International Journal of Early Childhood Special Education (INT-JECSE)
DOI:10.9756/INTJECSE/V14I5.543 ISSN: 1308-5581 Vol 14, Issue 05 2022

ASSESSMENT OF SURGICAL DIFFICULTY IN PATIENTS WITHMAXILLARY IMPACTED CANINE- A RADIOLOGICAL INTERPRETATION

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ABSTRACT

AIM: The aim of this prospective study was to investigate radiologic and clinical factors associated with increased difficulty in the removal of impacted maxillary canines. And to form an index to measure the difficulty of removal of the impacted maxillary canines preoperatively.

Materials and methods: A total of 40 patients who required surgical extractions of impacted maxillary canines betweenOctober 2020 and October2021 were involved in the study. Radiologic and clinical data were taken preoperatively. All extractions were performed under local anesthesia by a single operator. The surgical difficulty was measured by the total intervention time

Results: The increased surgical difficulty was associated with increasing age and body mass index. It was also associated with the curvature of the roots of the impacted tooth and the depth from point of elevation ($P > 0.05$)

Conclusions: Both clinical and radiologic variables are important in predicting surgical difficulty in impacted maxillary canine extractions. We tried to make CBCTa standard means and assess the difficulty of canine extraction in relation to root curvature, incisor overlap, and angulation of canine with lateral incisor but clinically there were differences are been appreciated and leading tothe form of a new index

KEYWORDS-maxillary canine, the curvature of roots, CBCT, impacted, index

INTRODUCTION

The maxillary canine is the most commonly impacted teeth, secondary to third molars. The permanent maxillary canine is frequently misplaced in teeth about other teeth in the maxilla. With early detection, timely interception, and well-managed surgical and orthodontic treatment, impacted maxillary canines can be erupted and guided to an appropriate location in the dental arch(1) The prevalence of non-eruption and ectopic eruption of this tooth has been reported to be 0.9-2.0% in samples not previously selected for orthodontic treatment.

About one-third of impacted maxillary canines are positioned labially or within the alveolus, and two-thirds are located palatally.(2). In most situations, the appropriate timing and surgical procedure for uncovering an impacted canine are determined by specific criteria.The most common localized factor is arch length-tooth size discrepancy. These factors are mainly for labially impacted canines, Jacoby's (3) found that only 17% of labially impacted canines had sufficient space, while 85% of palatally impacted canines had sufficient space. Two main theories associated with displaced maxillary canines are genetic and guidance theories (4). The genetic theory considers the genetic factors as a primary origin of palatally displaced maxillary canines. The guidance theory points out that the canine erupts guided by the root of the lateral incisor, and if the root of the lateral incisor is malformed or absent, the canine will not erupt. The sequelae of canine impaction include; malpositioning of the impacted tooth, migration of the neighboring teeth and loss of arch length, internal resorption, dentigerous cyst formation, external root resorption of neighboring teeth, and local infection of partially erupted canine.

The canine is the most frequently found palatal to the lateral incisor. Impactions are twice as common in females. This study is regarding the radiological assessment of surgical difficulty in maxillary impacted canines

Previously, conventional two-dimensional radiographic imaging modalities, especially panoramic radiographs, were most commonly used for diagnosis and treatment planning of the impacted maxillary canines. Still, drawbacks such as distortion, magnification, blurring, and projection of the three-dimensional complex maxillofacial structures on a two-dimensional image could decrease the value of panoramic radiographs and increase the misinterpretation risks. Accordingly, many studies recommended that the use of panoramic images alone are not satisfactory for the formulation of correct treatment plans for impacted maxillary canines(5) but sometimes we require to assess through CBCTbefore surgical intervention.

This prospective study aimed to investigate radiologic and clinical factors associated with increased difficulty in removing impacted maxillary canines. And to form an index to measure the difficulty of removal of the impacted maxillary canines preoperatively.

Previously our team has a rich experience in working on various research projects across multiple disciplines (Govindaraju and Gurunathan 2017; A. Christabel et al. 2016; Soh and Narayanan 2013; Mehta et al. 2019; Ezhilarasan, Apoorva, and Ashok Vardhan 2019; Campeau et al. 2014; Kumar and S 2016; S. L. Christabel 2015; Kumar and Rahman 2017; Sridharan, Ramani, and Patankar

2017; Ramesh et al. 2016; Thamaraiselvan et al. 2015; Thangaraj et al. 2016; Ponnulakshmi et al. 2019; "Fluoride, Fluoridated Toothpaste Efficacy and Its Safety in Children - Review" 2018) Now the growing trend in this area motivated us to pursue this project.

Materials and methods

A total of 40 (CBCT) images of 18 males and 22 females in the age group of 14–40 years were included in the study. The mean age of the sample was 21 ± 1.83 years. The mean ages were 22 ± 1.65 years and 20 ± 1.97 years for the males and females respectively. The CBCTs were collected routinely for screening and pre-treatment diagnostic purposes in these patients undergoing orthodontic treatment and referred to the department of oral and maxillofacial surgery in saveetha dental collegeand hospitals for surgical extraction of maxillary canine from a period between October 2020 to March 2021. Patients' consent and CBCTs were taken primarily for this research project. The study protocol was approved by saveetha Research Ethics Committee. This is a descriptive, cross-sectional, and prospective study in which all the CBCT images were screened by a single examiner for the presence of impacted teeth. The screened CBCTimages were then filtered according to the inclusion and exclusion criteria

Inclusion criteria

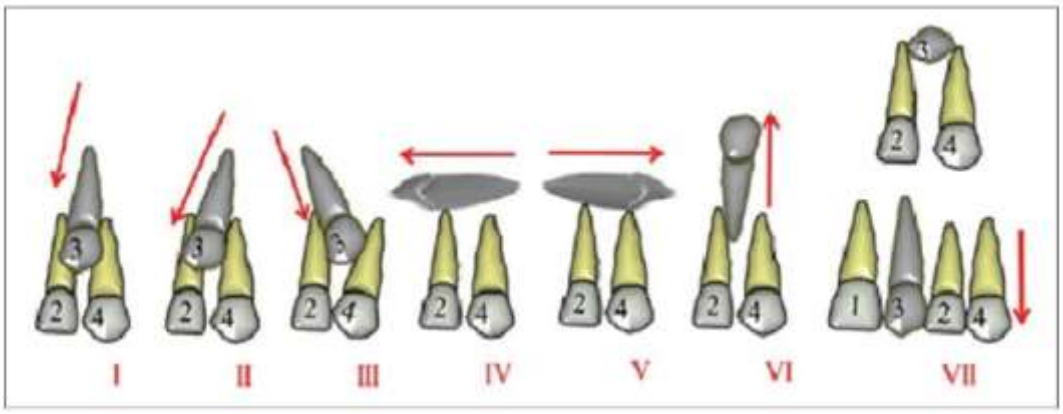
The age group of 14–40 years
Presence of impacted permanent maxillary canine which isnot likely to erupt
Dentulous patients with permanent dentition
Cases referred as pre-orthodontic surgical extraction of maxillary canine

Exclusion criteria

Surgical/Intentional extraction of maxillary canine
Associated cysts and pathology
Patient with systemic complications

A total of 40CBCTs images were screened, 40individuals(18 males and 22 females) with maxillary impacted canines fulfilled the selection criteria. The CBCT of these individuals wascategorized according to the classification system proposed byYamamoto et al. (2003)(6) in panoramic view. The anatomical position of maxillarycanine impaction (MCI) in each CBCT image was matched tothe seven subtypes mentioned in the classification asFigure 1 (7). The gender, BMI, and side of impaction were also recorded. After surgical intervention, occlusal plane,curvature of root,root relationship, periodontal space/ root bone interface, and depth from point of elevation were also recorded.The data was collected, sorted, and tabulated in Excel (Version:2003, Microsoft, Redmond, USA). The data was then statisticallyanalyzed descriptively using IBM SPSS (Version 20)to assess the prevalence of various subtypes of maxillarycanine impaction

Figure1



Results

A total of 40 individuals were screened in this study:- 40 individuals had maxillary canine impaction. . In terms of gender, females (n = 22, 58.38%) than males(n = 18, 41.62%) Evaluation of the side of canine impaction showed that approximately 48% of canine impaction occurred on the right side, and 52% occurred on the left side. In males, approximately 53% of canines were impacted on the right side, and the remaining 47% were impacted on the left side. In females, approximately 45% of the canines were impacted on the right side, and 55% were impacted on the left side.On assessing the seven subtypes of MCI according to Yamamoto et al. classification it was found that Type I(46%) accounted for the highest prevalence in the studied population. It was followed by Type II (37%) and Type VI (8%).Type III, V, and VII were 3% equally and no case of TypeIV was found

Based on age, BMI, and side of impaction were also recorded. After surgical intervention, occlusal plane, the curvature of the root,root relationship, periodontal space/ root bone interface, depth from point of elevation a new difficulty index was assessed

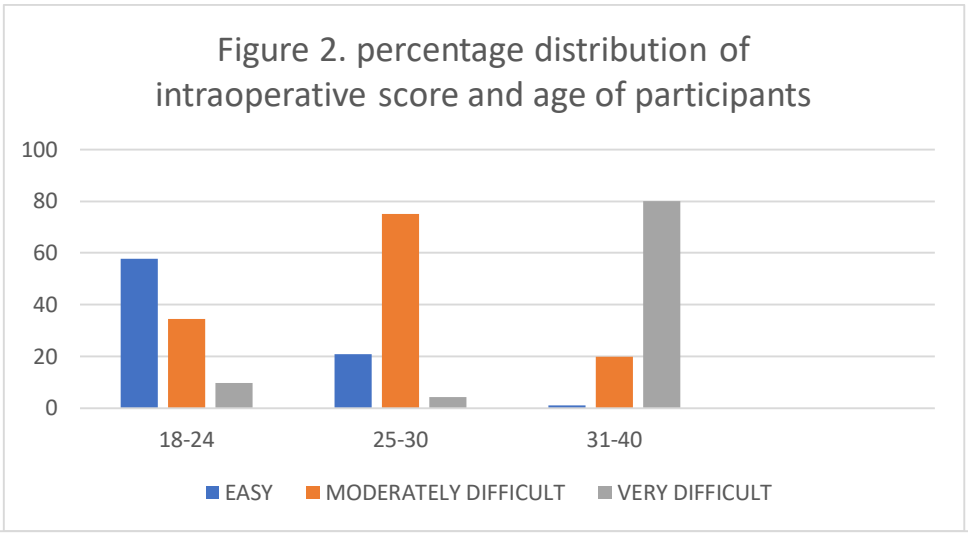


Figure 2. percentage distribution of intraoperative score and age of participants
100
80
60
40
20
0
18-24
25-30
31-40
EASY
MODERATELY DIFFICULT
VERY DIFFICULT

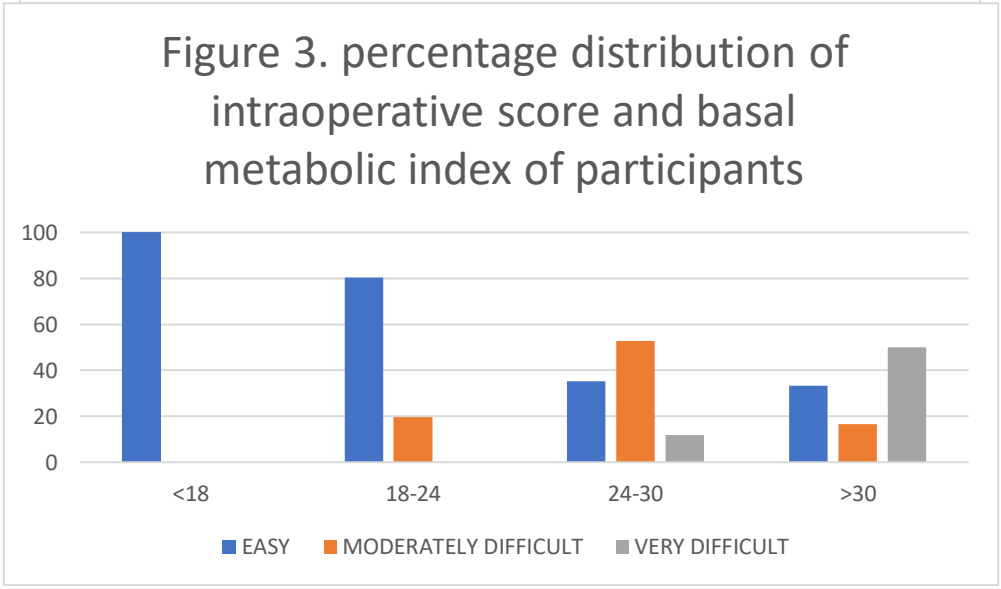


Figure 3. percentage distribution of intraoperative score and basal metabolic index of participants
100
80
60
40
20
0
<18
18-24
24-30
>30
EASY
MODERATELY DIFFICULT
VERY DIFFICULT

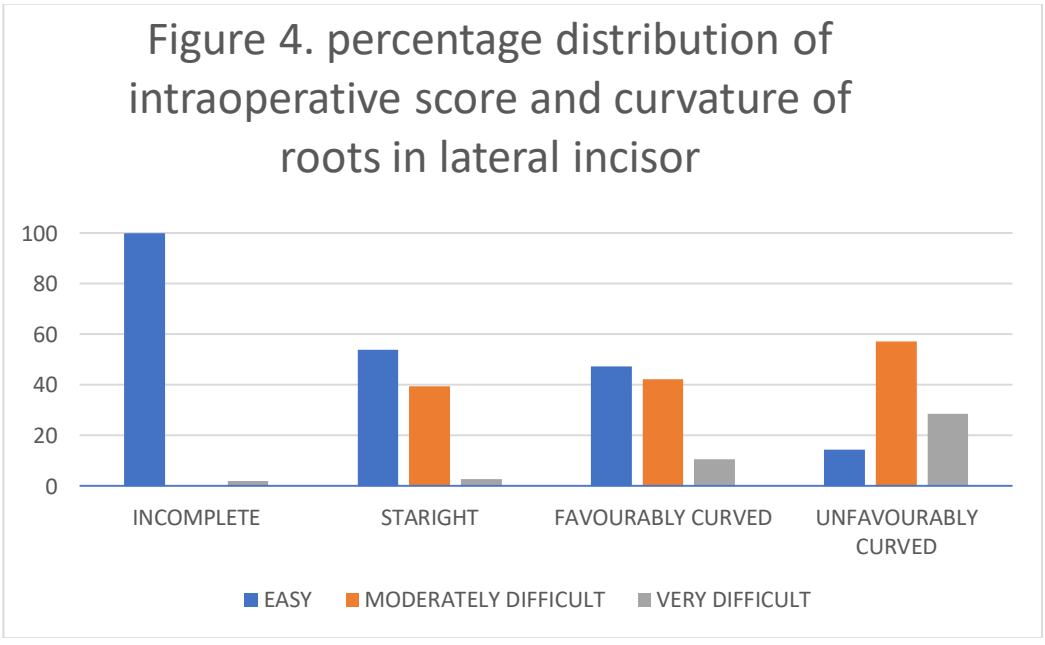
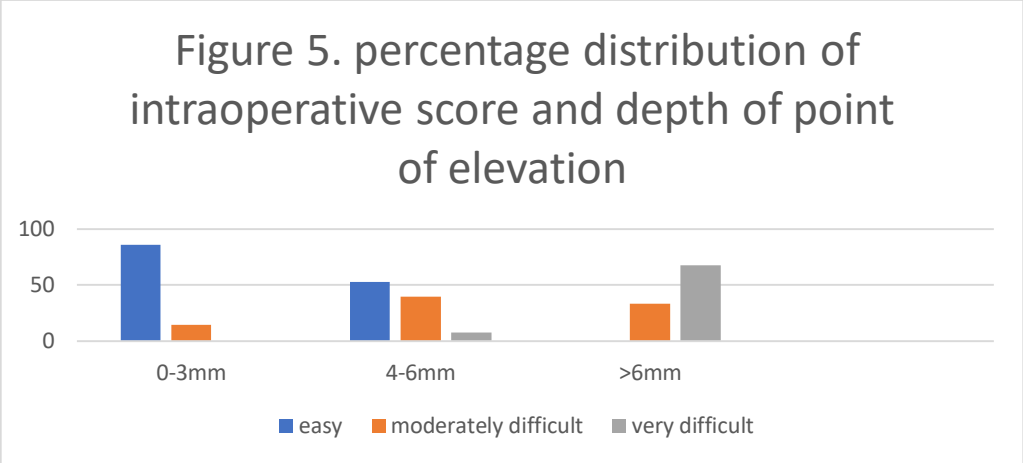


Figure 4. percentage distribution of intraoperative score and curvature of roots in lateral incisor
100
80
60
40
20
0
INCOMPLETE
STARIGHT
FAVOURABLY CURVED
UNFAVOURABLY CURVED
EASY
MODERATELY DIFFICULT
VERY DIFFICULT



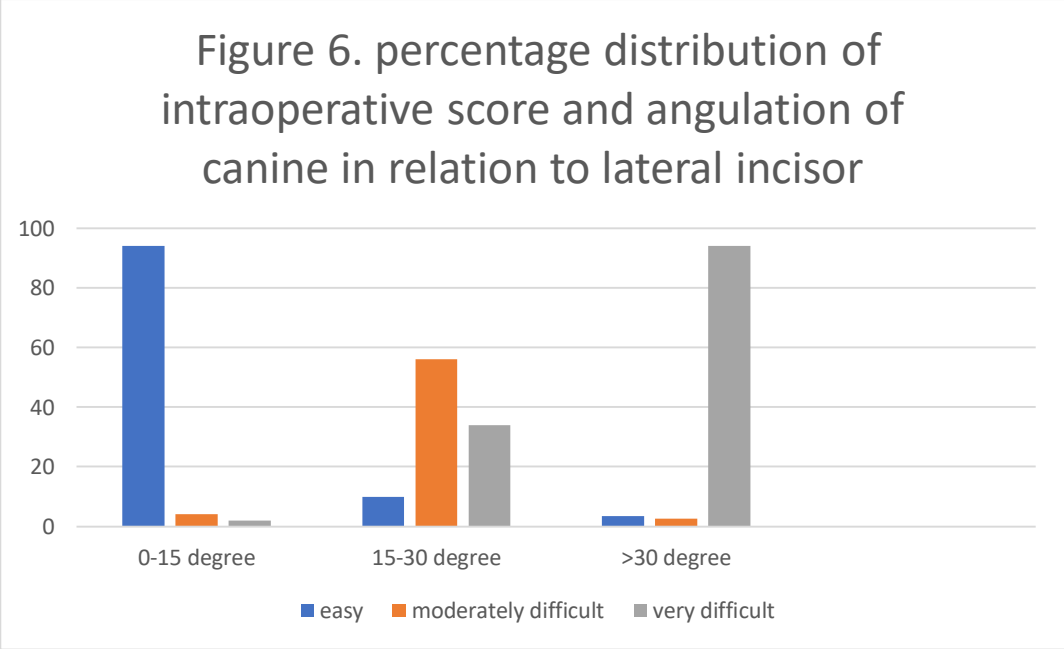


Table 1.

variable	Univariate analysis (p value)	Multiple linear regression (p value)
Gender	.096	.478
Age	.0007	.048
BMI	.001	.046
Angulation of impaction	.00002	.001
Curvature of roots	.0008	.063
Depth of elevation	.001	.365
Angulation of canine in relation to lateral incisor	.0001	.005

Table 2

variable	value	Range
AGE	1 2 3	18-24 25-30 31-40
BMI	1 2 3	<24 25-30 >30
Depth from point of elevation	1 2 3	0-3mm 4-6mm >6mm
Curvature of roots	1 2 3	Incomplete Straight/ favourable curved Unfavorable curved

Angulation of canine in relation to lateral incisor	1 2 3	0-15 degree 15-30 degree >30 degree

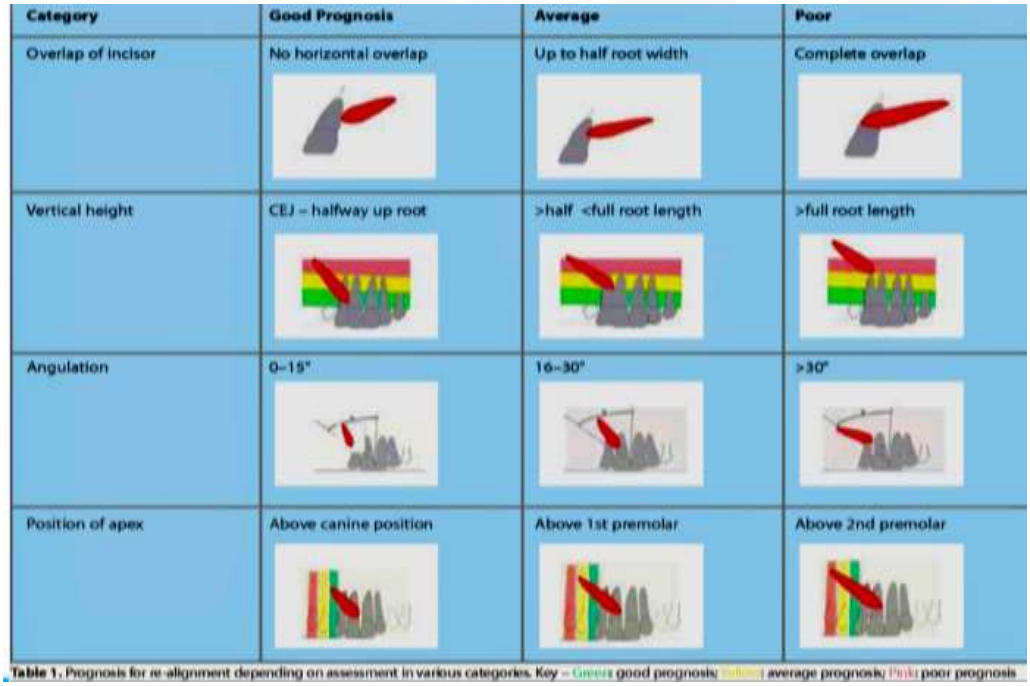


Table 1. Prognosis for re-alignment depending on assessment in various categories. Key – Green: good prognosis; Yellow: average prognosis; Pink: poor prognosis

Discussion

Out of all, 26 extractions (66.7%) were classified as easy, (25.6%) 10 as moderately difficult, and 4 (5.6%) were very difficult. Univariate analysis showed 9 variables
(3 clinical, 6 radiologic variables) which had *P* less than .1 (Table 1). However, after the multiple regressions only 4 variables had *P* values lessthan .05 (*P* values are shown in Table 1). The most important variable resulting in increased difficulty in this study was depth from point of extraction greater than6 mm. In the 3 cases where the depth was greater than 6 mm, 2 were classified as very difficult and 1 as moderately difficult.The relationship of these significant variables was used to form a new index of difficulty (table 2)Already existing 3D classification system for canine impactions, the KPG index gives a method of analyzing impactions using cone beam imaging. This method utilizes the entire three views of a CBCT image (8) but assessment is not only important to the dental surgeon who needs it to be able to decidewhether or not to refer patients for specialist care (10),but it is also important in predicting the possiblecomplications so that the patient can be informed.(9)The percentage of extractions in each group of theintraoperative score in this study (68.9%, 25.6%, and5.6% for easy, moderately difficult, and very difficultextractions, respectively)However,the present study contrasts those of Renton et al1 andYuasa et al,(11)although these studies used differentmodes of classification of intraoperative difficulty.However, most researchers agree that postoperativecomplications are more commonly associated withmore difficult extractions. With the range of difficult canine extractions from the studies between 4.1% and 44.5%,patients must be, to the highest level ofscientific certainty, informed of the possibility of complicationsafter removal of their impacted canine maxillae, based on a preoperative estimation ofdifficulty.Kokich and Mathews(12) recommend an alternative technique with earlier timing for uncovering palatally impacted canines. They time the uncovering of palatal canines before the start of orthodontic treatment.
Our institution is passionate about high-quality evidence-based research and has excelled in various fields ((JayaseelanVijayashreePriyadharsini 2019; Pc, Marimuthu, and Devadoss 2018; Ramesh et al. 2018; Ramadurai et al. 2019; Sridharan et al. 2019; Ezhilarasan, Apoorva, and Ashok Vardhan 2019; Mathew et al. 2020; Samuel 2021; R et al. 2020; Chandrasekar etal. 2020; J. VijayashreePriyadharsini, SmilineGirija, and Paramasivam 2018).
This research is a prospective observational study with the level of evidence to add benefit in clinical application.

Conclusions: Both clinical and radiologic variables are important in predicting surgical difficulty in impacted maxillary canine extractions. We tried to make CBCT standard means and assess the difficulty of canine extraction in relation to root curvature, incisor overlap, and angulation of canine with lateral incisor but clinically there were differences are been appreciated and leading to a new index (table 2)

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