A Difficulty Chart for Estimation of Treatment Duration of Palatally Impacted Canines

Riyadh A. Ruwiaee[1], Dhuha A. Al-Ali[2], Mushriq F. Abid [3]

[1] BDS, MSc/ Post Graduate/ [2] BDS, MSc / post graduate, [3]BDS, MSc, PhD Assist Prof. / Department of Orthodontics/College of Dentistry/University of Baghdad

Abstract

Treatment of maxillary impacted canine is a challenging process to dental specialists and orthodontists. The aim of the present study was to assess the duration of orthodontic treatment of palatally impacted canines, using a difficulty chart as an estimate of the prognosis, and relating it to the treatment time and to other factors that might affect the treatment duration. A cross-sectional study was undertaken using a self-administered questionnaire to be completed by orthodontists (82 participants). An index was used as a tool to assess the prognosis and treatment duration. The study found that 48.7% of active orthodontic treatment time for palatally impacted canines was completed in 1.5 to 2 years. The number of active treatment visits per patient was between 16 and 22 (62% of treatment visits). In terms of the treatment performed, 81.7% of cases had space created prior to surgical exposure, and 59.8% had open surgical exposure. Failed to attend visits by the patient accounted for 48.4% and 62.2% did not require repeated surgical exposure. Interestingly, 85% of the cases had 'good' or 'average' prognosis (49% and 36%, respectively). A prognostic chart can provide an estimate for the treatment time to bring a palatally impacted canine into the arch. This information might be valuable for both orthodontists and their patients, to estimate the time of the planned treatment and provide a valid consent form.

Keywords: *Palatally impacted canine; Treatment time; Difficulty chart, Surgical exposure.*

Intoduction

The maxillary canine plays a major role in the aesthetic and functional aspects of the occlusion and its absence should be avoided wherever possible. [1] This tooth is considered as the most frequently affected tooth with eruption problems, following the third molar, with a reported prevalence of 0.92% to 6.04%. [2,3] Data from previous studies suggests that, 85% of canine impactions occur palatally and 15% buccally, moreover 8% to 10% of canine impactions occur bilaterally. [4]

Several studies have linked canine impaction with multiple etiological factors such as anomalies and absence of lateral incisors, ectopic tooth germ position, the presence of mechanical obstruction, and genetic factors. [5] The treatment of palatally impacted canines is a common challenge faced by dental professionals in daily practice. Different types of treatment modalities have been suggested, including early interceptive or late management, that combines surgical–orthodontic methods. [6,7] Canine extraction and auto-transplantation have been suggested as an alternative way of management. [8,9] Special biomechanics and anchorage are always required during canine traction, such as large cantilever wires with adequate support for the adjacent teeth. [10,11]

The active orthodontic treatment time is defined in relation to either the bonding of a fixed orthodontic appliance or the final realignment of the impacted canine within the dental arch. Published data shows the overall treatment time ranging from 19.6 to 28.8 months, with large individual variations. [12] The number of orthodontic dental visits required to treat ectopic maxillary canines in past studies has varied from 17.7 to

Corresponding Author:
Name: Mushriq F. Abid
E-mail: mushriq.abid@codental.uobaghdad.edu.iq

39.8 appointments. [12,13]

Any treatment of palatally impacted canine is considered complex. [14] This complexity depends on several factors including the location (palatal, buccal), the angle of impaction, and how close the canine is to the midline. [15] Other factors that might complicate and increase the treatment time include unfavourable impaction, the method of exposure and traction, whether space has been created pre-exposure, the age of the patient, and appointment numbers relating to active orthodontic treatment. [16] Several classifications have been advocated to quantify the severity of canine impaction and to estimate the prognosis, considering how complex the treatment of each case could be. [17,18] According to the Ericson and Kurl classification, an impaction close to the midline is considered complex and requires special biomechanics. [19] Similarly, a horizontally impacted canine (angle of impaction) is more challenging and may compromise the prognosis. [20] Information about orthodontic treatment time and prognosis needs to be given to patients when discussing treatment options in order to obtain valid informed consent.

To our knowledge, no previous study in Iraq has addressed the prognosis and the actual treatment time needed to bring the canine into the dental arch. This study sets out to assess the treatment difficulty and duration of palatally impacted canines, with the help of an index (chart) especially used to estimate the prognosis of treatment.

Methods

This is a cross-sectional descriptive study designed with the aid of a self-administered questionnaire. The study was conducted in the College of Dentistry (Baghdad University) from April 2019 till October 2019. The study population included orthodontist specialists working at academic institutions, private clinics, and hospitals: all were invited to participate in the study. Overall, a total of 120 surveys were distributed, of which 38 were excluded as they were inappropriately filled in or incomplete; in the end, only 82 questionnaires were eligible for data analysis. The study was approved by a local committee in the Orthodontic Department at the College of Dentistry (Baghdad University).

This survey, in the form of a questionnaire, focused only on patients with palatally impacted canines (unilateral or bilateral) who had received treatment from the orthodontists. For example, one case was selected in which the canine was tracked to its ideal position in the arch using a fixed appliance; this case was chosen by the orthodontist to be one of the best cases that was treated, and the treatment was completed on time. It involved the selection of the prognostic factors and the canine position relating to the treated case, using the parameters from previous studies. [21,22] A chart recommended by the Royal College of Surgeons (RCS Eng) guidelines was given to the orthodontists to estimate treatment difficulty and prognosis [17], as shown in Figure 1. The prognosis considered 'good' was when all four categories were good, 'average' prognosis was considered when only two categories were 'good'. 'Poor' prognosis in all of the categories was considered to be 'poor'.

The questionnaire involved several questions in the form of closed questions, such as the active orthodontic treatment time was specified as the time from the bonding to the debonding of the fixed appliance, and the time needed to realign the canine to correct occlusion (from exposure time to the dental arch) to bring the canine in occlusion. Other details were recorded, including: the total number of active visits, the orthodontic anchorage devices used, the time taken for canine realignment from exposure to correct occlusion, the radiographic assessment, age and gender of the patient, whether the impaction was unilateral or bilateral, the method of exposure and mechanical traction, pre or post exposure space creation, number of failures, and emergency visits and failed to attend visits during the course of the orthodontic treatment (Table 1). The survey was piloted by ten orthodontists to assess the suitability of the questions which were reviewed and adjusted to ensure scientific accuracy. The data was analysed using Microsoft Excel starter 2010 (Microsoft Corporation).

Results

Data from 82 orthodontists for 82 patients with palatally impacted canines were collected and analysed with a response rate of 68.3%. About two-thirds of the patients were females (65.9%), and the age range of the patients was 12 to 20 years (mean = 14 years old). Unilateral canine impaction accounted for 69.5% of the

cases.

The survey revealed that 49% of active orthodontic treatment for palatally impacted canines was completed in 1.5 to 2 years, with a mean of 21 months (Figure 2A). Sixty-eight percent of the patient's canine realignment (from exposure to the correct occlusion) was achieved in 15 months (range of 12 to 18 months). Sixty-two percent of active treatment visits made by the patients were between 16 to 22, with a mean of 19 visits (Figure 2B).

In 81.7% of the cases, space for the impacted canine was created prior to exposure, and in 59.8% open surgical exposure was performed (Figure 3A). The number of visits failed to attend by the patient during the treatment was 48.8% (less than four visits) (Figure 3B), and 62.2% of the patients did not require additional or repeated surgical exposure (Figure 3C).

Regarding the estimation of treatment difficulty, using the chart provided, four categories were included: incisor overlap, vertical height, and the angulation and position of the apex. The results revealed that 51.3% of cases had a 'good' prognosis, and 34.1% had an 'average' prognosis, while 14.6% of cases had a 'poor' prognosis (Figure 4).

Age: Gender of patient:
Number of impacted canine A- Unilateral   B- Bilateral
The space for accommodating the tooth was created A-   Pre-exposure B-Post-exposure
The method of exposure was A- Open   B- Closed
Total Duration of active orthodontic treatment was A-   Up to 1 year, B- 1–1.5 year, C- 1.5–2 years, D- More than 2
Canine realignment from exposure to correct occlusion A-   6 months B- Less than 1 year C- 1–1.5 year D- More than 1.5
Total number of active visits during orthodontic treatment A-   Less than 16 visits, B- Between 16–22 visits, C- More 22 visits
The number of failures of surgical exposures A-   Less than 2 failures B- 2–4 failures C- More 4 failures D- None
The number of visits failed to attend during treatment A-   Less than 4 visits, B- 4–8 visits, C- More than 8 visits, D- None

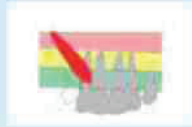**Table 1: Questionnaire for data collection.**

Category	Good Prognosis	Average	Poor
Overlap of incisor	No horizontal overlap	Up to half root width	Complete overlap
Vertical height	CEJ – halfway up root	>half <full root length	>full root length
Angulation	0–15°	16–30°	>30°
Position of apex	Above canine position	Above 1st premolar	Above 2nd premolar

Table 1: Prognosis for re-alignment depending on assessment in various categories. Key – : average prognosis; : poor prognosis

Figure 1: Prognosis for realignment depending on assessments across various categories. Key – Green = good prognosis; Yellow = average prognosis; Pink = poor prognosis. adapted from. [17]
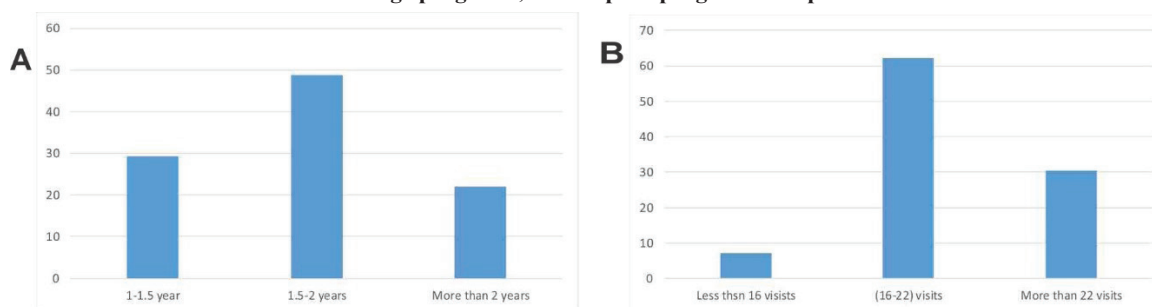
Figure 2: A) The duration of active orthodontic treatment, B) the number of visits attended by the patient.
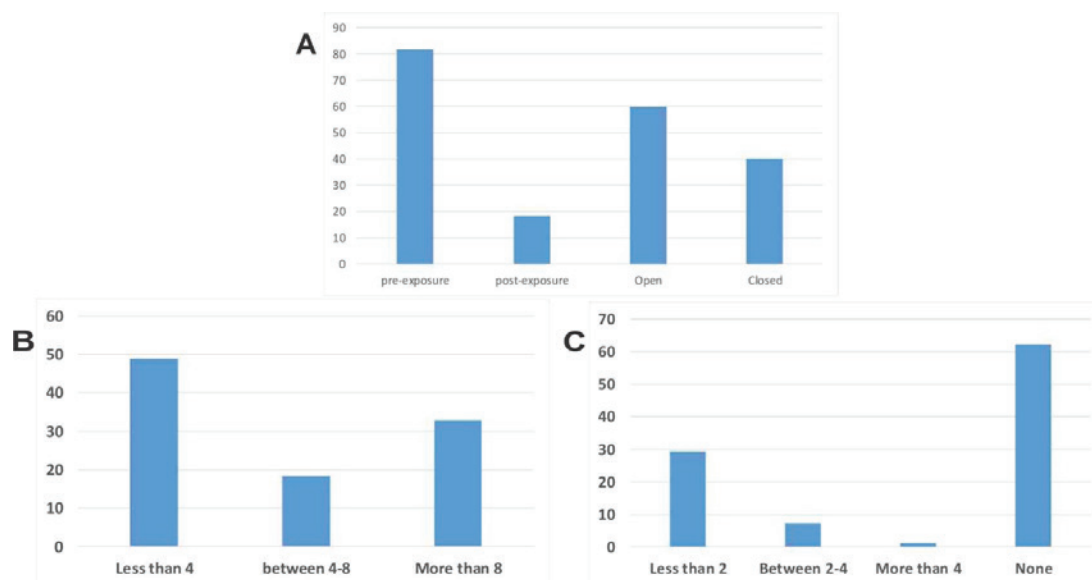
Figure 3: A) Space creation and type of surgical exposure B) Failed surgical exposure C) Visits failed to attend by the patient.

Figure 4: Prognosis assessment using the chart (%).

Discussion

The orthodontic management of palatally impacted canine requires an accurate assessment of the canine location in different dimensions. Accurate localisation helps to surgically expose and retrieve the tooth efficiently and individualise the clinical approach and biomechanics. Both patients and orthodontists need to know the expected treatment duration, which, to a great extent, is affected by the location of the canine. It has previously been observed that the duration of treatment is affected by several factors, including the number of missed appointments, the number of debonded brackets and bands, poor oral hygiene, the number of extracted bicuspid, mandibular plane angle, and age at the start of treatment. [23-25]

Various treatment difficulty indices have been proposed to estimate the severity of impaction. However, this study used a chart that has been recommended by the RCS-Eng guidelines for the management of palatally impacted canines. Four aspects of canine position were assessed, including incisor overlap, vertical height, the

angulation, and the position of the apex. Data from published studies suggest that the treatment duration of palatally impacted canine lasts for an average of 18 to 30 months. [13,26,27] Turning now to the results recorded in the present study, the average active orthodontic treatment time was 21 months, which falls within the range of the studies mentioned previously. The time needed to bring the canine from its location at the time of surgical exposure to the line of the dental arch was about 15 months in the majority of cases (68%).

The average total number of active orthodontic visits was 19 visits which falls within the same range found by other studies (17.7 to 39.8) visits. [22, 28, 29] In response to the prognosis, up to half of the cases (48.7%) had a 'good' prognosis while 36% had 'average' prognosis. This makes a total of 85% of the reported cases who had 'good' and 'average' prognosis. In most of these cases, the treatment time was around 21 months (between 1.5 to 2 years) which might indicate that the chart can be used as a useful tool to estimate the treatment duration. Conversely, other cases within the same categories showed a longer treatment time, which could be related to other factors, including the orthodontist's experience, mechanics, and age of the patients. Another possible explanation for finishing these cases within the expected duration could be attributed to results found in the present study. For example, for 81.7% of cases, the space was created prior to surgical exposure, 62.2% did not have to repeat the surgical exposure, and 48.4% had less than four visits which they failed to attend. Interestingly, these factors were previously emphasised by previous published data as contributing factors adding extra time to bring the impacted tooth into the arch. [15,28-30]

The limitations of the study were that only the best-treated case by each orthodontist was included and it did not involve different types of cases. Additionally, no inferential statistics were made in the present study, which would be more feasible if more cases and different groups were involved.

Conclusions

On the basis of the results of this study, a rough prediction for the treatment of palatally impacted canine can be made using a difficulty chart. This chart might be helpful in providing information to the patient to estimate the treatment duration. Further studies are required to include other variables to improve the accuracy of the time needed to complete the treatment.

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