Interobserver Analysis of Albertoni Classification for Mallet Finger, Using Plain Radiography: Importance of the Goniometer*

Análise interobservador da classificação das lesões em dedo em martelo segundo Albertoni, utilizando-se radiografias simples: Importância do uso do goniômetro

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Abstract

Objectives The objective of the present study is to evaluate the intraobserver and interobserver reliability of the Albertoni classification for mallet finger. Evaluation of goniometer device application is also an objective.

Methods A total of 10 lateral radiographs of patients with mallet finger were selected and measured by 60 orthopedic surgeons with and without the use of goniometer.

Results The intra- and interobserver reliability coefficients found were high. With the use of a goniometer, the interobserver reliability coefficient was even higher, but without statistical relevance.

Conclusion The Albertoni classification showed high intraobserver and interobserver reliability in assessing mallet finger lesions, and the goniometer is dispensable for this purpose.

Keywords

- acquired hand deformities/ classification
- finger injuries
- reproducibility of results
- rupture
- tendon injuries

Resumo

Objetivos Quantificar o grau de concordância intra- e interobservador da classificação Albertoni e avaliar a importância do uso do goniômetro na diferenciação do grau da lesão.

Métodos Foram selecionados 10 casos de dedo em martelo, os quais foram avaliados por 60 examinadores.

Resultados A concordância interobservador sem o uso do goniômetro foi elevada. Com o uso do goniômetro, obteve-se um "kappa" ainda maior, porém sem relevância estatística.

Conclusão A Classificação de Albertoni possui elevada concordância intra- e interobservador, e o uso do goniômetro se mostrou dispensável para classificar.

Palavras-chave

- deformidades adquiridas da mão/ classificação
- traumatismos dos dedos
- reprodutibilidade dos testes
- ruptura
- traumatismos dos tendões

* Study conducted at Hospital Vera Cruz, Belo Horizonte, MG, Brazil.

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Introduction

Mallet finger is, by definition, the rupture of the terminal extensor mechanism, resulting in a flexural deformity of the distal phalanx.[1]

Extensor mechanism injuries are very common in hand injuries. The third, fourth and fifth fingers of the dominant hand are the most affected, and 95% of the lesions are closed. The general mechanism of injury is a trauma on the fingertip causing sudden flexion or counter-resistance extension.[1,2]

This lesion, if left untreated, could result in an elongated and potentially less functional tendon. Rupture of the capsule and retinacular ligaments leads to greater deformity. Importantly, the fibers of the oblique retinacular ligament also have a role in the extension. Bone injuries by avulsion cause similar deformities due to disinsertion alongside the fragment of tendon and ligament structures.[2–4]

The present research has as overall objective to quantify the intra- and interobserver agreement of the Albertoni classification, and to evaluate the importance of using the goniometer in the lesions of the terminal extensor mechanism of the finger[3,5,6] (►**Figure 1**).

Materials and Methods

The study protocol was approved by the institutional ethics committee, under the number CAAE 57854216300005135.

This is a cross-sectional observational study conducted between August 08 and 22, 2016. A total of 10 cases with mallet finger injuries were selected to be examined by lateral radiographs, with and without the use of the goniometer. All images were digitalized and then analyzed by orthopedists and orthopedics residents working in public and private health services in the city of Belo Horizonte, state of Minas Gerais, Brazil and its metropolitan region. The questionnaire is divided into two parts, each containing 10 questions and a heading with information about the professional formation (Supplementary Material 1).

We have omitted types C and D from the Albertoni classification to emphasize angle measurement and the use of the goniometer. In types C and D, angulation is not essential for classification (in addition, they are rarer lesions).

In one of the questionnaires, the radiographs should be analyzed without the use of a goniometer (NG) and in the other with the use of this instrument (WG). The inclusion criteria of professionals were familiarity with the use of the goniometer and knowledge of the Albertoni classification for mallet finger. The radiographs were evaluated by 60 professionals, being 20 orthopedic residents, 32 orthopedists, and 8 hand surgeons.

To describe the angle between the questions and between the question classifications, measures of central tendency, dispersion and position were used. To verify intra- and interobserver agreement, the Kappa coefficient was used.[7,8]

The software used in the analysis was R, version 3.2.2.

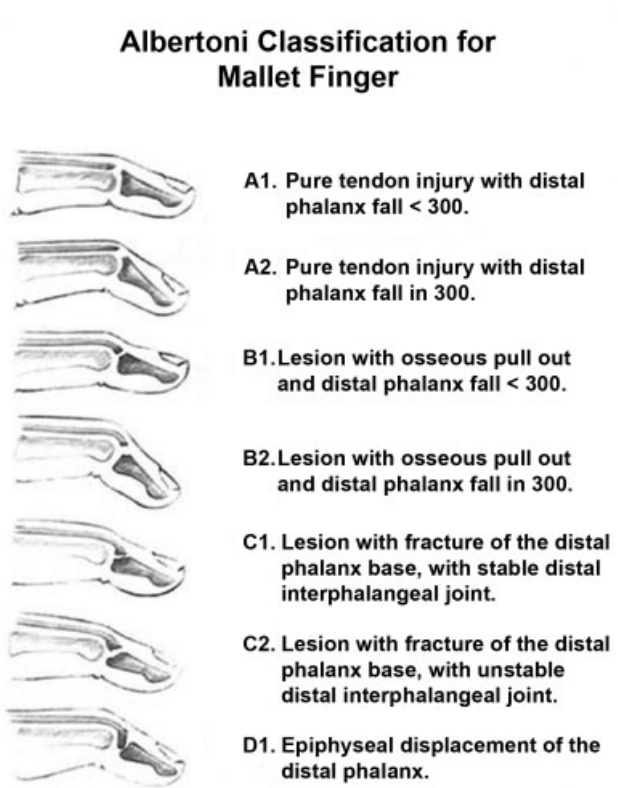

Fig. 1 Scheme demonstrating the classification proposed by Albertoni (We have omitted types C and D to emphasize angle measurement). Source: Albertoni et al.[7]

Results

A total of 60 questionnaires were applied. Of these, two questionnaires were excluded because they were not complete or had angles measured with unreadable letters.

►**Table 1** presents the observers considering the formation of "Hand Surgery". Eight (13%) of respondents were hand surgery specialists.

►**Table 2** presents the description of the questions classification with and without use of the goniometer. The response agreement percentage was high, and in questions 2 and 8 the majority was classified as "A", in questions 3, 4 and 5 most were classified as "B", in questions 1, 6, 7 and 9 most were classified as "C" and in question 10 most were classified as "D".

The following ►**Figure 2** illustrates the information of the table above.

►**Table 3** presents the mean angle measured by the interviewees.

The following ►**Figure 3** illustrates graphically the information of the table above.

Table 1 Description of subspecialty and professional formation variables

		n	%
Hand Surgery Specialist	No	50	86%
	Yes	8	13%

Table 2 Description of Questions Classifications with and without Goniometer use

Questions	Questions without using the Goniometer								Questions using the Goniometer							
	A1		A2		B1		B2		A1		A2		B1		B2	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Question 1	0	0.0%	0	0.0%	58	100.0%	0	0.0%	0	0.0%	0	0.0%	57	100.0%	0	0.0%
Question 2	58	100.0%	0	0.0%	0	0.0%	0	0.0%	54	94.7%	3	5.3%	0	0.0%	0	0.0%
Question 3	0	0.0%	57	98.3%	1	1.7%	0	0.0%	0	0.0%	56	98.2%	0	0.0%	1	1.8%
Question 4	7	12.1%	46	79.3%	1	1.7%	4	6.9%	4	7.0%	52	91.2%	0	0.0%	1	1.8%
Question 5	1	1.7%	56	96.6%	1	1.7%	0	0.0%	1	1.8%	56	98.2%	0	0.0%	0	0.0%
Question 6	1	1.7%	0	0.0%	54	93.1%	3	5.2%	2	3.5%	0	0.0%	53	93.0%	2	3.5%
Question 7	0	0.0%	1	1.7%	55	94.8%	2	3.4%	1	1.8%	0	0.0%	55	96.5%	1	1.8%
Question 8	55	94.8%	2	3.4%	1	1.7%	0	0.0%	55	96.5%	2	3.5%	0	0.0%	0	0.0%
Question 9	0	0.0%	4	6.9%	54	93.1%	0	0.0%	0	0.0%	0	0.0%	56	98.2%	1	1.8%
Question 10	0	0.0%	0	0.0%	0	0.0%	58	100.0%	0	0.0%	0	0.0%	0	0.0%	57	100.0%

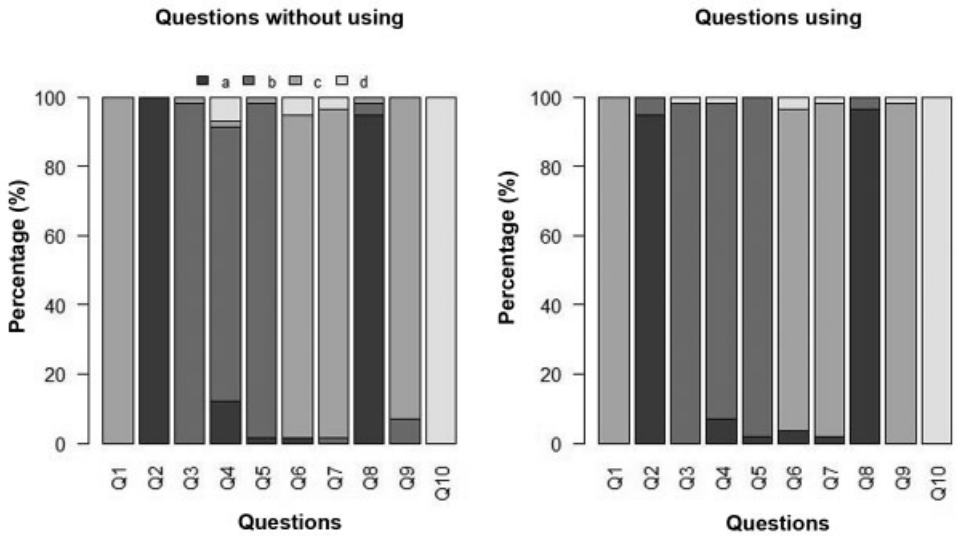

Fig. 2 Description of using and without using questions classifications.

Table 3 Description of the angle between the questions

Angle	Mean	SD	Min.	1° Quartile	2° Quartile	3° Quartile	Maximum
Question 1	18.32	3.78	10.00	16.00	20.00	20.00	28.00
Question 2	22.47	4.15	13.00	20.00	21.00	26.00	35.00
Question 3	40.95	4.01	30.00	40.00	40.00	44.00	50.00
Question 4	35.35	4.90	26.00	32.00	35.00	40.00	48.00
Question 5	35.47	4.49	28.00	32.00	35.00	39.00	49.00
Question 6	21.53	3.49	10.00	20.00	20.00	22.00	32.00
Question 7	9.86	4.64	2.00	8.00	10.00	11.00	35.00
Question 8	17.46	5.46	10.00	13.00	18.00	20.00	32.00
Question 9	11.79	4.58	4.00	10.00	10.00	12.00	35.00
Question 10	44.33	4.62	34.00	40.00	45.00	48.00	58.00

Abbreviation: Standard deviation.

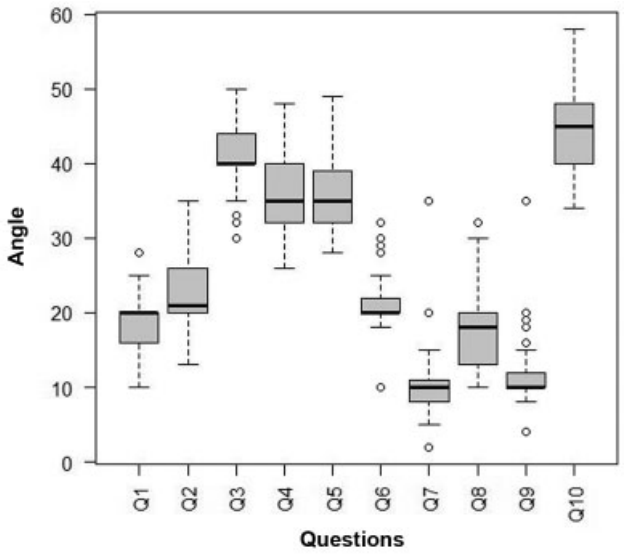

Fig. 3 Description of the angle between the questions.

►**Table 4** presents the intraobserver and interobserver agreement for each question. From this, it can be highlighted that the agreement was high for all questions, and:

- Regarding the intraobserver agreement ("with goniometer" versus "no goniometer"), questions 1 and 10 presented 100% agreement, while question 4 presented the lowest agreement. The Kappa coefficient presented a value of 0.906, which indicates a high agreement ($p = 0.000$).

Table 4 Intraobserver and Interobserver agreement for each Question

Question	Intraobserver		Interobserver			
			Without using		Using	
	n	%	*n*	%	*n*	%
Question 1	57	100.0%	58	100.0%	57	100.0%
Question 2	54	94.7%	58	100.0%	54	94.6%
Question 3	55	96.5%	57	98.2%	56	98.2%
Question 4	45	78.9%	46	79.0%	52	91.1%
Question 5	54	94.7%	56	96.5%	56	98.2%
Question 6	53	93.0%	54	93.0%	53	92.9%
Question 7	53	93.0%	55	94.7%	55	96.4%
Question 8	52	91.2%	55	94.7%	55	96.4%
Question 9	52	91.2%	54	93.0%	56	98.2%
Question 10	57	100.0%	58	100.0%	57	100.0%
Kappa	0.906		0.829		0.865	
P-Value	0.000		0.000		0.000	

Discussion

The importance and efficiency of a classification is based on simplicity and reproducibility. It should also allow the comparison between scientific studies and present high agreement between examiners.[9,10] In assessing the reliability and agreement among observers, there is a need to consider chance in the evaluation,[11,12] and for that the Kappa method of comparison is used. The use of the goniometer and its influence on the agreement in this classification was also incorporated in this work.[11,13,14]

►**Table 2** shows the distribution of answers for each question without and with the use of the goniometer. We see that the questions 1, 2, 3, 5, 6, 7, 8, 9 and 10 presented low intra- and interobserver variation. Question 4 presented greater disagreement for the same answer. This is because this question demonstrates a mallet finger injury with borderline measurement.[15–17]

There was uniformity between the responses, demonstrated by a standard deviation with little variation between them (between 3.49° and 5.46°). In question 8, the distal phalanx presented a deformity, which may have affected these isolated results obtained. In the boxplot chart, it is shown that the variation of angles between quartiles of each question was small, with a mean of 5.1° (smaller difference: 2° / greater difference: 8°). No work was found as a reference for comparison with this data. However, we consider the values obtained as adequate.[18,19]

The results of the intra- and interobserver evaluation were excellent, as shown by ►**Table 4**, following the Kappa Intraclass Coefficient Scale (►**Table 5**).

There was no statistically significant difference between the evaluators considering the formation (resident, orthopedist or hand surgeon). Noting that residents who did not know the classification, or who reported not knowing how to use the goniometer, were not included.

The interobserver agreement for each question without using the goniometer with Kappa index 0.829 (excellent) suggests that even without the instrument, the classification is reproducible for different observers. The use of the goniometer generated a slightly higher kappa of 0.865, which shows that the goniometer can increase agreement, but without statistical significance.[20–22]

Table 5 Kappa Intraclass Coefficient Scale

Kappa	Interpretation
< 0	No Agreement
0 - 0.19	Poor
0.20 - 0.39	Fair
0.40 - 0.59	Moderate
0.60 - 0.79	Good
0.80 - 1	Excellent

Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1977; 33: 159-179.

The intraobserver measure of agreement, by comparing results obtained with and without the use of the goniometer, showed a Kappa index of 0.906. For this work, it was established that the classification does not require the use of the goniometer and that the assessment by a professional who is aware of the classification (orthopedic resident, orthopedist or hand surgeon) is sufficient.

Conclusion

We conclude that the Albertoni classification is simple, reproducible and with good intra- and interobserver agreement, both with and without the goniometer. The use of the goniometer slightly increased the interobserver agreement, but without statistical significance, suggesting that it is a dispensable instrument for Mallet Finger assessment.

Conflict of Interests
The authors have no conflict of interests to declare.

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