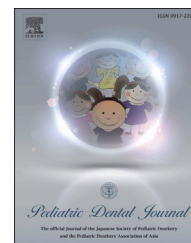Available online at www.sciencedirect.com

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## Original Article

# Validity and reliability of Child Perception Questionnaire (CPQ$_{11-14}$) by Rasch Analysis in Turkish children

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## ARTICLE INFO

## ABSTRACT

Assessment for the reproducibility of the answers to the Child Perception Questionnaire (CPQ$_{11-14}$) in different languages with test-retest exercises have importance to be acceptable in other populations. The present study is to evaluate the validity and reliability of Child Perception Questionnaire for ages 11−14 (CPQ$_{11-14}$) with 37 items by means of Rasch Analysis in a group of Turkish population. 133 children aged 11−14 years old were included to the study. CPQ$_{11-14}$ was administered at their first visit, as well as Facial Image Scale questions. After two weeks, CPQ$_{11-14}$ was re-applied to a subgroup (n = 25) of the children. The construct validity of the CPQ$_{11-14}$ data was assessed by using Rasch Analysis. Intra-class Correlation Coefficient was calculated with the CPQ$_{11-14}$ scores of first and second visits. Cronbach's $\alpha$ coefficient was obtained for evaluating internal consistency. According to Rasch Analysis, mean item infit $\pm$ sd was $0.98 \pm 0.25$; mean item outfit $\pm$ sd was $1.08 \pm 0.91$. Item and person separation indices and reliabilities were calculated as 3.34 and 2.42; 0.92 and 0.85, respectively. The Pearson's correlation coefficient between the total scores of CPQ$_{11-14}$ and the Facial Image Scale was found as 0.74 (p < 0.001). Cronbach's alpha coefficient was 0.93 and ICC was 0.90 for the total scale. The findings of the present study showed that the Turkish version of CPQ$_{11-14}$ with 37 items is valid and has excellent reliability.

## 1. Introduction

Oral diseases is still the most common chronic disease in the worldwide [1]. There are several studies clearly showing that the impact of the oral disease on psychological and social well-being of the patients is very important aspect of modern living [2,3]. The World Health Organization accepted oral health as a vital component of overall health and quality of life [4].

Over recent years the concept of Oral Health Related Quality of Life (OHRQoL) has been introduced extending the assessment of oral health to include the social and psychological impact of oral diseases on individuals. Development of the questionnaires at international level for OHRQoL was based on the three main dimensions of health-related quality of life: physical symptoms, perception of well-being and functional capacity [5].

A child's oral conditions can also impact on eating, smiling, speaking and socializing, as well as adults. Although the several measures of OHRQoL have been developed and validated for use among adults, there is limited evidence on the children's OHRQoL. In 2002, the Child Perceptions Questionnaire ($CPQ_{11-14}$) was reported to measure OHRQoL among children aged between 11 and 14 years by Jokovic et al. [5]. The $CPQ_{11-14}$ includes the four domain subscales of oral symptoms, functional limitations, emotional well-being and social well-being. Even the discriminative properties (i.e., cross-sectional validity and test-retest reliability) of the $CPQ_{11-14}$ were found to be acceptable in previous studies [6,7], it is important to have more reports from other populations confirming the discriminative properties of such measures be acceptable in other populations.

The results of a test should exhibit high stability if the instrument is applied in the same conditions at different points in time. The aim of this study was to assess the reproducibility of the answers to the $CPQ_{11-14}$ in Turkish with test-retest exercises by repeating the test on the same study group at a later point in time. Therefore, the validity and reliability of $CPQ_{11-14}$ in a Turkish population aged 11—14 years was evaluated by means of Rasch Analysis.

## 2. Material and methods

### 2.1. Participants (sampling and study design)

This study was a prospective, observational study. Ethics approval was obtained from the Ethics Committee of Yeditepe University (26.04.2011/No.103). 133 children aged 11—14 years who attended Marmara University, Dental School, Department of Pediatric Dentistry Clinics were included to this study. Marmara University is the 2nd largest Dental School in Istanbul as well as in Turkey. Children from each social segment of Turkish population visit dental clinics of the university. Thus, a convenience sample was performed among Turkish speaking children between the ages 11 and 14 years who were asked if they would agree to take part in the study and accepted to participate to this study.

Participants were collected from pediatric dental clinic over 6 months period (between November 2011 and April 2012) with dental caries. Children were excluded if they possessed physical, visual, auditory or mental disabilities that would interfere with their ability to comprehend instructions for completing the $CPQ_{11-14}$.

An informed consent was obtained from the parents of children who were participating to the study. $CPQ_{11-14}$ was applied by the same researcher in order to avoid the parental influence on children. The questionnaire was administered at the first visit before oral examination was performed. Two weeks later, a second copy of $CPQ_{11-14}$ was completed by a subgroup (n = 25) of the children for the assessment of test-retest reliability.

Four additional questions concerning subscales of $CPQ_{11-14}$ were also asked to children and they were let to answer with Facial Image Scale by choosing the very similar facial expression of their feelings.

### 2.2. Description of $CPQ_{11-14}$ and four questions with Facial Image Scale

The $CPQ_{11-14}$ is a questionnaire which assesses the impact of oral health conditions on the quality of life in 11—14 years. It addresses the frequency of events for the last three months regarding impacts of dental problems. It consists of 37 items with four subscales as oral symptoms (6 items), functional limitations (9 items), emotional well-being (9 items) and social well-being (13 items). Items have 5-point Likert scale with those response options: 'Never' = 0; 'Once/twice' = 1; 'Sometimes' = 2; 'Often' = 3; and 'Everyday/almost every day' = 4. The sum of response codes gives the $CPQ_{11-14}$ score [5]. Since there are 37 items, the $CPQ_{11-14}$ score can vary from 0 to 148. A higher score denotes that children have more impact of oral conditions, which means a lower OHRQoL. Conversely, a lower $CPQ_{11-14}$ score means a higher OHRQoL. $CPQ_{11-14}$ subscale scores are also be computed by summing response codes in that subscale.

Four questions related to each subscale of $CPQ_{11-14}$ were also asked to children by asking them to show which face reflects the facial expression as close as their feelings. All these questions had to be answered by Facial Image Scale as seen in Fig. 1 [8]. These questions were asked for the previous three months as well as in $CPQ_{11-14}$. A total score was obtained by summing the response codes of four questions. As in $CPQ_{11-14}$ score, the higher score means the lower OHRQoL and the lower score means the higher OHRQoL.
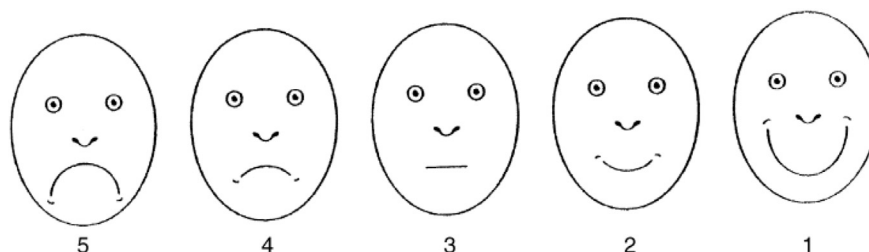


**Fig. 1 — Facial Image Scale.**

## Table 1 – CPQ$_{11-14}$ items with Rasch fit statistics and item calibration.

| Item description | Infit mean square (z std) | Outfit mean square (z std) | Item calibration (S.E.) |
|---|---|---|---|
| **Oral symptoms (Oral semptomlar)** | | | |
| 1. Pain in teeth, lips, jaws or mouth (Dişlerde, dudaklarda, çenedeveya ağızda ağrı) | 1.01 (0.2) | 0.98 (−0.1) | −1.70 (0.10) |
| 2. Bleeding gums (Dişeti kanaması) | 1.15 (1.1) | 1.34 (1.9) | −0.87 (0.11) |
| 3. Mouth sores (Ağız yarası) | **1.52 (3.3)**[a] | **2.09 (3.2)**[a] | −0.59 (0.13) |
| 4. Bad breath (Kötü nefes) | 1.26 (1.8) | 1.19 (1.0) | −0.98 (0.11) |
| 5. Food caught between/in teeth (Dişlerin arasına yemek (parçalarının) girmesi) | 0.84 (−1.2) | 0.76 (−1.3) | −1.46 (0.10) |
| 6. Food stuck to roof of mouth (Damağa yemek yapışması) | 1.46 (1.0) | **2.16 (1.4)**[a] | 0.30 (0.21) |
| **Functional limitations (Fonksiyonel Kisitlamalar)** | | | |
| 7. Breathing through the mouth (Ağızdan nefes alıp verme) | **1.60 (2.3)**[a] | **1.72 (1.1)**[a] | −0.42 (0.11) |
| 8. Taken longer than others to eat a meal (Yemek yemenin diğerlerinden (zamanlardan) daha uzun zaman alması) | 0.81 (−1.3) | 0.70 (−1.3) | −0.39 (0.12) |
| 9. Trouble sleeping (Uyumada sıkıntı) | 0.76 (−1.8) | 0.63 (−1.7) | −0.83 (0.10) |
| 10. Difficult to bite or chew food like apples, corn on the cob or steak (Elma, mısır veya biftek gibi sert yiyecekleri ısırmada ve çiğnemede zorlanma) | 1.10 (0.8) | 0.90 (−0.5) | −1.41 (0.10) |
| 11. Difficult to open your mouth wide (Ağzı geniş açmada sıkıntı) | 1.00 (0.1) | 0.67 (−0.3) | 1.35 (0.43) |
| 12. Difficult to say any words (Bazı kelimeleri söylemede zorlanma) | 0.89 (−0.2) | 0.63 (−0.4) | 0.50 (0.22) |
| 13. Difficult to eat foods you would like to eat (Sevilen yiyecekleri yemedezorluk) | 1.09 (0.7) | 1.03 (0.2) | −0.94 (0.10) |
| 14. Difficult to drink with a straw (Pipetle içmede zorluk) | 1.27 (0.7) | **4.18 (2.5)**[a] | 0.56 (0.26) |
| 15. Difficult to drink or eat hot or cold foods (Sıcak ya da soğuk yiyecekler yemede veya içecekler içmede zorluk) | 0.77 (−1.7) | 0.77 (−1.3) | −1.03 (0.10) |
| **Emotional well-being (Duygusal durum)** | | | |
| 16. Irritable/frustrated (Huzursuzluk veya bıkmışlık) | 0.72 (−1.9) | **0.44 (−1.8)**[a] | −0.39 (0.11) |
| 17. Felt unsure of yourself (Kendini güvensiz hissetme) | 0.89 (−0.2) | 0.77 (0.0) | 0.05 (0.16) |
| 18. Shy/embarrassed (Utangaç veya mahçup) | 1.44 (0.9) | 1.05 (0.4) | 0.13 (0.19) |
| 19. Concerned with what other people think (Başkalarının ne düşündüğü ile ilgilenme) | 0.91 (−0.1) | **2.12 (1.1)**[a] | −0.04 (0.16) |
| 20. Worried that is less attractive than other people (Başka kişilerden daha az çekici olma konusunda endişelenme) | 0.97 (0.0) | 0.65 (−0.1) | −0.07 (0.15) |
| 21. Upset (Keyfin kaçması) | 0.92 (−0.5) | 1.05 (0.3) | −0.71 (0.10) |
| 22. Nervous or afraid (Gergin veya sinirli) | 0.70 (−1.9) | **0.39 (−1.4)**[a] | −0.41 (0.11) |
| 23. Worried that is less healthy than other people (Başkalarından daha az sağlıklı olma konusunda endişelenme) | 0.70 (−0.9) | **0.40 (−0.2)**[a] | −0.05 (0.15) |
| 24. Worried that is different than other people (Başkalarından farklı olma konusunda endişelenme) | 0.90 (−0.2) | 0.71 (0.2) | −0.14 (0.14) |
| **Social well-being (Sosyal durum)** | | | |
| 25. Missed school because of pain, appointment or surgery (Ağrı, dişçiyle randevu veya diş ameliyatı sebebiyle okula gidememe) | 1.26 (1.3) | 1.38 (1.5) | −0.40 (0.13) |
| 26. Had hard time paying attention in school (Okulda dikkatini toplamada zorlanma) | 0.80 (−1.0) | 1.17 (0.5) | 0.06 (0.13) |
| 27. Had difficulty doing your homework (Ev ödevlerini yapmada zorlanma) | 0.81 (−1.0) | **0.39 (−1.4)**[a] | −0.43 (0.11) |
| 28. Not wanted to speak/read out loud in class (Sınıfta yüksek sesli konuşmak veya okumak istememe) | 0.77 (−0.2) | **0.44 (0.0)**[a] | 0.60 (0.29) |
| 29. Not wanted/been unable to participate in sports, clubs … (Faaliyet kollarında (müzik kolu v.b.) yer alamama veya yer almayı istememe) | 1.06 (0.3) | **3.23 (2.6)**[a] | 2.52 (0.72) |
| 30. Not wanted to talk to other children (Diğer çocuklarla konuşmayı istememe) | 1.02 (0.2) | **3.35 (1.6)**[a] | 0.15 (0.19) |
| 31. Avoided smiling/laughing when around other children (Diğer çocukların yanında gülümsemek veya gülmekten kaçınma (sakınma) | 0.89 (−0.2) | **0.35 (−0.2)**[a] | 0.25 (0.16) |
| 32. Had difficulty playing a musical instrument such as a recorder, flute, clarinet, trumpet (Blok flüt, flüt, klarnet, trompet gibi bir müzik aleti çalmada zorlanma) | 1.04 (0.4) | **0.30 (−0.2)**[a] | 1.20 (0.51) |
| 33. Not wanted to spend time with other children (Diğer çocuklarla vakit geçirmeyi istememe) | 0.72 (−0.2) | **0.15 (−0.5)**[a] | 0.61 (0.30) |
| 34. Argued with other children or your family (Diğer çocuklarla ya da aile ile tartışma) | 0.97 (0.3) | **0.26 (−0.7)**[a] | 3.23 (1.01) |
| 35. Teased/called names by other children (Diğer çocuklar tarafından sataşma veya kötü bir söz söylenmesi) | **0.48 (−0.6)**[a] | **0.22 (−0.6)**[a] | 0.38 (0.27) |
| 36. Left out by other children (Diğer çocuklar tarafından dışlanmak) | 1.02 (0.2) | 0.70 (0.0) | 1.16 (0.40) |
| 37. Asked questions about your teeth, lips, jaws or mouth by other children (Diğer çocuklar tarafından dişlerin, dudakların, çenen veya ağzın hakkında sorular sorulması) | 0.91 (−0.2) | 0.61 (−0.3) | 0.23 (0.17) |

Remark: Items in Turkish were given in the parenthesis.

z std values have expected value of 0.00 and values less than 0.00 indicate too predictability, values more than 0.00 indicate lack of predictability.

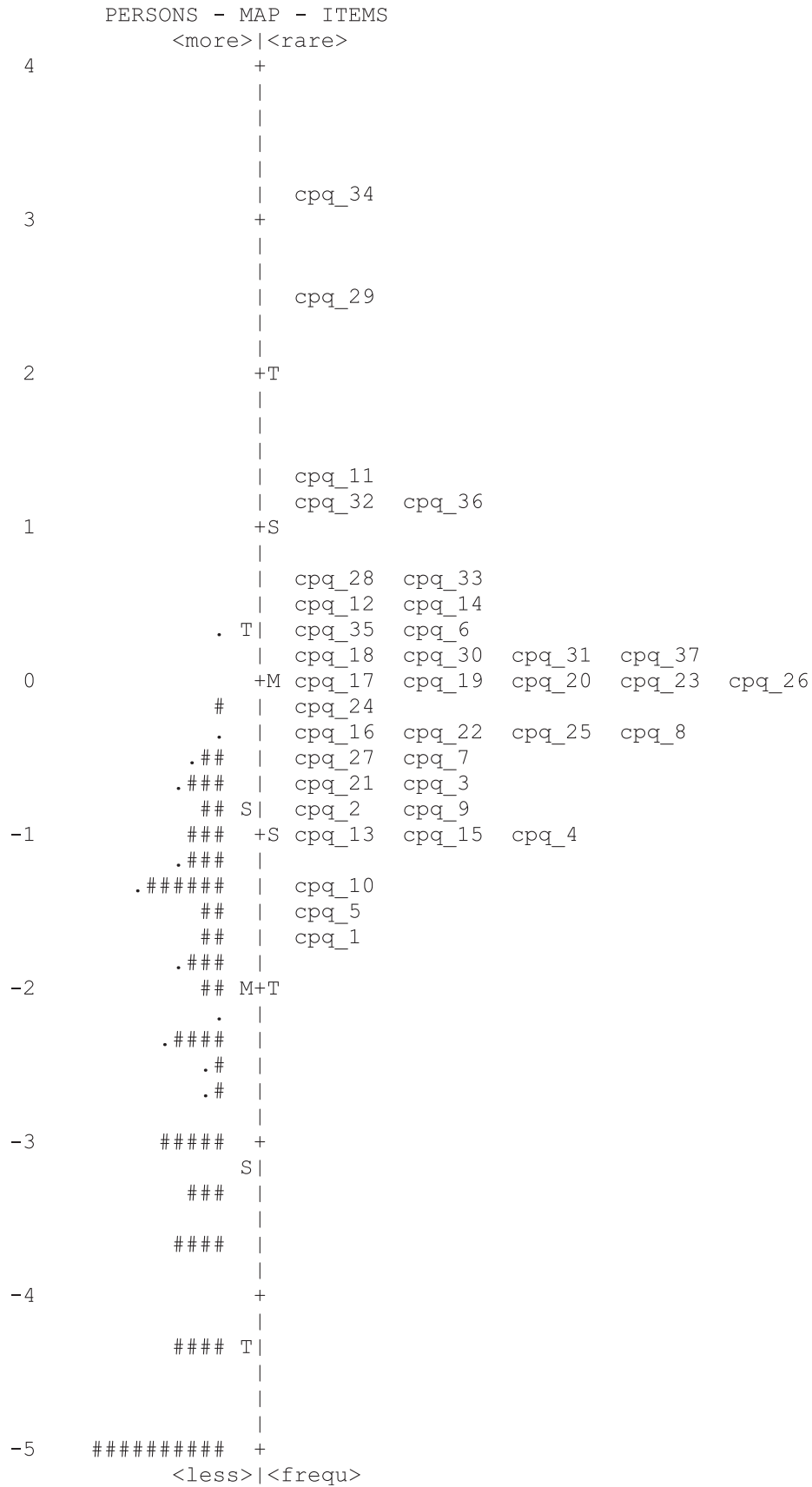[a] It means that infit or outfit mean square statistics (written bold) are outside the range of (0.50–1.50) (http://www.winsteps.com/winman/diagnosingmisfit.htm).

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**Fig. 2 – Person-item map for CPQ$_{11-14}$ (In the Person-item map; on the left hand side of the dashed line, children appear according to their perception, represented by #, and on the right hand side of the dashed line, items appear according to their effects on children's perception, represented by item names. It is expected that the distribution of both items' effects and children's perception is similar. If the items were well targeted to the children; M (the means), S (1 SD from the mean) and T (2 SD from the mean) for both distribution would be close to each other.).**

### 2.3. Adaptation of CPQ$_{11-14}$ to Turkish version

For the adaptation of CPQ$_{11-14}$ to Turkish version, the guidelines about translation, back translation, committee review of these translations, and pretesting of the questionnaire were followed in order to ensure its conceptual and functional equivalence as suggested [9,10].

The questionnaire CPQ$_{11-14}$ was translated from English to Turkish by two translators who were aware of the aim of the instrument. Two back translations were performed by two translators who are (native) English-speaker. After the committee review of translations and back translations, a pilot study (n = 12) of the questionnaire was conducted. Following the pilot study, according to the feedbacks, three items which caused confusion for the children, were revised slightly in order to adapt to Turkish colloquial language, instead of word to word translation. These items were "item 7, Breathing through the mouth"; "item 20, Worried that is less attractive than other people" and "item 25, Missed school because of pain, appointment or surgery". Besides, the "item 29" was translated by considering the current opportunities of Turkish schools to participate in such as music clubs, sports teams, etc. As a result of this process, the final Turkish version of CPQ$_{11-14}$ was obtained.

## 3.  Statistical analysis

### 3.1.  Validity

The construct validity of the CPQ$_{11-14}$ data was assessed by using Rasch Analysis. The Rasch Analysis mean square fit statistics are reported as infit (information weighted) and outfit (outlier-sensitive) mean squares. The item/person separation is represented by two calculations; item/person separation index and reliability. A Rasch person/item map is constructed to show the distribution of the children and items on the same measurement scale. Differential item functioning (DIF) is used to present weather children from different gender have different probabilities of success on an item or not [11].

Pearson's correlation coefficient between the total scores of CPQ$_{11-14}$ and Facial Image Scale was calculated for convergent validity.

### 3.2.  Reliability

Intraclass Correlation Coefficient [12] was calculated for the CPQ$_{11-14}$ scores of first and second visits. For internal consistency, Cronbach's α coefficient was calculated. Both ICC and Cronbach's α coefficient ≥0.70 were considered acceptable [13,14]. Data was analyzed by SPSS 17.0 and by Winsteps 3.65 (Linacre, JM. Chicago, USA) [11]. p < 0.05 was considered as significant.

## 4.  Results

The mean age of 133 children, who are 47.4% (n = 63) were boys and 52.6% (n = 70) were girls, was calculated as 12.34 ± 1.01.

### 4.1.  Validity

According to Rasch Analysis, mean item infit ± sd was 0.98 ± 0.25; mean item outfit ± sd was 1.08 ± 0.91. Both, mean infit and outfit mean square values, were found close to 1.00 as expected. The fit statistics and item calibrations for each item were given in Table 1. Item calibrations also appear in Person-item map as difficulty of items (Fig. 2). Item and person separation indices were calculated as 3.34 and 2.42, respectively, which were greater than 2.00. Item and person reliability were 0.92 and 0.85, respectively, which were close to 1.00, indicating that the CPQ$_{11-14}$ can discriminate children's perceptions and item's difficulties well. In Fig. 2, the person-item map for 37 items was demonstrated and CPQ$_{11-14}$ with the child frequency appears as #s on the left, as well as, the item difficulty with item names appears on the right.

Fig. 2 shows that children with high CPQ$_{11-14}$ scores are at the top of the graph, while those who had low CPQ$_{11-14}$ scores are at the bottom of the graph. Therefore, most of the children had low CPQ$_{11-14}$ scores which mean their perception related quality of oral health is positive. Besides, the items which affect children's perception more negatively appear at the bottom. The difficulty of the items spread between (−1.70) and 3.23 logits, and the average measure of items centered on 0. Except "item 3", no DIF was observed for any of items, which means that all the items have the same difficulty for two groups of gender, as expected (p > 0.05).

Pearson's correlation coefficient between the total scores of CPQ$_{11-14}$ and Facial Image Scale was found as 0.77 (p < 0.0001).

### 4.2.  Reliability

Cronbach's alpha coefficient was 0.93 for the total score and 0.79, 0.83, 0.87, 0.76 for the subscales which are oral symptoms, functional limitations, emotional well-being and social well-being, respectively (Table 2). Furthermore, any remarkable changes were seen in the calculation of Cronbach's alpha coefficient during the sequential absence of each item was performed. ICC was 0.90 for the total scale and 0.94, 0.81, 0.73, 0.94 for the subscales which are oral symptoms, functional limitations, emotional well-being and social well-being, respectively (Table 2).

| Table 2 – CPQ$_{11-14}$ reliability statistics. | | |
|---|---|---|
| | Number of items | Cronbach's alpha (n = 133) | ICC between scores of first and second visits (n = 25) |
| Total scale | 37 | 0.93 | 0.90 |
| Subscales | | | |
|   Oral symptoms | 6 | 0.79 | 0.94 |
|   Functional limitations | 9 | 0.83 | 0.81 |
|   Emotional well-being | 9 | 0.87 | 0.73 |
|   Social well-being | 13 | 0.76 | 0.94 |

## 5. Discussion

Oral Health Related Quality of Life measurements has gained popularity with the recognition of the importance of the subjective assessment of oral health, because the huge variability in the individual evaluations, which is influenced by many cultural, economic and social factors, was confirmed at many times. Thus, the combination of clinical and subjective indicators seems to be the best approach for more comprehensive therapy of oral diseases. One of the OHRQoL components for children aged 11—14 years is the Child Perceptions Questionnaire. The validity and reliability of $CPQ_{11-14}$ have been confirmed many times in different ages and populations [15—17], but the Turkish version of $CPQ_{11-14}$ with 37 items was firstly evaluated in this study. The translation was carefully conducted following the procedure recommended by Beaton et al. and resulted in a very similar version to its original [10].

Test-retest reliability for the $CPQ_{11-14}$ was evaluated in a time interval of two weeks as it was suggested to be in 2—3 weeks for excellent scores [5,18].

The present study was performed with the 37 items as later publications have used [19,20], but the 35 items were preferred in a German study [21] which was believed to have similar psychometric properties. Although the study of Jokovic et al. aiming the validation of $CPQ_{11-14}$ was performed on the children aged 11—14 with dental caries, orthodontic disorders and cleft lip and/or palate [5], this study presented the reliability and validity of $CPQ_{11-14}$ through the participants composed of 11—14 year old Turkish children only with dental caries.

Since it is still the most common chronic disease in the worldwide and mostly results in pain which in turn may lead to consequences on a person's daily life, dental caries seems to be one of the most important oral health impacts that are responsible from the quality of life [1,22,23]. According to findings of the present study may suggest that the Turkish version of $CPQ_{11-14}$ can be reduced to 14 items (item 1, 2, 4, 5, 8, 9, 10, 13, 15, 21, 24, 25, 26 and 27) which address to the children who have especially dental caries. It sounds feasible to have a short form of the questionnaire specific to dental caries if the work is liked to be directed on this field.

The strengths of this study is that the Rasch Analysis is preferred to evaluate the validity of $CPQ_{11-14}$ with 37 items, instead of generally used exploratory and supportive confirmatory analysis, because it has some superiorities over the factor analyses as; it gives weights to items by taking into consideration person's ability and item difficulty, and it provides evaluation of how well an item performs in terms of its relevance for measuring the underlying construct objectively [24]. Especially, construct validity and convergent validity with Facial Image Scale findings support that the Turkish version of $CPQ_{11-14}$ with 37 items is perfectly valid and reliable. ICC and Cronbach's alpha coefficient were both acceptable (>0.70) and were both matched with other studies which were working on the validation of $CPQ_{11-14}$ [20,21,24].

As a weakness of the study, $CPQ_{11-14}$ was applied to children only with dental caries rather than children with orthodontic disorders and/or oro-facial disorders as in the study of Jokovic et al. [5]. In consequence of this, the questions which are more specific to dental caries were shown up and they may lead a short way during working on particularly dental caries.

## 6. Conclusions

This study provides sufficient evidence to accept the validity and reliability of the Turkish version of $CPQ_{11-14}$ with 37 items as an overall assessment. It is possible that the parents and children may not share the same views about health, because the parents knowledge of their children can be limited [25]. This particularly gives the importance of children's perceptions on the relevant to the quality of their life. Furthermore, the present study may be useful to apply short form of $CPQ_{11-14}$ with 14 items when a study is carried out on children with dental caries.

## Conflicts of interest

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