



Original article

Applicability of calf subcutaneous tissue to subcutaneous injection in young adults

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ABSTRACT

Aim: The aim of the study is to provide usage of subcutaneous tissue of lateral calf area (region of M. Gastrocnemius) in addition to the existing injection regions and to compare tissue thicknesses of the lateral upper arm, anterior and lateral thigh, anterior abdomen regions and calf regions.

Background: Subcutaneous injection (SC) is an application of 0.5 cc drug with an injection (No. 25 and 8–15–18 mm long) to the connective tissue under the skin. Individuals to which SC injection is frequently applied, should rotate the injection areas.

Methods: This research uses the descriptive method.

One hundred and sixty-one students (aged; 20.09 ± 2.268) were used as test subjects. Demographic data was obtained from the students who agreed to participate in the research. Body Mass Index (BMI) was calculated. Skin thickness measured using the Holtain Skinfold Caliper. SPSS 20 package software was used for statistical analysis of the data. For comparison of the tissue thicknesses between genders, the *t*-test was used for independent groups. In order to determine the interactions between anthropometric measurements within each other and other numerical measurements (age, length, BMI, etc.). Pearson Correlation coefficient and related P value was performed. Statistical P value is taken as 0.05.

Results: Consideration of subcutaneous injection applicability of the calf region depended on the injector lengths: 8 mm, 15 mm and 18 mm, 86.3%, 59.6% and 47.8% of the population, respectively were found applicable for this region.

Conclusions: The calf region could be recommended as SC injection region with an 8 mm injector. According to the findings it can be said that the calf region of female genders is more applicable than male genders for SC injection. Calf region could be proposed as anticoagulation treatment.

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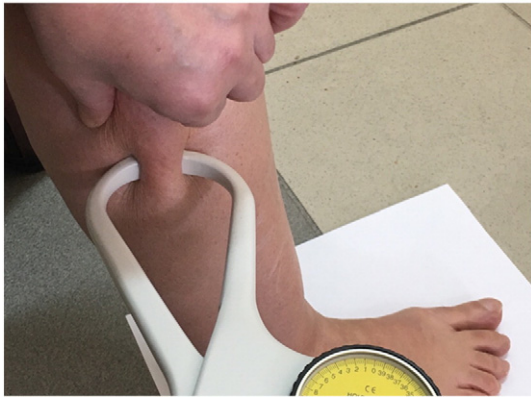
1. Introduction

Subcutaneous injection is the administration of 0.5 cm³ water-soluble drug, using a needle (No. 25 and 8–15–18 mm long), to the connective tissue under the dermis (Potter & Perry, 2011; Hall, 2004; Kim, 2005; Gibney et al., 2010; Zeraatkari et al., 2005). Subcutaneous tissue thickness varies by body mass index and several body regions (Smith, Sargent, Wilson, & Price, 1991). Therefore, subcutaneous (SC) injection is administered at a 45–90° angle (Potter & Perry, 2005; Acaroğlu et al., 2008; Ulusoy & Görgülü 2001; Ay, 2007). The angle must be 90° when pen injectors are used (Şenturan, Karabacak, Ecevit Alpar, & Sabuncu, 2008). SC injection of vaccines, hormone replacement, and anticoagulant agents requires short- or long-term treatment. For type 1 diabetes patients it is typically required as a lifelong injection

(Karadakovan & Eti-Aslan, 2011). The injection site is changed by rotation in patients administered SC injection in order to avoid hematoma, lipohypertrophy, and lipodystrophy (Akpınar, Polat, Yaman, & Özer, 2010; Akpınar & Çelebioğlu, 2008; Rızalar et al., 2007; Zaybak & Khorshid, 2008; Kuzu, 1999). The most appropriate body regions for self-injection of patients for a SC injection are the outer surfaces of the upper arm, the abdomen region from the lower end of the costae to the iliac processes, and the anterior face of the femurs (Potter & Perry, 2011; Hall, 2004; Kim, 2005; Potter & Perry, 2005; Acaroğlu et al., 2008). The regions over the scapula and the hip can be used as a site for SC injection; however, they fall outside the application area for self-injection. Lipodystrophy, ecchymosis, or hematoma, developing on the injection site despite protective measures, prevents the use of the application area (Akpınar et al., 2010; Akpınar & Çelebioğlu, 2008; Rızalar et al., 2007; Zaybak & Khorshid, 2008; Kuzu, 1999; Zaybak, 2008). This leads to a limited number of injection sites for nurses and self-injecting patients during the rotation. The calf region is important, since it is easy to access and adds extra injection site to the rotation.

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Picture 1. Measurement side of calf region with caliper.

2. Material and method

The study was designed as a descriptive and an anthropometric study aiming to determine the calf region applicability on subcutaneous injection. The universe consisted of 161 young adults were students from Çukurova University, Faculty of Health Science between March 2013 and December 2014.

Students whose measurements were taken are all agreed to participate in the study and were randomly selected. Approval was obtained from the study sites, Çukurova University, Faculty of Health Science and Ethics Committee of Çukurova University, Faculty of Medical School.

2.1. Data and sample

The data were collected by obtaining the demographic characteristics and checking the body mass indexes of young adults who agreed to participate in the study. The skin fold thicknesses of exterior arm, anterior and lateral femur, anterior abdomen, medial and lateral calf were measured. And with these measurements; the applicability of the calf region to subcutaneous injection was compared with the other injection regions (for needle No. 25 and 8–15–18 mm long). These measurements were taken by using a Holtain skinfold caliper (Picture 1).

The leg length of the young adult was measured by using a measuring tape. While the young adult was in the fowler position with a free lower leg; the skin and the subcutaneous tissue on the calf's lateral surface (which is approximately 10 cm below the knee's lateral surface) was grab by using the thumb and index finger, and the thickness of this skin fold was measured by using the skinfold caliper. The measurement process was repeated for the outer arm (lateral aspect of the arm, one-third of the landmark between the acromion of the scapula and the head of the radius), anterior femur (anterior aspect of the thigh from the linear line centering the muscle extending from the muscle anterior

quadriceps femur on one-third area), lateral femur (lateral aspect of the thigh from the linear line centering the vastus lateral muscle on 1/3 area), anterior abdomen (anterior side to the thickest part of the rectus abdominal muscle from the linear line between the anterior superior iliac spine and the umbilicus) and calf (the lateral aspect of the gastrocnemius muscle) (Picture 1). The measurement was made three times in order to eliminate measurement errors and the arithmetic mean of the results was calculated. The obtained result was considered as subcutaneous tissue thickness and analyzed statistically.

2.2. Statistical analysis

The statistical analysis of the data was made using SPSS 20 packaged software. Categorical measurements were summarized in numbers and percentages; numerical measurements were summarized in mean and standard deviation (median where required, and min.-max.). The comparison of tissue thickness measurements between genders was made using *t*-test in independent groups. The interactions between anthropometric measurements within each other and other numerical measurements (such as age, length, BMI) were analyzed using Pearson's Correlation coefficient and related *P* values. Statistical *P* value was considered 0.05 for all tests.

3. Results

The present study included 161 participants (male: 80, female: 81) with a mean age of 20.09 ± 2.268 years. Body mass index was for females $23, 13 \pm 3, 5$ (17–33) and $23, 17 \pm 3, 3$ (17–32) for males.

All anthropometric measurements were found statistically significant when compared with gender ($P < 0.005$).

Considering subcutaneous injection applicability of calf (M. gastrocnemius) region by injector size of 8 mm, 15 mm and 18 mm; 86.3%, 59.6% and 47.8% of the population, respectively were found applicable for this region.

4. Discussion

This study was conducted to compare the tissue thicknesses of the calf versus the outer arm, the anterior femur, lateral femur, and the anterior abdomen. And to determine the applicability of the calf region for subcutaneous (SC) injections, in order to enable the use of subcutaneous tissue of the lateral calf region in addition to SC injection sites during drug administration. Based on the study data, calf (M. gastrocnemius) region was found applicable for subcutaneous injections with an 8-mm injector size for 86.3% of the population. Considering the applicability for 8-mm and 15-mm injector size, 59.6% and 47.8%, respectively were found applicable for this region. It can be suggested that the calf region of the female population is more applicable for SC injections compared with the male population.

The mean values of subcutaneous tissue thicknesses at the calf, anterior abdomen, lateral femur, anterior femur, and outer arm were respectively, $23,72 \pm 6,95$, $23,92 \pm 5,36$, $29,08 \pm 5,93$, $29,91 \pm 6,05$ and

Table 1
The demographic and anthropometric data by gender.

| Measuring sites | Female (n = 80) Mean \pm SD (mm) | (Min-max) | Male (n = 81) Mean \pm SD (mm) | (Min-max) | P value |
|-----------------------|---------------------------------------|-----------|-------------------------------------|-----------|------------|
| Age | 20,09 \pm 1,7 | (18–28) | 20,81 \pm 2,5 | (17–32) | |
| BMI | 23,13 \pm 3,5 | (17–33) | 23,17 \pm 3,3 | (17–32) | |
| Tissue thickness (mm) | | | | | |
| Calf | 23,72 \pm 6,5 | (7–40) | 12,09 \pm 6,4 | (5–34) | $P < 0005$ |
| Anterior abdomen | 23,92 \pm 5,3 | (13–38) | 16,93 \pm 8,4 | (4–37) | $P < 0005$ |
| Lateral thigh | 29,08 \pm 5,92 | (17–40) | 13,88 \pm 7,4 | (4–37) | $P < 0005$ |
| Anterior thigh | 29,91 \pm 6 | (3–40) | 16,22 \pm 7,4 | (3–40) | $P < 0005$ |
| Outer arm | 24,87 \pm 6,1 | (13–39) | 14,72 \pm 7,6 | (1–39) | $P < 0005$ |

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