



VALIDATION OF THE INDONESIAN CARPAL TUNNEL SYNDROME QUESTIONNAIRE TO OBSERVE ITS INCIDENCE IN DENTISTS

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ABSTRACT

Carpal tunnel syndrome (CTS) has been identified as a work-related condition and is significantly more prevalent in individuals who use hand instruments that generate vibration and require repetitive motion and heavy force, such as dentists. CTS might be assessed using both subjective and objective methods, including the Carpal Tunnel Syndrome (CTS) Questionnaire and the Phalen test, respectively. The present study aimed to construct an Indonesian version of the CTS questionnaire and to analyze whether this translated questionnaire could be used as a subjective measurement tool, since this study was conducted in Indonesia. The CTS questionnaire was translated into Bahasa Indonesia, followed by a standardized cross-cultural adaptation procedure, and was subsequently distributed to sixty-five dentists selected through simple random sampling. The validity and reliability of the translated questionnaire were analysed using corrected item-total correlation and Cronbach's alpha tests, respectively, with statistical analysis performed by IBM SPSS. The validity of each item was in the range from 0.321 (min) to 0.895 (max), and the reliability of the questionnaire was 0.901. These findings indicated that the Indonesian version of the CTS questionnaire has satisfactory psychometric properties, including adequate validity and reliability.

Keywords: carpal tunnel syndrome; dentist; questionnaire; reliability; validity

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INTRODUCTION

The dental practitioner requires a high degree of precision and technical skill to perform dental treatments. The tendency to perform awkward postures while working on the patient, such as bending the body towards the patient, twisting the trunk, raising the arms, and staying in a static posture during working hours, is a common issue among dentists. The dentist's awkward posture generates unsupported pressure that is further transmitted to the lower back, neck, and shoulder muscles. It can also lead to muscle tension, pain, and fatigue. If these occur repeatedly for a long time, the cumulative effect can result in musculoskeletal disorders (MSDs) (Alhusain et al., 2019; Alshouibi et al., 2020; Analdi et al., 2024; Anggraini, Ranggaini, et al., 2024a, 2024b; Annisa et al., 2021; Ariyani et al., 2022, 2024; Larasati et al., 2022; Safitri et al., 2025; Veeresh et al., 2015; You et al., 2014). Dentists have been reported to be at high risk of suffering MSDs (Analdi et al., 2024; Ariyani et al., 2024; Syahril et al., 2025), with the prevalence ranging from 10% to 97.9% (Thorat et al., 2022). Lower back pain was the most common body part complained about by dentists, followed by neck pain, upper back body pain, shoulder pain, and hand/wrist pain (Analdi et al., 2024; Ariyani et al., 2024; Trisha et al., 2025; Veeresh et al., 2015).

The vibration, heavy hand force, and repetitive movement generated by held-hand instruments play a role in inducing hand or wrist pain. This symptom is identified as Carpal Tunnel Syndrome (CTS) (Alhusain et al., 2019; Annisa et al., 2021; Ariyani et al., 2025; Haghighi et al., 2013; Larasati et al., 2022; You et al., 2014). CTS has negatively impact on an individual's life quality, daily activities, productivity, and sleep quality (Brigitta et al., 2024; Chenna et al., 2023). A previous study (Javed et al., 2023) found that 40% of dentists experienced mild hand or wrist pain during a day, and 30%

complained of wrist pain 1-2 times a day. Mild and moderate hand weakness was also experienced by 40% and 6% of dentists, respectively. Even a meta-analysis report stated that one in seven dentists might experience CTS (Chenna et al., 2023).

CTS arises when the nervus medianus becomes compressed due to the inflammation or thickening of the surrounding structures as it passes through the carpal tunnel in the wrist (Ariyani et al., 2024; Genova et al., 2020; Sevy JO; et al., 2024). The carpal tunnel is a narrow tunnel structure on the wrist (Anggraini et al., 2025), bordered by the ossa carpi, or ossa carpalia, at the lower part. It is bordered medially by the os. pisiform, the hamulus of the os. hamatum, and laterally by os. scaphoideum and os. trapezium. The roof of the carpal tunnel is formed by fibrous connective tissue, which is well-known as the retinaculum flexorum carpi, attached to the os. scaphoideum, os. trapezium, os. lunatum, and os. pisiform (Anggraini et al., 2024; Ferreira, 2023). Inside the carpal tunnel, the nervus medianus traveled and provided motoric branches for the group of thenar muscles and sensory branches for the palmar side of the thumb, index, middle, and radial sides of the ring finger. Its compression may trigger pain, tingling, and paresthesia in the area innervated by the nervus medianus (Anggraini et al., 2025; Annisa et al., 2021; Ariyani et al., 2025; Newington et al., 2015). The damage to the myelin sheath surrounding the Ranvier node of the nervus medianus might also occur due to compression, and if it lasted over a prolonged period, the motor nerve suffered more damage than the sensory nerve (Chen et al., 2023). The accumulated adipose tissue within the carpal tunnel may lead to the compression of the nervus medianus and injure the sensory nerve (Becker et al., 2002; Tang et al., 2022).

The movement of the wrist may change the form and size of the carpal tunnel. During wrist movement in the normal range, the width of the carpal tunnel may decrease significantly and result in increased pressure. The flexion and extension movement may also trigger an elevation of the pressure inside the carpal tunnel, up to 8–10 times (Ariyani et al., 2024; Sevy JO; et al., 2024), which then leads to protein and inflammatory cell accumulation in the nervus medianus area and results in blood vessel damage (Annisa et al., 2021; Genova et al., 2020; Javed et al., 2023). The use of hand-held instruments in combination with repetitive movement, heavy hand pressure, vibration, and the flexion and extension of the wrist over a prolonged period of time may wrist generates an increased pressure leading to injury of the nervus medianus (Annisa et al., 2021; Genova et al., 2020; Newington et al., 2015) and elevate the risk of developing CTS (Annisa et al., 2021; Ariyani et al., 2024; Newington et al., 2015). These factors contribute to thenar muscle weakening, which reduces hand grip strength and hand function (Alhusain et al., 2019; Annisa et al., 2021; Chenna et al., 2023; Newington et al., 2015).

A comprehensive approach to assessing whether a person is experiencing CTS symptoms requires a clinical history and a physical examination of the individual (Abdullah et al., 2019; Wang et al., 2020). The Phalen's test is a commonly used objective examination with high sensitivity for assessing the presence of CTS symptoms. It identifies the pain or paraesthesia in the area innervated by the nervus medianus (Cao et al., 2022; Samuellia Edyanto et al., 2024). Moreover, a subjective examination using a self-administered questionnaire may provide a valuable assessment of the severity of the CTS symptom history. The severity of CTS symptoms has been measured using a number of questionnaires, including the Boston Carpal Tunnel Questionnaire (BCTQ), the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, and the Michigan Hand Outcomes Questionnaire (MHQ) (Sambandam et al., 2008; Yücel & Seyithanoğlu, 2015). CTS severity and functional status of individual patients have been assessed using the BCTQ, which is considered “the gold standard” for CTS evaluation (Bakhsh et al., 2012; Bougea et al., 2018; Metro North Hospital and Health Service & Queensland Government, 2021b, 2021a; Multanen et al., 2020; Yücel & Seyithanoğlu, 2015). It has also been recommended as an effective measurement to determine pre- and postoperative patient-related outcomes of the CTS treatment (Bakhsh et al., 2012; Yücel & Seyithanoğlu, 2015).

The sample population of the present study was in Indonesia. Bahasa Indonesia is an official language and commonly used as the primary language of communication among Indonesian citizens. Therefore, it is necessary to adopt the questionnaire for the appropriate population and regional language. Previously, the BCTQ has been successfully adopted and translated into several languages and has shown a good validity construct with high internal consistency and high reliability (Abdullah et al., 2019; Alanazy et al., 2019; Bougea et al., 2018; Hassankhani et al., 2018; Karabinov et al., 2020; Khalid et al., 2023; Mosegaard et al., 2021; Multanen et al., 2020; Upatham & Kummerddee, 2008). Validity and reliability tests were further required to confirm that all items in the translated version of the questionnaire reflect the research concept and provide the same level of accuracy as the original version (Beaton et al., 2000; Bougea et al., 2018). The present study aimed to construct an Indonesian version of the BCTQ and then determine its validity and reliability for our sample population.

METHOD

This study was conducted with 65 respondents who were selected using simple random sampling. Only dentists with more than one year's experience in providing dental care treatment and who agreed to provide informed consent were included. Those with a history of musculoskeletal pathology or trauma, diabetes mellitus, thyroid disease, steroid medication, or neurological problems were excluded. All procedures applied to the present study have been approved by the Ethics Committee of the Faculty of Dentistry, Universitas Trisakti, under the number 251/S2/KEPK/FKG/4/2019.

The present study conducted adaptation and translation transculturally. The carpal tunnel syndrome (CTS) questionnaire used in the present study consisted of an eleven-item set of questions adapted from the BCTQ designed by Levine et al. (Metro North Hospital and Health Service & Queensland Government, 2021b; Von Der Heyde, 2007) to assess the severity of the symptoms experienced by the respondent on a typical day over the past two weeks. The respondents were asked to indicate their level of symptoms with each question on a Likert scale based on the level of symptom experienced, which addresses pain, numbness, weakness, tingling, and difficulty with fine motor tasks. A score of 0 indicated none of the symptoms, whereas a score of 4 indicated a high level of symptoms.

Adaptation Procedure

This cross-cultural measurement process followed Beaton et al.'s recommendation (Beaton et al., 2000). Briefly, two translators with different backgrounds were responsible for translating each item from the original questionnaire to Bahasa Indonesia. The first translator should understand the research concepts and each item in the research being quantified. Whereas the second translator was not informed about the concepts being quantified and was asked to determine whether the translated version conveyed by the first translator reflected the meaning of the original. The appropriate words that reflect the native language used by the population were used. Subsequently, the translated version was translated back into the English version. This step was undertaken to ensure that the translated version reflected the same content as the original version. Both versions of the questionnaire were further discussed to achieve agreement among the authors and translators and to ensure that the translated questionnaire was in equivalence with the research aim. Furthermore, the pre-final translated version of the questionnaire was distributed to 65 volunteer respondents to confirm that respondents would define each item as originally intended. The validity and reliability of the pre-final questionnaire were analysed statistically.

Validity Test

The validity test was employed to ascertain the validity of each item set and question in the pre-final CTS questionnaire. A questionnaire is considered valid if each item can reflect the information that is related to the variables under quantification. The validity test using Corrected Item-Total

Correlation was performed to evaluate the correlation between the items in the question set and the total item. The correlation coefficients were considered valid if the value for each item was greater than 0.3.

Reliability Test

A reliability test is a method of evaluating the degree of accuracy, precision, and reliability of a questionnaire. Internal consistency and reliability are linked to the extent of each item of the set question, providing an instrument that is homogeneous and capable of reflecting the research concepts. A reliability test using Cronbach's Alpha was performed to confirm that the pre-final questionnaire utilized in the present study was consistent and accurate.

The reliability of each item was measured by the Cronbach's alpha value, which represents the reliability coefficient. The pre-final questionnaire was considered reliable if it obtained an alpha coefficient of 0.60 or greater, indicating a positive correlation between individual items in the questionnaire. A Cronbach's alpha value of 0.60 or above indicates that the item is suitable for use (reliable). Conversely, a value below 0.60 indicates that the item is not reliable and unsuitable for use.

RESULT

The validity and reliability test involved a total of 65 respondents working as dental practitioners who met the inclusion criteria. The validity test of the pre-final translated version of the CTS questionnaire from the eleven-item set of questions was overall valid, with a range of 0.321 (min) to 0.895 (max); all items obtained corrected item-total correlation values higher than 0.3, indicating that they were valid, suitable, appropriate, and satisfactory for measuring CTS symptom severity. Subsequently, the Cronbach's alpha coefficient for the questionnaire obtained a value of 0.901, indicating that the pre-final questionnaire was reliable (Table 1). The responses provided by the respondents' answers to the questions can be used to assess the carpal tunnel syndrome severity with a high degree of consistency, and the construct of the pre-final CTS questionnaire can be trusted.

Table 1.
Validity Test Results of the Pre-Final Translated Carpal Tunnel Syndrome Questionnaire

	Question Item	Corrected Item-Total Correlation	Decision	Cronbach's Alpha	Decision
P1	<i>Seberapa parah rasa sakit pada bagian tangan dan pergelangan ketika malam hari?</i>	0.75	Valid	0.901	Reliable
P2	<i>Seberapa seringkah anda terbangun dari tidur dikala malam hari karena rasa sakit di bagian tangan dan pergelangan dalam waktu dua minggu terakhir? (berapa kali/hari)</i>	0.40	Valid		
P3	<i>Apakah anda mengalami sakit nyeri di tangan atau pergelangan tangan pada pagi/siang hari?</i>	0.90	Valid		
P4	<i>Seberapa sering anda mengalami sakit nyeri tangan atau pergelangan tangan pada pagi/siang hari (waktu / hari)?</i>	0.83	Valid		
P5	<i>Berapa lama rata-rata sakit nyeri berlasung pada pagi/siang hari (dalam menit)?</i>	0.73	Valid		
P6	<i>Apakah anda merasa mati rasa (kehilangan sensasi) pada tangan?</i>	0.54	Valid		
P7	<i>Apakah anda memiliki kelemahan pada tangan atau pergelangan tangan?</i>	0.32	Valid		

	Question Item	Corrected Item-Total Correlation	Decision	Cronbach's Alpha	Decision
P8	Apakah anda pernah merasa sensasi geli (seperti kesemutan) pada tangan?	0.86	Valid		
P9	Seberapa parah kesemutan di malam hari?	0.76	Valid		
P10	Seberapa kesemutan terjadi dalam 2 minggu terakhir?	0.56	Valid		
P11	Apakah anda mengalami kesulitan dengan menggenggam dan menggunakan benda-benda kecil seperti kunci atau pensil?	0.37	Valid		

DISCUSSION

The present study aimed to assess the validity and reliability of the Indonesian version of the CTS questionnaire and demonstrated the following procedures of cross-cultural measurement. The pre-final translated version of the CTS questionnaire had a valid and acceptable construct and accurately reflected the same content as the original version, for all items with a correlation coefficient value ranging from 0.321 to 0.895. The translated version of the questionnaire has also shown good reliability with a Cronbach's alpha value of 0.901, indicating that it can be used as an instrument of research to assess the CTS severity while maintaining the same accuracy level as the original version.

This finding was consistent with those evaluated in the Spanish (Oteo-Álvaro et al., 2016), Korean (Park et al., 2013), and Finnish (Mutanen et al., 2020) versions, revealing a high internal consistency level as evidenced by the Cronbach's alpha values of 0.91, 0.92, and 0.93, respectively. In addition, previous validation and reliability studies of the BCTQ translated version into languages, including Malay (Abdullah et al., 2019), Persian (Hassankhani et al., 2018), Thai (Upatham & Kumnerddee, 2008), Turkish (Sezgin et al., 2006), Greek (Bougea et al., 2018), Bulgarian (Karabinov et al., 2020), and Arabic (Alanazy et al., 2019) also demonstrated the corresponding result, which exhibited the Cronbach's alpha values ranging from 0.84 to 0.88. The Thai and Korean cross-cultural versions of the BTCQ have reported that some respondents do not understand the difference between the term's numbness, pain, and tingling in the severity question item (Park et al., 2013; Upatham & Kumnerddee, 2008).

Our findings showed that P2, P7, and P11 items had a low validity value of 0.397, 0.321, and 0.369, respectively, in comparison to the other items in the translated questionnaire. The explanation for this low validity value was unclear. Previous studies evaluating the factor loading of the original and translated versions of the BCTQ reported the lowest factor loading values on question items 2, 6, and 11 (Alanazy et al., 2019; Lue et al., 2015) of the severity symptom scale part. This might be related to the respondents' inability to specify the exact time when the symptom occurs (day or night), thus resulting in respondents' inconsistency in answering the question (Lue et al., 2015).

Besides measuring the Symptom Severity Scale, the original version of the BCTQ also consisted of 8 items evaluating the functional status scale for the upper extremity (Metro North Hospital and Health Service & Queensland Government, 2021a; Von Der Heyde, 2007). This was determined by evaluating the presence of pain, numbness, weakness, and difficulty gripping in activities such as writing, holding something, or performing some duties (Mutanen et al., 2020; Von Der Heyde, 2007). However, the functional status scale in the translated version of BCTQ exhibited a limitation in detecting functional disability among respondents. This might be caused by the fact that not all respondents do those activities frequently (Alanazy et al., 2019; Mutanen et al., 2020).

Considering this limitation, we plan to perform the subsequent investigation using Phalen's test to evaluate the functional status of the hand and wrist in our future study. Phalen's test is one of the objective examination tools that is commonly used to evaluate the functional status of the hand and

wrist in a patient with CTS (Cao et al., 2022). A positive Phalen's test is indicated when the respondent complains about paresthesia or numbness while flexing his or her wrist maximally with the flexed elbow and pronated forearm within 60 seconds (Cao et al., 2022; Kamel et al., 2017; Samuella Edyanto et al., 2024).

A previous study (Javed et al., 2023) observed that the severity of the symptoms experienced by dentists in their hands or wrists varied. The BCTQ revealed that 28% of dentists have complained of mild discomfort in their hands or wrists, while 4% of dentists reported moderate severity. Slight numbness in their hands during the day had been complained about by 14% of dentists, while the remaining 4% had medium numbness. In addition, the weakness in the hand was also experienced by 40% of dentists as a slight weakness, while 6% experienced a medium weakness. A tingling sensation during the day was observed in 16% of dentists, with a slight and 2% with medium severity. Moreover, 8% of dentists reported a slight tingling sensation at night, while 6% reported a medium level of severity. Furthermore, 18% of dentists revealed that it was slightly difficult to grasp small objects, while 2% revealed that it was moderately difficult. This finding suggested that the BCTQ could serve as a self-assessment tool for evaluating the presence and severity of CTS symptoms experienced by dentists, particularly given that dentists are one of the occupational groups at high risk of developing CTS. The language-adapted version of the BCTQ has been introduced with good construct validity, high internal consistency, and high reliability. Furthermore, it has been reported as a suitable instrument for subjective assessment to measure the severity of symptoms associated with CTS.

The present study was conducted by 65 dental practitioners and does not represent the entire population of Indonesia. The participants' educational level and occupation might have affected their responses to the translated version of the CTS questionnaire. Hence, further validation involving a larger sample size with diversity in the professional and educational background needs to be considered.

CONCLUSION

In conclusion, the findings demonstrated that the CTS questionnaire in Bahasa Indonesia was valid, reliable, had satisfactory psychometric properties, and was acceptable for measuring the severity of the CTS symptoms. We assume that the translated-CTS questionnaire can be used by healthcare professionals to assess the presence of CTS symptoms in patients, as well as by researchers during observation for rapidly screening CTS.

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