

# Quantitative Classification of Impacted Teeth: A New Proposal

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## ABSTRACT

**Aim:** To propose a quantitative classification scheme that is useful for all impacted teeth as well as to describe their angulations, relationships to adjacent teeth and proximity to adjacent vital structures.

**Materials and methods:** The abbreviation SPAN was used as a system of classification. S stands for size, which indicates the relationship of the mesiodistal diameter of the impacted tooth to its normal space. P stands for the position, which indicates the relationship of the most occlusal point of the impacted tooth to the crown of the mesial tooth or distal tooth if the mesial tooth is missing. A stands for angulations, which means the relationship of the long axis of the impacted tooth to that of the adjacent mesial tooth or distal tooth if the mesial one is missing. N stands for proximity to vital structures.

**Results:** This proposal has been applied to some radiographic examples and was found to be effective.

**Conclusion:** This proposal is effective and inexpensive as it only depends on panoramic views. Cone beam computed tomography (CBCT) may become readily available in the future and decrease radiation exposure and expenses, making future classifications more accurate, easier and beneficial.

**Clinical significance:** The scientific rationale for this study is to propose a quantitative classification system for the impacted teeth. This system can be applied to all impacted teeth by using a panoramic view, which is less expensive and readily available. It also describes angulations, space available, depth, and the relationship of the impacted teeth to vital structures. By applying this scheme, the clinicians can quantify surgical difficulty.

**Keywords:** Classification, Impacted canine, Impacted teeth, Impaction, Wisdom teeth.

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## INTRODUCTION

Several complications may result from tooth impaction, including aesthetic and phonetic compromises, loss of arch length, and referred pain.<sup>1</sup> For these reasons, surgical removal of impacted teeth is important, but these

surgeries also have complications. Surgical complications can be minimized by proper preoperative clinical and radiographic assessments. Data collected from clinical examinations and radiographs can be used to create a classification scheme that can be used as a guide for surgeons.

The aims of any classification scheme are to simplify the scientific communication between clinicians, provide information regarding surgical difficulty and possible complications,<sup>2</sup> and maintain adequate record-keeping that can be used for both audit and research purposes.<sup>3</sup>

Many classification schemes for impacted teeth have been proposed.<sup>1,4-6</sup> The most popular are the Pell and Gregory and Winter's classifications of wisdom teeth as well as Archer's classification of impacted canines.<sup>7</sup> However, a literature review revealed that no classification scheme is applicable to all types of impactions. Furthermore, most trials relate impacted teeth to one or two anatomical areas. Winter<sup>8</sup> and Pell and Gregory related wisdom teeth to the adjacent second molar, similar to Archer and Kruger.<sup>9</sup> These classification schemes ignored the relationship between impacted teeth and adjacent vital structures. Archer's impacted canine classification does not mention the angulations of the impacted canine nor its relationship to vital structures. Other recent classifications have considered many important variables, but they are complicated and limited to the lower third molar as well as require expensive radiographic techniques.<sup>4-6</sup> The aim of this study was to propose a quantitative classification method that is useful for all impacted teeth, and that can describe the angulations of the impacted tooth as well as its relationship to adjacent teeth and proximity to adjacent vital structures using less expensive and more readily available radiographic techniques.

## MATERIALS AND METHODS

The keywords for the literature search were: impaction, impacted teeth, classification, impacted canine, wisdom teeth. Relevant articles and chapters from textbooks were reviewed to create this new classification scheme. The proposed classification scheme was based on the same idea employed for the classification of tumors (TNM system) as well as the system used by obstetricians to describe gravidity, parity, and abortion (GPA).

In this work, the abbreviation SPAN was used as the system of classification. S stands for size, which indicates the relationship of the mesiodistal diameter of the

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impacted tooth to its normal space. S1 indicates that the mesiodistal diameter of the impacted tooth is less than or equal to its normal space. S2 indicates that the mesiodistal diameter of the impacted tooth is greater than its normal space. S3 indicates that the normal space is almost closed. P indicates the relationship of the occlusal point of the impacted tooth to the crown of the mesial tooth or distal tooth if the mesial tooth is missing. P1 indicates that the most occlusal point of the impacted tooth is at the occlusal plane of the mesial tooth or the distal tooth if the mesial tooth is missing. P2 indicates that the most occlusal point of the impacted tooth is between the occlusal plane and the cement-enamel junction (CEJ) of the mesial tooth or the distal tooth if the mesial tooth is missing. P3 indicates that the most occlusal point of the impacted tooth is apical to the CEJ of the mesial tooth or the distal tooth if the mesial tooth is missing. A stands for angulations, which indicates the relationship of the long axis of the impacted tooth to that of the adjacent mesial tooth or the distal tooth if the mesial tooth is missing. A1 indicates a vertical angulation, A2 indicates a mesioangular angulation of lower teeth and distoangular angulation of upper teeth, A3 indicates a buccolingual angulation, A4 indicates a horizontal angulation, A5 indicates a distoangular angulation of lower teeth and mesioangular angulation of upper teeth, A6 indicates an inverted angulation, and A7 indicates an aberrant angulation. N stands for the proximity to vital structures. N1 indicates that the most apical part of the impacted tooth is 2 mm or more from adjacent vital structures. N2 indicates that the most apical part of the impacted tooth is less than 2 mm from adjacent vital structures. N3 indicates that the most apical part of the impacted tooth is just penetrating the boundary of adjacent vital structures. N4 indicates that the most apical part of the impacted tooth crosses the boundary of adjacent vital structures. The vital structure in the upper posterior area is the maxillary sinus, whereas, in the lower posterior area, it is the inferior alveolar nerve (IAN) and in the upper anterior area, it is the nasal cavity. In this area, the letter D for proximity to the nasopalatine nerve (NPN) is added, so the abbreviation becomes SPAND, where D1 indicates that the impacted tooth is distant from the canal and D2 indicates that the impacted tooth touches the canal. No vital structures were present in the lower anterior area, so N is N0.

For example, the abbreviation S2P3A2N4D2 of the upper left canine, which can also be written as SPAND23241<sub>3</sub>, indicates that the mesiodistal diameter of the impacted canine tooth is greater than its normal space, the most occlusal point of this tooth is apical to the CEJ of the lateral incisor or first premolar if the lateral incisor is missing, the canine is buccally inclined and the impacted canine crosses the nasal cavity and is

away from NPN. If we add the numbers 23241, the result is 12 compared with another example, SPAND33442, for which the result is 16. Obviously, 16 is greater than 12 for the upper left impacted canine, and from reading the description of these two examples, the second example is more difficult to correct surgically.

Another example is SPAN3353 or S3P3A5N3<sub>8</sub>, which indicates that the normal space of the impacted lower wisdom tooth is almost closed, the most occlusal point of this tooth is apical to the CEJ of the second molar, its long axis is distoangular to that of the second molar, and the most apical part of the impacted wisdom tooth just penetrates the boundary of the inferior alveolar canal.

An orthopantomogram (OPG) and, sometimes, Clark's technique were the tools used to study these cases and for the classification scheme described herein.

There is no active agency or research board in Libya during this time of conflict (Libyan war), and this work mainly depended on a review of the literature.

There were no humans nor animals evaluated in this work.

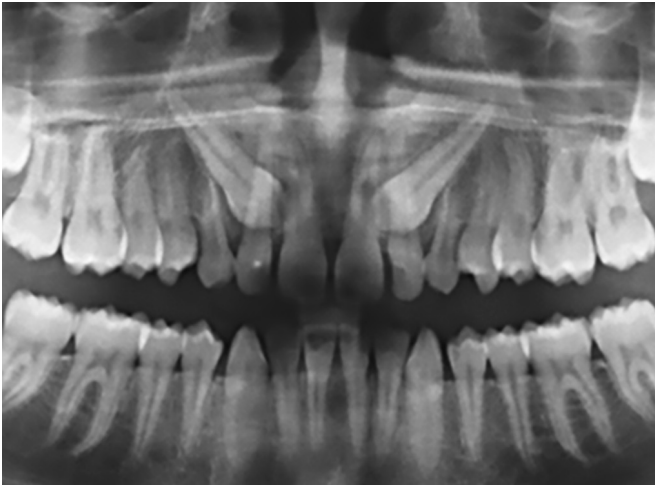
Figures 1 and 2 show examples of different impacted teeth classified according to the described in this proposal. The radiographs were collected from a Google search (<http://www.hi5ortho.com/3d-imaging-standard-care-orthodontist/>) (<http://www.beaconcovedental.com.au/our-services-treatments/surgical-extractions-wisdom-teeth/>).

## DISCUSSION

Many studies describing the classification of canine teeth have been published,<sup>1,4-7</sup> but that by Archer<sup>7</sup> in 1975 is considered to be a simple and common classification for impacted canines. The most popular classification scheme



**Fig. 1:** SPAN1143<sub>8</sub>. The mesio-distal diameter of the impacted lower left wisdom tooth is equal to its normal space, the most occlusal point of this tooth is in the occlusal plane, the long axis is horizontal and related to the second molar, and the most apical point penetrates the boundary of the IAN canal



**Fig. 2:** SPAND23511<sup>3</sup>. The mesio-distal diameter of the impacted upper left canine is greater than its normal space, the most occlusal point of this tooth is apical to the CEJ, the long axis is mesioangularly related to the adjacent teeth, the most apical point is more than 2 mm from the boundary of the nasal cavity, and the canine is away from the NPN

for wisdom teeth is that published by Pell and Gregory,<sup>2,9</sup> while the simplest method was published by Winter.<sup>8</sup> Both classifications were proposed several decades ago and intended to determine the orientation of the great axis of the tooth, the relationship of the tooth with the ramus, and the depth of impaction.<sup>10</sup> However, Pell and Gregory's classification has recently been found to be inadequate for the determination of surgical difficulty.<sup>11</sup> Furthermore, both classifications are limited to wisdom teeth. Other trials are complicated and require expensive tools, such as CBCT.<sup>5</sup> To make the classification scheme easier and applicable to all surgeons and even general dental practitioners, only radiographic variables were examined in this trial, unlike other studies,<sup>12</sup> in which demographic, radiographic and operative variables were the tools used to assess the difficulty of treating the third molar surgically.

Reviewing the literature revealed a similar classification system to that proposed herein, known as WHARFE (Winter's classification, height of the mandible, angulation of second molar, root shape and morphology, follicle development, exit path),<sup>12</sup> but this is not popular and, in my opinion, is a lengthy scoring system. In another similar work proposed by Gintaras and Povilas,<sup>5</sup> the risk degree for surgical intervention is scored as conventional, simple, moderate or complicated by determining the mandibular third molar mesiodistal position in relation to the second molar (M) and mandibular ramus (R), apico-coronal position in relation to the alveolar crest (A) and mandibular canal (C), buccolingual position in relation to the mandibular lingual and buccal walls (B) and spatial tooth position (S). The authors of this trial used the abbreviation MRACBS to assess the surgical difficulty for an impacted third molar, similar to the SPAN abbreviation

used in this proposal. However, the Gintaras and Povilas<sup>5</sup> method is limited to the lower third molar and requires the use of CBCT, in contrast to this trial, where OPG is the main tool and classification, which can be used for all types of impactions.

The present proposal overcomes the shortcomings of previous classifications and has following advantages i.e. it can be applied to all impacted teeth, simple and can be made from a panoramic view, which is less expensive and readily available, it describes angulations, space available, depth, and relationship to vital structures, it can quantify surgical difficulty, it can make communication between clinicians easier.

The majority of the classifying results were from analyses of radiographs. For most situations, periapical radiographs provide adequate detail and should be the radiographs that are most commonly used. Panoramic radiographs show a more accurate picture of the total anatomy of the region and can be used as an adequate substitute.<sup>2</sup>

Despite the low sensitivity, 39%, and specificity, 66%, of pantomography in predicting inferior alveolar nerve damage during extraction of impacted lower third molars,<sup>1</sup> OPG is the most commonly used technique in many studies<sup>11,13,14</sup> and it was the main tool used in this proposal because it is more readily available and less expensive, particularly in third world countries.

Panoramic radiographs, however, do not always provide reliable data on the precise relationship between anatomical structures as they are 2-dimensional (2D) and distortions.<sup>4,13</sup> The proximity of the root apex of the impacted third molar to the mandibular canal may be strongly indicative of the risk of injury to the nerve.<sup>13</sup>

The more recently developed OPG devices minimize magnification, reduce distortion and have a measuring ruler that helps to estimate the distance between anatomical areas. The other radiographic modalities mentioned in the literature,<sup>15</sup> such as computed tomography, tuned aperture computed tomography (TACT), volumetric CT scan and CBCT, are more costly and have higher radiation exposure compared to panoramic images.<sup>1</sup> Some authors have limited the use of such techniques to complicated cases and use pantomography as the main tool in their studies.<sup>16</sup>

A IAN is a very important vital structure that is at risk in lower third molar surgery and is an interesting area of study for many authors.<sup>4,6,8,11,14-17</sup> The relationship between the mandibular canal and lower wisdom teeth has been evaluated in detail, including their spatial relationship, diameter of the canal, and root anatomy.<sup>18</sup> The frequency of IAN injury may vary from 0.5–7%, and the risk of permanent injury is below 1%.<sup>4,13</sup> Few reports discuss the risk of injury to other vital structures related to impacted teeth, such as the maxillary sinus,<sup>19</sup> nasal cavity, and nasopalatine bundle, which may be due to low

chances of harm and less serious sequela from trauma to these structures. In this work, I tried to simplify the relationship between impacted teeth and the previously mentioned vital structures.

The limitation of this proposal was ignorance of the fine details, such as Rood's signs (darkening, narrowing or deflection of the root, dark or bifid apex of the root, interruption of the cortical outline of mandibular canal, canal diversion or narrowing, island-shaped apex, etc.). Leaving out these details is important for creating a simple classification scheme that fits all teeth. The other limitation was the determination of the actual position of the IAN as either lingual or buccal, which requires more complex tools, such as CBCT, and this work mainly utilized OPG. Finally, this classification proposal was a little bit lengthy.

## CONCLUSION

As technology advances, CBCT may become readily available in the future and lead to decreased radiation exposure and costs, making future classification schemes more accurate, easier and beneficial. Further research is recommended to apply and test the benefits of this proposed classification system.

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