากกว่า สิ่งที่สำคัญคือการประเมินระยะเวลาการหายโดยละเอียดต้องใช้ความยาวและความกว้าง ประเมินร่วมกันตามเกณฑ์ขึ้น Y = 9.092 + 0.105L + 1.288W หรืออาจประเมินกว้างๆ โดยใช้ความยาวเพียงอย่างเดียว ถ้าความยาวบาดแผลอยู่ระหว่าง 12-13 ซม. จะใช้เวลาในการหายประมาณ 9-13 วัน หากบาดแผลกว้าง 3 ซม. จะใช้เวลาในกรอบ 13-15 วัน โดยประมาณ อย่างไรก็ตาม เนื่องจากปัจจัยที่มีผลต่อการลอกหลุดของสะเก็ดมีอยู่หลายอย่างในการศึกษานี้ยังไม่สามารถควบคุมปัจจัยดังกล่าวที่มีผลต่อการลอกหลุดของสะเก็ดอย่างชัดเจนและในการปฏิบัติบาดแผลถูครูดมีลักษณะเฉพาะไปจากที่กำหนดในการศึกษานี้ ทำให้การน่าผลการศึกษาไปประยุกต์ใช้ในทางปฏิบัติจริงจำเป็นต้องทำการศึกษาอย่างระมัดระวังและจำเป็นต้องศึกษาเพิ่มเติมต่อไป

คำสำคัญ: บาดแผลถลอกถูครูด ระยะเวลาการหาย การลอกหลุดของสะเก็ด ขนาด การประเมินความสัมพันธ์