

# The Impact of Toe Amputation on the Quality of Life of Diabetic Foot Patients: A Cardiff Wound Impact Schedule (CWIS) Evaluation

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**Abstract:** *Background:* The treatment and management of diabetic foot significantly impact the quality of life (QoL) of patients, yet studies concerning the effects of toe amputation on QoL are relatively limited. *Methods:* This study included 12 diabetic foot patients with Wagner Grade 4 who underwent toe amputation. Using the Cardiff Wound Impact Schedule (CWIS), we systematically assessed their QoL before and after the surgery. *Results:* Data indicated that there were significant improvements in multiple areas of QoL post-surgery. Particularly in the domains of “overall quality of life” and “well-being,” average scores demonstrated noticeable declines compared to pre-surgery levels. Statistical analysis further confirmed the significance of these results. *Conclusion:* Toe amputation holds significant value in enhancing the QoL for diabetic foot patients. This study provides robust evidence for clinical decision-making, emphasizing that treatment choices should consider the QoL of the patient in addition to physiological outcomes.

**Keyword:** Cardiff Wound Impact Schedule; Diabetic foot; Toe amputation

**Online publication:** March 20, 2024

## 1. Introduction

Diabetes is a global public health issue that places enormous stress on healthcare systems and individual patients alike <sup>[1]</sup>. Diabetic foot complications, in particular, are of high concern. According to global diabetes research reports, approximately 15–25% of diabetic patients will experience at least one foot complication in their lifetime <sup>[2]</sup>. These complications often lead to more severe issues, such as infections, ulcers, and even toe or limb amputations.

Although prevention and early intervention are the preferred strategies for treating diabetic foot, toe amputations or even more advanced forms of amputation may be inevitable in cases with advanced disease or severe complications <sup>[3,4]</sup>. Such surgeries are generally performed in situations graded as Wagner 4, accompanied by osteomyelitis or gangrene <sup>[5]</sup>.

Increasingly, research is focusing on patients' quality of life (QoL) post-medical intervention, especially after major surgeries like toe amputation. Understanding how surgeries impact QoL not only aids physicians in

making more comprehensive and personalized treatment decisions but also provides patients with more realistic and complete prognostic information <sup>[6]</sup>.

To accurately assess the post-operative QoL of diabetic foot patients who have undergone toe amputation, we chose the Cardiff Wound Impact Schedule (CWIS) for evaluation <sup>[7]</sup>. CWIS is a validated, highly reliable, and effective scoring tool that comprehensively considers multiple aspects like “overall quality of life,” “well-being,” “physical symptoms and daily living,” as well as “social life” <sup>[8]</sup>.

## **2. Methods**

### **2.1. Study design**

This study aims to evaluate the changes in the QoL of diabetic foot patients post-toe amputation by comparing pre- and post-surgery CWIS scores, intending to explore whether QoL significantly improves after toe amputation.

### **2.2. Study population and inclusion and exclusion criteria**

The study selected diabetic foot patients aged between 40 and 80 years. Inclusion criteria were those graded as Wagner 4, accompanied by osteomyelitis or gangrene. Exclusion criteria included patients who failed to follow up after six weeks. In total, 12 eligible patients were included, six of whom were male and six were female.

### **2.3. Application of the CWIS score**

The CWIS scoring system was utilized as the assessment tool <sup>[9]</sup>. This scoring system includes four aspects <sup>[10]</sup>:

- (1) “Overall quality of life” contains two items scored out of 10 (total score of 20).
- (2) “Well-being” contains seven items scored on a scale from 1 (“not at all”) to 5 (“always”), totaling 35.
- (3) “Physical symptoms and daily living” are divided into experiences and stress, totaling 24 items scored out of 5 (total score of 120).
- (4) “Social life” is divided into experiences and stress, totaling 14 items scored out of 5 (total score of 60).

Higher scores correspond to lower well-being. All participants completed the score both pre-amputation and six weeks post-amputation.

### **2.4. Data collection and processing**

Data were primarily collected at two time points (pre-surgery and six weeks post-surgery), patients were guided by professional medical staff to fill in the CWIS. All data were anonymized to ensure participant privacy. Subsequently, the data were entered into a spreadsheet and cleaned for statistical analysis.

### **2.5. Statistical analysis**

Initially, a descriptive statistical analysis was performed for all variables, including the calculation of mean and standard deviation (SD). Paired sample *t*-tests were then employed to compare pre- and post-surgery CWIS scores. Lastly, *t*-distribution tables were consulted to ascertain the *t*-values for each aspect of the CWIS score.

## **3. Results**

### **3.1. Patient information**

A total of 12 patients with diabetic foot were included in this study, ranging in age from 40 to 80 years. All

patients had a Wagner classification of Grade 4, accompanied by osteomyelitis or gangrene. The sample comprised 6 males and 6 females. All patients successfully completed the 6-week follow-up.

### 3.2. Changes in CWIS scores

To accurately assess the changes in the QoL in diabetic foot patients following toe amputation, the Cardiff Wound Impact Schedule (CWIS) was employed. The detailed data and differences in CWIS scores before and after the surgery are summarized in **Table 1**. The two groups of data in the table are the average and variance of the scores and total scores in four aspects of CWIS before and after the surgery.

**Table 1.** CWIS scores before and after the surgery

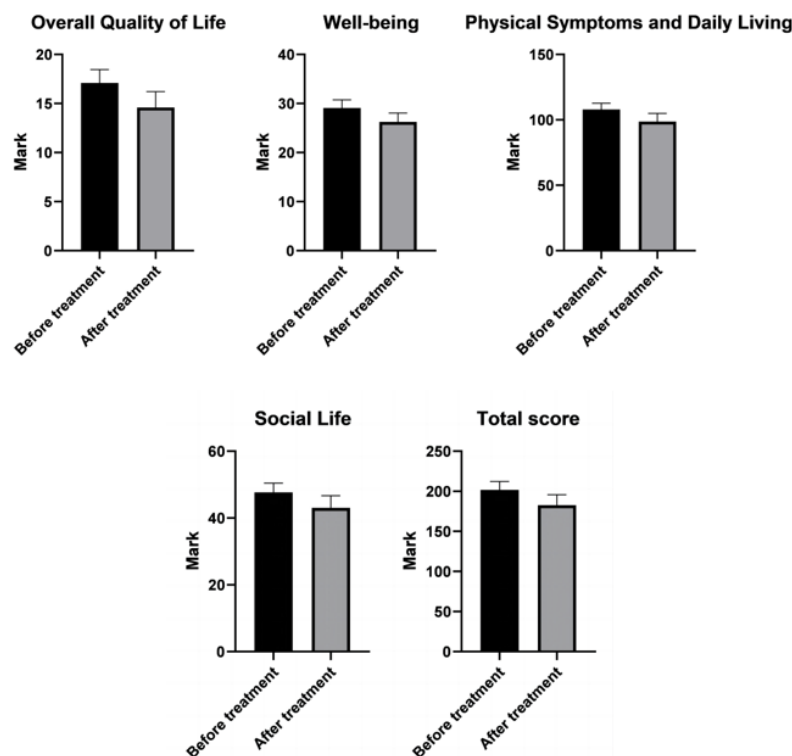
Parameters	Before treatment		After treatment		Variation	
	Mean	SD	Mean	SD	Mean	%
Overall quality of life	17.08	1.38	14.58	1.62	-2.50	12.50
Well-being	29.08	1.68	26.25	1.82	-2.83	8.09
Physical symptoms and daily living	107.92	4.74	98.67	6.21	-9.25	7.71
Social life	47.67	2.77	43.00	3.67	-4.67	6.67
Total score	201.75	10.46	182.50	13.19	-19.25	8.19

According to **Table 1**, the pre-surgery average score for “overall quality of life” was 17.08 (SD = 1.38), which reduced to 14.58 (SD = 1.62) post-surgery, a mean decrease of 2.5, or 12.5%. The pre-surgery average score for “well-being” was 29.08 (SD = 1.68), and it was 26.25 (SD = 1.82) post-surgery, marking a mean decrease of 2.83, or 8.09%. For “physical symptoms and daily living,” the pre-surgery mean score was 107.92 (SD = 4.74), and the post-surgery mean score was 98.67 (SD = 6.21), representing a mean decrease of 9.25, or 7.71%. “Social life” had a pre-surgery mean score of 47.67 (SD = 2.77), which dropped to 43 (SD = 3.67) post-surgery, a mean decrease of 4.67 or 6.67%. The total score dropped from a pre-surgery mean of 201.75 (SD = 10.46) to a post-surgery mean of 182.50 (SD = 13.19), a mean decrease of 19.25, or 8.19%. The most substantial decline in scores was observed in the “overall quality of life” aspect, while the least decline was seen in “social life.”

### 3.3. Statistical analysis

Paired samples *t*-tests were performed on the collected data to determine its statistical significance, and the results are visually represented in **Figure 1**.

For “overall quality of life,”  $t = 7.461$ ,  $df = 11$ ,  $P < 0.0001$ ; for “well-being,”  $t = 9.530$ ,  $df = 11$ ,  $P < 0.0001$ ; for “physical symptoms and daily living,”  $t = 9.172$ ,  $df = 11$ ,  $P < 0.0001$ ; and for “social life,”  $t = 5.897$ ,  $df = 11$ ,  $P < 0.0001$ . For the overall CWIS score,  $t = 8.184$ ,  $df = 11$ ,  $P < 0.0001$ . All these results showed statistically significant differences between the two sets of scores. The paired samples *t*-test was the best choice for analyzing this type of data because it compares the scores of the same patients at different points in time. According to the CWIS, a higher score indicates poorer well-being. Therefore, the statistically significant decrease in average scores in all four aspects and the total score post-surgery suggests a substantial improvement in the patients’ quality of life.



**Figure 1.** Paired samples *t*-tests for the four aspects of CWIS scores and the total score, before and after the surgery

## 4. Discussion

In this study, we observed a significant improvement in the quality of life of diabetic foot patients following toe amputation. Firstly, the most noticeable decrease in “overall quality of life” scores was 12.5%, suggesting that patients experience not only an improvement in physical comfort but also increased psychological and emotional satisfaction after undergoing toe amputation. This is crucial for the overall well-being and recovery process of the patients. Physical discomfort often negatively influences emotional states, leading to issues like anxiety and depression. Our data suggest that toe amputation could be an important intervention for enhancing the overall quality of life in patients with diabetic foot.

Scores in “physical symptoms and daily life” and “social life” both decreased by 6.67%, a smaller margin. This suggests that, although the surgery provides some physical benefits, there may still be some limitations or challenges in social interaction and daily activities. These differences may be due to various factors, such as individual differences among patients, the surgical technique employed in toe amputation, and postoperative rehabilitation treatments.

Diabetic foot is a global public health concern that significantly impacts the quality of life and survival rates of a large number of diabetic patients. Against this backdrop, focusing on the quality of life of diabetic foot patients becomes particularly important. An improved quality of life is not only beneficial for the psychological well-being of patients but is also closely related to better disease management and prognosis. The findings of this study further highlight the pivotal role of medical interventions like toe amputation in improving the quality of life of patients with diabetic foot.

However, the study does have some limitations. Firstly, the sample size is relatively small and may not be reflective of the broader diabetic foot population. Additionally, while the CWIS is a well-recognized evaluation tool, its adaptability to different cultural and geographical contexts requires further investigation<sup>[11]</sup>.

Based on these findings and limitations, we recommend that future research should expand the sample size and include participants from diverse cultural and geographical backgrounds to obtain more comprehensive data.

## 5. Conclusion

Utilizing the Cardiff Wound Impact Schedule (CWIS), we systematically evaluated the changes in the quality of life of diabetic foot patients before and after toe amputation. The data indicates a significant improvement in various aspects of life quality post-surgery, especially in the dimensions of “overall quality of life” and “well-being.”

These findings provide valuable insights for clinicians. When determining treatment plans, physicians should take into account not only physiological factors and therapeutic efficacy but also the patient’s quality of life and its changes. The conclusion of this study emphasizes the importance of surgical intervention in enhancing patients’ quality of life.

Moreover, these findings have significant implications for diabetic foot patients and their family members. Knowing the positive changes post-surgery can help patients and their families set more optimistic expectations, further promoting the recovery process and improving treatment adherence. However, it should be noted that each patient’s situation is different. While the overall quality of life has improved, some patients may still face difficulties or challenges. Therefore, physicians should closely monitor each patient’s individual needs and responses during the decision-making and treatment processes.

## Disclosure statement

The authors declare no conflict of interest.

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