

**THE PREVALENCE AND ASSOCIATED
FACTORS OF TOOTH WEAR AMONGST
ADULTS SEEKING TREATMENT IN THE
FACULTY OF DENTISTRY, UNIVERSITY
MALAYA**

BILAL ZUHAIR NAFEA AL-ANI

UNIVERSITI SAINS MALAYSIA

2019

**THE PREVALENCE AND ASSOCIATED
FACTORS OF TOOTH WEAR AMONGST
ADULTS SEEKING TREATMENT IN THE
FACULTY OF DENTISTRY, UNIVERSITY
MALAYA**

by

BILAL ZUHAIR NAFEA AL-ANI

Thesis submitted in fulfilment of the requirement

for the Degree of

Master of Science

August 2019

ACKNOWLEDGEMENT

All praise is for Allah, the exalted, the most merciful and the most beneficent who has given me the strength to complete this study. May Allah's peace and blessings on Prophet Muhammed, on his family and on his companions.

A major research project like this is never the work of anyone alone. The contributions of many different people, in different ways, have made this possible. The best and worst moments of my study journey have been shared with many people. It has been a great privilege to spend several years in USM and its members will always remain dear to me. My first debt of gratitude must go to my supervisor Dr. Noor Huda Ismail and co-supervisors Associated Professor Dr. Wan Zaripah Wan Bakar and Associated Professor Dr. Norasmatul Akma Ahmad. I have great pleasure in placing on record my deep sense of gratitude to them for their motivation, constructive discussions, guidance and encouragement throughout this study. I would like to acknowledge the moral support and inspiration they had given to me, especially during the writing of this thesis.

Words cannot express my deep sense of gratitude and feel to my dearest father Prof. Dr. Zuhair Nafea and my lovely mother for the supporting, encouragement, patience and prayers, which were vital for sustaining the efforts, required for completing this master program. I am also indebted to my sisters for their love, patience and understanding. Finally, I would like to express my thanks for the UM Dental Faculty and many friends cannot be mentioned here due to a narrow field, whole assistance, encourage and shared me some beneficial ideas regarding this work.

TABLE OF CONTENT

Acknowledgment	ii
Table of Contents	iii
List of Tables	ix
List of Figures	xii
Abstrak	xiii
Abstract	xv

CHAPTER I - INTRODUCTION

1.1 Aetiology.....	2
1.2 Tooth wear indices.....	6
1.3 Prevalence.....	7
1.4 Clinical problems.....	7
1.5 Tooth wear management.....	8
1.6 Problem statement.....	11
1.7 Justification of study.....	11
1.8 Objectives and aims.....	13
1.8.1 General objective.....	13
1.8.2 Specific objectives.....	13
1.9 Research questions.....	13
1.10 Research hypotheses.....	14

CHAPTER II - LITERATURE REVIEW

2.1 Introduction.....	16
2.2 Tooth wear.....	17
2.2.1 Prevalence of tooth wear.....	19

2.3	Tooth wear pattern.....	28
2.3.1	Dental attrition.....	28
2.3.2	Dental erosion.....	45
2.3.3	Dental abrasion.....	64
2.3.4	Dental abfraction.....	66

CHAPTER III - METHODOLOGY

3.1	Introduction	71
3.2	Study design	72
3.2.1	Study area	72
3.3	Population and study sample	72
3.3.1	Inclusion criteria	72
3.3.2	Exclusion criteria	73
3.4	Pathology	73
3.5	Sample size and selection of the sample	73
3.5.1	Prevalence and severity of tooth wear	73
3.5.2	The relationship between the questionnaire items (variables) of tooth wear	75
3.6	List of questionnaire items (variables)	76
3.7	Equipment requirements	76
3.8	Infection control requirements	77
3.9	Diagnostic system	78
3.10	Questionnaire	79
3.11	Methods of data collection and data analysis.....	79

CHAPTER IV - RESULTS

4.1	Introduction.....	84
4.2	Sample characteristics of the cross-sectional study.....	85
4.2.1	Age relation to tooth wear and its division	85
4.2.2	Gender relation to tooth wear and its division in cross-tabulation.....	89
4.3	The prevalence and demographic associations of tooth wear.....	91
4.3.1	Estimation of the prevalence and pattern of tooth wear in adult population	91
4.3.2	Investigation of tooth wear frequency according to each teeth groups	92
4.3.3	The prevalence of affected surfaces (buccal, cervical, lingual/palatal and occlusal/incisal).....	94
4.4	Factors associated with tooth wear in general	95
4.4.1	The prevalence of tooth wear according to marital status	95
4.4.2	The prevalence of tooth wear according to education level	95
4.4.3	The prevalence of tooth wear according to smoking.....	96
4.5	Factors associated with dental attrition	97
4.5.1	Grinding and TMJ clicking in relation with dental attrition.....	97
4.5.2	Hard food and its relation to dental attrition	98
4.6	Factors association with dental abrasion	100
4.6.1	Oral hygiene practices and its relation to abrasion	

type of tooth wear	100
4.6.2 Habits and its relation to dental abrasion	104
4.7 Dental erosion and its related factors	105
4.7.1 The prevalence of dental erosion in association with work environment	105
4.7.2 The prevalence of dental erosion in selected systemic diseases	106
4.7.3 The prevalence of dental erosion in association with acidic food and drinks	109
4.8 Risk factors of tooth wear and its relationship with the variables	116
4.8.1 Risk factors (variables) that result in general tooth wear	116
4.8.2 Risk factors (variables) that result in dental attrition	117
4.8.3 Risk factors (variables) that result in dental abrasion	122
4.8.4 Risk factors (variables) that result in erosion.....	125
4.9 Data analysis that related to the severity of tooth wear	131

CHAPTER V - DISCUSSION

5.1 Introduction	133
5.1.1 Objectives addressed in the cross-sectional study	134
5.1.2 Results discussion constructed under the below headings	135
5.2 Measurement of tooth wear and the prevalence of different patterns of tooth wear	136

5.2.1	Tooth wear prevalence and its association with cigarettes smoking	136
5.3	Factors associated with dental attrition	138
5.3.1	Grinding, clicking, muscle stiffness and their effectiveness on dental attrition.....	139
5.3.2	Hard food and their relation to dental attrition	140
5.4	Factors associated with dental erosion	141
5.4.1	Systemic diseases that associated with dental erosion	142
5.4.2	Alcohol consumption and its relation to the prevalence of erosive type of tooth wear	145
5.4.3	Beverages and other drinks associated with dental erosion	146
5.4.4	Acidic food associated with dental erosion.....	147
5.4.5	Working environments and its relation to dental erosion.....	147
5.5	Factors associated with dental abrasion	149
5.5.1	Oral hygiene practices and its relation to abrasive type of tooth wear	151
5.5.2	Selected habits and its relation to dental abrasion	152
5.6	Severity of tooth wear in adults seeking treatment in the Faculty of Dentistry, University of Malaya.....	153

CHAPTER VI - CONCLUSION

6.1	Overview	154
6.2	Conclusion	154
6.3	Future study and recommendations	157

REFERENCES158

APPENDICES

Appendix A: USM ethics approval

Appendix B: UM ethics approval

Appendix C: Questionnaire

Appendix D: Data collection form

Appendix E: List of Conferences and Journals

LIST OF TABLES

		Page
Table 2.1	Tooth wear and its prevalence - Summary of articles	24
Table 2.2	Attrition types of tooth wear - Summary of articles	39
Table 2.3	Dental erosion (intrinsic/extrinsic factors) - Summary of articles	57
Table 2.4	Abrasion and abfraction - Summary of articles	68
Table 3.1	The explanatory variables considered	76
Table 3.2	Smith and Knight Tooth Wear Index (TWI)	78
Table 4.1	Age cross-tabulation in total tooth wear	86
Table 4.2	Age cross-tabulation in dental attrition	87
Table 4.3	Age cross-tabulation in dental abrasion	87
Table 4.4	Age cross-tabulation in dental erosion	88
Table 4.5	Gender cross-tabulation in tooth wear	89
Table 4.6	Gender cross-tabulation in attrition	90
Table 4.7	Gender cross-tabulation in erosion	90
Table 4.8	Gender cross-tabulation in abrasion	91
Table 4.9	Affected and non-affected teeth	92
Table 4.10	Frequency of affected surfaces	94
Table 4.11	Marital status cross-tabulation in tooth wear	95
Table 4.12	Education level cross-tabulation in general tooth wear	96
Table 4.13	Smoking cross-tabulation with tooth wear	96
Table 4.14	Grinding attrition cross-tabulation	97
Table 4.15	Clicking attrition cross-tabulation	98
Table 4.16	Nuts attrition cross-tabulation	99
Table 4.17	Ice attrition cross-tabulation	99
Table 4.18	Carrot attrition cross-tabulation	100
Table 4.19	Toothbrush bristles cross-tabulation in dental abrasion	101
Table 4.20	Brushing frequency cross-tabulation in dental abrasion	102
Table 4.21	Brushing duration cross-tabulation in dental abrasion	103

Table 4.22	Brushing methods cross-tabulation in dental abrasion	104
Table 4.23	Habits cross-tabulation in dental abrasion	105
Table 4.24	Work environment cross-tabulation in dental erosion	106
Table 4.25	Heartburn cross-tabulation in dental erosion	107
Table 4.26	Diabetes mellitus cross-tabulation in dental erosion	107
Table 4.27	Breathing disorder cross-tabulation in dental erosion	108
Table 4.28	Others diseases cross-tabulation in dental erosion	109
Table 4.29	Alcohol vs. dental erosion	110
Table 4.30	Frequency of alcohol intake in dental erosion	111
Table 4.31	Acidic foods and drinks in relation to dental erosion	113
Table 4.32	Pearson correlation of tooth wear vs. selected variables	116
Table 4.33	Binary logistic regression of gender, age, marital status, education, smoking and its frequency	116
Table 4.34	Pearson correlation between tooth wear and sensitivity	117
Table 4.35	Pearson correlation of attrition vs. selected variables	118
Table 4.36	Binary logistic regression of gender, age, marital status and education	118
Table 4.37	Pearson correlation of attrition vs. hard food	119
Table 4.38	Logistic regression between attrition and nuts, ice, carrot	119
Table 4.39	Pearson correlation of attrition vs. grinding, clicking and stiffness	120
Table 4.40	Binary logistic regression between attrition and grinding, clicking and stiffness	121
Table 4.41	Pearson correlation of abrasion vs. gender and age	121
Table 4.42	Pearson correlation of abrasion vs. oral hygiene	122
Table 4.43	Logistic regression between abrasion and oral hygiene	123
Table 4.44	Pearson correlation between abrasion and habit	123
Table 4.45	Pearson correlation of erosion vs. selected variables	124

Table 4.46	Logistic regression between erosion and gender, age, marital status and working environment	125
Table 4.47	Pearson correlation of erosion vs. systemic diseases	126
Table 4.48	Binary logistic regression between erosion and selected systemic diseases	126
Table 4.49	Pearson correlation of alcohol in relation with erosion	127
Table 4.50	Binary logistic regression between erosion and alcohol and its frequency	127
Table 4.51	Pearson correlation between erosion and selected acidic food and drinks	128
Table 4.52	Logistic regression between erosion and selected acidic food and drinks	129
Table 4.53	Pearson correlation between erosion and medication	130
Table 4.54	Tooth wear severity according to Smith and Knight Tooth Wear Index (1984)	132

LIST OF FIGURES

		Page
Figure 2.1	Development of an ‘edge-to-edge’ bite	36
Figure 2.2	Direct and indirect effect of alcohol	54
Figure 2.3	Severe erosion, resulting in occlusal amalgam restorations in teeth 44, 45 and 46	55
Figure 2.4	The photograph shows the location of erosion in sample of battery factory who are exposing to sulfuric acid	56
Figure 2.5	Abfraction; articulating paper markings indicate eccentric, loading which induced stress concentration in the cervical region	57
Figure 3.1	The stages involved in the cross sectional study	71
Figure 3.2	Sample size of the current study	74
Figure 3.3	Sample size summary	75
Figure 3.4	Phases of data analyses	82
Figure 4.1	The frequency of tooth wear pattern in sample of $n=384$	92
Figure 4.2	Prevalence of affected teeth by tooth wear pattern	93
Figure 4.3	Prevalence of affected teeth according to group of teeth	94
Figure 4.4	Acidic food and drinks and its frequency vs. erosion	114

**PREVALENS DAN FAKTOR YANG BERKAITAN GIGI HAUS DALAM
KALANGAN DEWASA YANG MENERIMA RAWATAN DI FAKULTI
PERGIGIAN, UNIVERSITI MALAYA**

ABSTRAK

Gigi haus seperti hakisan, lelasan dan/atau atrisi telah menyebabkan kebimbangan kepada doktor gigi dan masyarakat. Secara umumnya, prevalens gigi haus dalam kalangan semua peringkat umur: remaja, dewasa dan orang tua telah meningkat secara signifikan sejak beberapa tahun ini. Tujuan penyelidikan ini adalah untuk menentukan prevalens setiap jenis gigi haus, menilai hubungkait faktor risiko penyebab gigi haus dan juga untuk mengenal pasti tahap keterukan gigi haus dalam kalangan pesakit yang datang ke Fakulti Pergigian, Universiti Malaya, Kuala Lumpur, Malaysia untuk mendapatkan rawatan pergigian. Hipotesis kajian ini adalah terdapatnya prevalens gigi haus tinggi bagi kesemua jenis gigi haus (hakisan, lelasan dan atrisi) dalam kalangan orang dewasa dan perkara ini berhubungkait dengan faktor risiko yang juga mempengaruhi ketahanan gigi. Seramai 384 peserta yang terlibat dalam kajian adalah dalam lingkungan 20 hingga 65 tahun yang terdiri daripada lelaki dan perempuan. Penyelidik menggunakan soal selidik yang telah disahkan terlebih dahulu dan borang pemeriksaan klinikal di dalam mulut berdasarkan Indeks Gigi Haus Smith dan Knight 1984 untuk pengumpulan data. Program SPSS telah digunakan untuk menganalisa data. Keputusan menunjukkan prevalens gigi haus adalah tinggi (95%) dan jenis gigi haus yang paling lazim adalah atrisi gigi (82%), diikuti oleh hakisan gigi (52%) dan jenis abrasi merupakan yang paling rendah (43%). Sebagai tambahan, faktor usia adalah berhubungkait secara signifikan dengan gigi haus. Pengambilan alkohol dan merokok tembakau juga telah mempengaruhi secara

signifikan tisu gigi dan peningkatan terhadap kejadian gigi haus. Selain itu, amalan kebersihan mulut sangat berhubungkait dengan abrasi gigi. Tabiat pengetaman gigi pula berkait rapat secara signifikan dengan atrisi gigi. Keputusan kajian menunjukkan bahawa majoriti permukaan gigi yang haus mendapat skor gred 1 (71%) mengikut Indeks Gigi Haus Smith dan Knight. Gigi haus yang mempunyai skor gred 2 adalah sebanyak 26% dan baki 3% dijangka sebagai gred 3 dan 4. Berdasarkan kajian ini, prevalens gigi haus adalah tinggi (95%) di kalangan orang dewasa yang menghadiri Fakulti Pergigian, Universiti Malaya dan jenis gigi haus yang paling lazim adalah atrisi gigi.

**THE PREVALENCE AND ASSOCIATED FACTORS OF TOOTH WEAR
AMONGST ADULTS SEEKING TREATMENT IN THE FACULTY OF
DENTISTRY, UNIVERSITY MALAYA**

ABSTRACT

Tooth wear of all patterns, like erosion, abrasion and/or attrition is a growing concern amongst dentist and community. Generally, the prevalence of tooth wear amongst all age group young adults, adult and elderly has significantly increased in recent years. The aim of the current study is to determine the prevalence of each type of tooth wear, evaluate the associated aetiological risk factors for such condition, as well to detect the severity of tooth wear in a group of participants who were seeking treatment in the Faculty of Dentistry, University of Malaya, Kuala Lumpur, Malaysia. The hypothesis state that there is a high prevalence of tooth wear for all subdivisions (erosion, abrasion and attrition) amongst adult with the associated risk factors that affect the longevity of teeth. In this study, 384 individuals who visited the Faculty of Dentistry, University of Malaya to seek treatment were involved. Subjects were 246 males and 138 females aged 20 to 65 years old. The researcher used the previously validated questionnaire and the clinical examination sheet based on Smith and Knight Tooth Wear Index 1984. SPSS program was used in the analysis of data. The results showed that the prevalence of tooth wear is high (95%) and the most prevalent type of tooth wear is dental attrition (82%), followed by dental erosion (52%), while dental abrasion is the lowest prevalent type (43%). In addition, age is significantly related to tooth wear. Alcohol consumption and tobacco smoking have significantly affected dental tissues and increased the incidence

of tooth wear. Oral hygiene practice is highly related to dental abrasion. Moreover, bruxism shows a significant relationship with dental attrition. Overall, the majority of the affected tooth surfaces scored grade 1 based on Smith and Knight Tooth Wear Index (71%). Tooth wear grade 2 are scored (26%) and the remaining 3% were scored as grade 3 and 4. Based on this study, the prevalence of tooth wear was high (95%) amongst the adults attending the Faculty of Dentistry, University of Malaya and dental attrition was the most prevalent type of tooth wear.

CHAPTER I

INTRODUCTION

Tooth wear (TW) is normally considered as a physiological development which takes place throughout our life. However, it might affect tooth longevity as it can compromise the esthetics, function and even can cause pain. Traditionally, erosive, abrasive and dental attrition have been described as the pathological types of tooth wear. The above terms have revealed the specified risk factors related to the aetiology of tooth wear. Eccles proposed that in case with a single aetiological factor, the term tooth surface loss (TSL) should be used, although, it is usually problematic to be recognised (Eccles, 1982). In contrast, Smith and Knight reported in their study that 'TSL' term is related mainly to the severity of the phenomenon. Thus, they recommended the usage of the term of tooth wear instead of TSL to hold all three aetiological circumstances (Smith and Knight, 1984). A wide range of terms have been found to describe the processes of tooth wear and it might be supportive when a solo aetiology is less frequent to be recognised. Additionally, the term TW will be used throughout this study to describe the prevalence and its associated risk factors of tooth wear amongst adults seeking treatment in the Faculty of Dentistry, University of Malaya, Kuala Lumpur. Every so often, the tooth wear phenomenon is complex and the grouping of the multifactorial aetiology makes it difficult to recognise a single risk factor (Addy and Shellis, 2006). Definitive diagnosis and prevention methods for the treatment of such a condition have a duty to be based on these multifactorial causes.

1.1 AETIOLOGIES

Identifying the aetiology of tooth wear as part of knowledge enhancement is essential. Understanding the aetiology of tooth wear helps dentists to prevent additional lesions and break the preserved one from being developed. Additionally, ineffective treatment and management can warrant long term therapy if the aetiological factors are still persisting. There are many causes that might be related to tooth wear; some of these are elaborated below:

a) Congenital abnormalities

In the case of both amelogenesis and dentinogenesis imperfect, normal teeth function may lead to extensive tooth wear.

Amelogenesis imperfecta (AI)

Protein found in the external tooth layer or enamel has a responsibility to form and regulate the enamel layer. Abnormal development of these layers of the crown is related to certain protein anomalies such as enamelin, amelogenin, ameloblastin and tuftelin. For people who suffer from amelogenesis imperfect, their oral cavity is characterized as teeth discoloration grey, brown and/or yellow. This condition can affect a large number of both permanent and primary teeth in a different age range.

Dentinogenesis imperfecta (DI)

This is a developmental genetic disorder of tooth structure. This disorder is a part of dentin dysplasia which led to teeth discoloration

(usually appear as yellow-brown or blue-gray color) and/or transparent that appear as opalescent sheen. Additionally, the tooth will be weaker than the normal tooth, making it disposed to quick wear, loss and breakage.

b) Attrition

Dental attrition is the process of tooth tissue or restoration loss as a result of normal or paranormal mastication that affects the contact between interproximal and/or occluding surfaces. Dental attrition mainly happens on incisal or occlusal surfaces, however, contact points may show slight wear. Attrition pattern of tooth wear might be significant in relation to the persons who are on “primitive diets” for example, the rudimentary population with a high amount of abrasives diet (Molnar *et al.*, 1983). On the other hand, the most prevalent aetiology of dental attrition is in all probability the parafunctional activities like bruxism (Smith, 1989).

c) Abrasion

Abrasion is wearing of tooth material or restorations that produced by reasons not related to tooth to tooth contact. Hairclips bites, mouthpieces, musical tool, pipe smoking, tooth picking and etc., might be the cause of an abrasive type of tooth wear. However, the most prevalent cause is related to inappropriate or over-vigorous tooth brushing (Zero and Lussi, 2006).

d) Erosion

Erosive type of tooth wear is the advanced wear of tooth structure and tissue that occur by chemical acid from other sources rather than from

bacterial action. Moreover, the acid sources can be divided according to its origin into:

Dietary erosion: might arise from acidic food and drinks such as natural and carbonated juices, soft beverages and Cola/Pepsi drinks (Frese *et al.*, 2015). Furthermore, dietary acids are linked to oral consumption of certain medications such as aspirin, iron, vitamin C, tonics and replacement of hydrochloric acid and many other medications that increase the acidity through direct and/or indirect effects (Wei *et al.*, 2016; Bahal and Djemal 2014). Wine tasters and alcohol abuse are often present with a significant erosive type of tooth wear (Uhlen *et al.*, 2016).

Regurgitation erosion: is the coming back of gastric acid to the oral cavity and it's divided into voluntary and involuntary regurgitation (gastroesophageal reflux). Gastric content is usually highly acidic (pH 2) and has a highly erosive effect on dental tissue. The frequency of such condition may be extremely associated with dental erosion.

- **Involuntary (gastroesophageal) reflux:** this might happen as a consequence of hiatus hernia or as a result of tobacco smoker, pregnancy, alcohol abuse and etc. (Talalwah and Woodward, 2013; Pace *et al.*, 2008).

- **Voluntary (psychological) reflux:** this type of regurgitation is mainly related and highly linked to certain psychological problems such as bulimia nervosa and anorexia nervosa (Uhlen *et al.*, 2016).

Environmental erosion: persons who are facing the acidic environments in their workplace, for instance, workers in battery factory has shown a higher frequency of dental erosion in Tokyo, Japan due to the high

percentage of sulfuric acid (Suyama *et al.*, 2010). Moreover, frequent swimming in an inadequate swimming pool could be a risk factor of dental erosion (Dawes and Boroditsky, 2008).

e) Abfraction

Abfraction tooth wear appears as a cervical lesion supposed to be related to occlusal stresses. The tensile and compressive forces that loaded on the occlusal surface transforms to abfraction wear that appears in the cervical area of teeth subsequent in cracks in the tooth enamel (Litonjua *et al.*, 2004).

f) Lifestyle, health, habits and practices

Tooth wear in all types is highly related to our lifestyles, including general health and systemic problems, oral hygiene practice and dietary behaviors. Subsequently, the preceding factors have been linked to tooth wear, then multiagency and multidisciplinary cooperation have a duty in the prevention manner, treatment and management of tooth wear. Tooth wear is increasing throughout the time and the risk factors are multifactorial, then an investigation of the relationship of the many aetiological factors is critical (Van't Spijker *et al.*, 2009; Zero and Lussi, 2006). The eventual goal for oral health would be to sustain good health, live free from pain and operative dentition is minimized to reduce the complex restorative treatment among the elderly. This philosophy fits with an overall health philosophy of adding 'life to years and not just years to life'.

1.2 TOOTH WEAR INDICES

Quantitative and qualitative study methods are classically applying grouping or recording structures that intended to categorize the rate of increasing severity or development of a situation. These subjects are defined as indices that generally appear in a numerical form. The superlative index has to be understandable, simple and clear in the scoring measures. Its application should be beneficial for research study in the aetiology, diagnosis, treatment, management, prevention manner and observing of such phenomenon. The previous studies recognise many dissimilar indices to be used in both laboratory and clinical studies. The first tooth wear index was predicted by Broca (Broca, 1879). It was used as a basis to create and develop additional indices that classified oblique or horizontal outlines of occlusal tooth loss deprived of assuming the aetiological factors (López-Frías *et al.*, 2012). In addition, Smith and Knight presented the more general consumption of determining the grading of tooth wear (Smith and Knight,1984). Tooth wear index of Smith and Knight is the first index considered to measure and screen the multi-factorial nature of tooth wear. Furthermore, it is designed as a complete system to recognise wear of all visible surfaces (buccal/labial, cervical, lingual/palatal and occlusal/incisal) of all existing teeth without knowing how it happened. Smith and Knight Tooth Wear Index (TWI) was used in the current study to eliminate the misunderstanding and confusion related to the terminology or variation in opinion for the identification of aetiological risk factors that grounded on clinical outcomes.

1.3 PREVALENCE

The prevalence of TW phenomenon is usually an age-related problem, however, the strict prevalence is not understandable. Moreover, the wide-range variation is due to the divergent evaluation criteria. For instance, Hugoson *et al.*, stated that 13% to 24% of tooth surfaces showed signs of wear commonly on the occlusal surfaces. While further researches showed that the evidence of TW is between 25-50% of the participants. Tooth wear normally starts throughout a person's life due to frequent wear and tear on the hard tissue that arises from different forces. However, it is considered pathological and a target of concern if the degree of wear become more than the normal and acceptable range of tissue loss in relation to the age (Hugoson *et al.*, 1988; Pace *et al.*, 2008; Zhang *et al.*, 2015).

1.4 CLINICAL PROBLEMS

a) Aesthetic: as a sequence of tooth wear, the aesthetic concept of teeth appearance will be altered and the patients usually complain of their teeth shape that may become shorter, discoloured or even fractured.

b) Conservation of tooth structure: to save the remaining tooth structure and also to maintain the appearance and function of our teeth. The young population is the target in this case, as the pulp chamber is near to the enamel surface that might cause pain, as well to increase the longevity of the natural tooth structure.

c) Sensitivity and pain: patients are often suffering from tooth sensitivity especially with hot, cold and sweets. Usually, this pain and sensation are

related to the dentinal tubules that become open as a result of tooth wear. Persisting disclosing of this tubules may lead to bacterial invasion and pulpal inflammation.

d) Inter-occlusal space: the compensatory mechanism of the dental tissue will act to close the interocclusal space as the teeth shortened from dental attrition, but if the rate of wear is faster than the rate of jaw compensatory mechanism, then the occlusal vertical dimension (OVD) will decrease.

1.5 TOOTH WEAR MANAGEMENT

The initial management of tooth wear rest on the exact diagnosis of the present situation, the documentation of the aetiology and repeated observing of the successive changes; hence to avoid additional dental tissue damage. Accurate examination of tooth surfaces and reporting the extent and severity of tooth surface loss are essential in maintaining tooth longevity throughout the life. Once the associated factors are correctly understood, these measures can be perfectly initiated. Recognition of the multifactorial reasons of the circumstances is the initial phase in its management. Besides, failure to gain the multifactorial reasons of tooth wear could lead to inappropriate management and critical failure of restorative therapy (Rashid, Hanif and Nasim, 2015).

In 1999, Kelleher and Bishop reported the three stages of tooth wear therapy in all types (immediate term therapy, reassessment therapy and long term therapy) (Kelleher and Bishop, 1999).

A. Immediate phase therapy: this point is developed to dismiss the sensitivity from tooth structure that appears as uncomfortable to severe pain. It is to recognise the multifactorial risk factors and make the definitive diagnosis and to protect the remaining tooth tissue from further tooth wear. Moreover, all risk factors of each type of tooth wear should be recognised and eradicated. Damage limitation policy should be well known by the dentist to be introduced in such condition. This might involve categorization of the situation, regulate and guidance concerned to the aetiological risk factors. The following guide is used to cover these problems:

- I. Dietary consultation and diet analysis are helpful to change lifestyle and elimination of aetiological risk factors.
- II. Avoid drinking beverages of high acidity without a wide straw. Swallowing these drinks immediately will reduce the incidence. Moreover, reducing the frequency of beverages consumption will support the treatment plan.
- III. Daily use of a neutral, sodium fluoride gel or mouth rinse. Application of fluoride varnish or gel can increase the resistance of the tissue from further erosive attack (Hellwig and Attin., 2004).
- IV. If the aetiology is uncertain or the patient is suspected to have a parafunctional habit, the dentist should construct a close-fitting occlusal splint. Additionally, mouth guard is useful in bulimic patients to reduce erosion during periods of vomiting.
- V. Direct application of restorative material like composite and/or glass ionomer cement to reduce tooth sensitivity.

VI. In the case of bulimia or anorexia nervosa, medical consultation is required to assess the background and the psychological status of the patients.

B. Reassessment: It is a period of time that should be given to the patients after the initial phase and before starting with the long-term therapy. This phase is designed to allow patient's response to the initial care.

C. Long-term management: This phase is divided into review and monitoring and restorative treatment to manage tooth wear.

- **review and monitoring:** As long as the individual is not suffering from esthetic, sensitivity or functional problems and maintain regular check-up then on your doorstep monitoring of the condition is tolerable. Such phase involves the creation of perfect casts for the study. Create systematic recall organization and patient should be informed to come back if he suspects any worsening in his situation. However, when the degree of tooth wear threatens the tooth's longevity, then reviewing and monitoring phase alone is not enough and restorative treatment should be essential.

- **restorative treatment:** This phase starts when the maintaining and monitoring phase is unable to solve the problem and the rate of tooth wear persisting more than the rate of remineralization. Here the dentist should eliminates the causative factors, reconstruct tooth structure and remove the pulpal sensitivity, if present.

1.7 PROBLEM STATEMENT

Tooth wear is frequently unable to be discovered in the initial periods as well as the aetiological risk factors cannot be recognised. Partial or incomplete treatment of such problem may be related to the lack of awareness of both the dentists and patients of the multifactorial behavior of tooth wear. Complex and expensive conservative treatment is a result of improper diagnosis and partial solution of these problems. While significant damage can be carried out if preventive manners and early recognition are established. The increasing rate of awareness among the people and the demand to prolong their teeth life and to enhance their appearance. Moreover, the alteration in lifestyle which includes stressful life, fast foods and beverages, improper habit and increases the incidence of systemic diseases in young adult. Furthermore, not only the effect of the bacterial carious lesion is important for tooth survival, the non-carious tissue surface loss threaten the longevity of tooth structure as well.

1.8 JUSTIFICATION OF STUDY

Early recognition of tooth wear is important as it is essential to avoid permanent destruction sequences to the permanent dentition. To be able to deal with these conditions, a dentist requires a high level of knowledge and awareness of the clinical presentation of all patterns of tooth wear. For that reason, it is necessary to understand the aetiologies, early detection landmarks and the risk factors of TW.

Understanding the multifactorial reasons of tooth wear and the occurrence of each pattern of tooth wear are once in a blue moon happen

alone in a certain individual. For instance, the subject who is suffering from generalized tooth wear could be reported as to be grinding his/her teeth as a bruxer or a hard bristle toothbrush user, deprived of the identification of gastroesophageal reflux disease (GERD), component to the problem (A. Johansson *et al.*, 2008). Furthermore, Zahara *et al.*, 2011, in their study focused on the association between food habits and dental erosion amongst Malaysian university students (Zahara *et al.*, 2011). In 2013, another study in relation to the severity of tooth wear reported that the mostly affected surfaces are incisal and occlusal surfaces (Solanki, Gupta and Prasad, 2013). Additionally, Daly *et al.*, in 2010 studied tooth wear forms and its related aetiological risk factors in adults population in Kelantan, Malaysia and reported that most participants in Kelantan population have minimal TW match to three traditional cohorts of Sabah, Malaysia (Daly *et al.*, 2010). In this study, the prevalence of all types of TW, the associated risk factors and also the severity of TW will be obtained particularly for adult population seeking treatment in the Faculty of Dentistry, University of Malaya, Kuala Lumpur as it considers one of the biggest dental center in Kuala Lumpur.

1.9 OBJECTIVES AND AIMS

1.9.1 General objective:

To evaluate the prevalence and risk factors of tooth wear amongst adults seeking treatment in the Faculty of Dentistry, University of Malaya, Kuala Lumpur.

1.9.2 Specific objectives:

1. To identify the prevalence of tooth wear among adults seeking treatment in the Faculty of Dentistry, University of Malaya in Kuala Lumpur.
2. To assess the risk factors of tooth wear and its relation to the variables from the questionnaire.
3. To evaluate the severity of tooth wear among adult patients seeking treatment in the Faculty of Dentistry, University of Malaya in Kuala Lumpur.

1.10 RESEARCH QUESTIONS:

1. A- What is the prevalence of tooth wear of adults people seeking treatment in the Faculty of Dentistry, University of Malaya, Kuala Lumpur?
B- What is the prevalence of each type of tooth wear (erosion, attrition and abrasion) as well as the prevalence of the combination of two or more of these types?
C- What is the prevalence of the affected surfaces “each tooth has 4 visible surfaces” and the frequency of which group of teeth is mostly

affected “teeth are divided into 4 groups molar, premolar, canine and incisor.

2. What is the risk factors of tooth wear in the adult population seeking treatment in the Faculty of Dentistry, University of Malaya, Kuala Lumpur?
3. What is the severity of TW in the adult population seeking treatment in the Faculty of Dentistry, University of Malaya, Kuala Lumpur?

1.11 RESEARCH HYPOTHESES:

There is a high prevalence of tooth wear in all subdivisions (erosion, abrasion and attrition) amongst adult with the associated risk factors that are affecting the longevity of teeth.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION:

Generally, the phenomenon of tooth wear (TW) is irreversible that demonstrate as wearing and losing of tooth hard tissue leading to changes in shape and appearance of the anatomical outer surface of the tooth. Tooth wear patterns are divided into three: attrition, erosion and abrasion, regardless of whether a person is an adult or a child. It might sometimes intractable to achieve the causative factor or the combination of causative agents of TW (Okunseri *et al.*, 2015). Likewise, there is a noticeable occurrence of an increased the retention of the natural tooth and therefore, a maximal tooth wear prevalence is displayed in the elderly population. The condition does not only involve the middle-aged group and the aging population who are suffering from the pathological loss of dental hard tissue, but also the younger population (Bishop *et al.*, 1994).

Generally, the problem is worsening and tooth management (prevention and treatment) of persons who are affected by tooth wear has been providing complications for Dental Center for several years. Partially explanation could only be understandable by the fact of the retaining natural teeth into the old-age population (Smith and Knight, 1984; Watson and Tulloch, 1985). The term 'TW' is delivered to depict dental hard tissue loss that caused by rubbing contact between the opposing occlusal surfaces of teeth or during the friction contact between hard food and occlusal tooth

surface throughout jaw's masticatory and non-masticatory movements, without evidence of bacterial dental caries or occurrence of traumatic tooth injury (Liu *et al.*, 2014).

2.2 TOOTH WEAR

Tooth wear is known as the loss of tooth hard tissue due to the continuous process of erosion, abrasion and attrition. TW may appear as a result of one of the three aetiological progressions, however, it is most likely to appear as a multi-factorial phenomenon. Generally, tooth wear phenomenon is acceptable as a part of the physiological caducity process, in spite of the degree and the amount of wear, while the process has a duty to be observed as pathological or non-pathological (El Wazani, Dodd and Milosevic, 2012). Tooth wear or non-carious loss of tooth tissue is a normal physiological development that arises during life. The degree of loss is likely to threaten the longevity of the tooth or is a point of complaint from patients, then it takes into consideration of pathological tooth wear (Smith and Knight, 1984).

Tooth wear phenomenon usually happens as a multifactorial condition which is leading to loss of tooth tissue (enamel and dentin). Tooth wear could be divided according to the causative factor into chemical wear which appears as erosion and mechanical tooth wear which appear as abrasion and attrition (Wetselaar *et al.*, 2016). The multifaceted interface of chemical, mechanical and biological factors are usually seen in tooth wear. Traditionally, tooth wear is divided into the following three patterns: abrasion, attrition and erosion, based on the aetiological factors. (Wei *et al.*, 2016). Eccles proposed in 1982 that tooth surface loss term would be used

once a single aetiological risk factor is habitually challenging to be identified (Eccles, 1982). However, Smith and Knight in 1984 stated that 'TSL' underestimate the severity that comes out from such problem and, as a result, supported the usage of tooth-wear (TW) term to hold all three aetiological features (Smith and Knight, 1984).

Throughout the life, both intrinsic causes like reflux that rise from the gastroesophageal sickness and extrinsic causes like dietary and non-dietary habits, oral hygiene practice and occupation and/or environment factors will affect tooth surfaces leading to abrasion, erosion, attrition and abfraction. Distinguishing amongst these causative agents is a challenge and generally TW is a multifactorial condition (Schierz *et al.*, 2014). In both in-vivo and in-vitro studies, singular tooth wear mechanisms hardly occur in isolation (Wetselaar *et al.*, 2016). Moreover, understanding of the multifactorial nature of tooth wear and its permanent effect on tooth structure, which is a consequence in neglected cases to serious loss of dental hard tissue and to recurrent failure in restorative treatment, is very important (Kelleher and Bishop, 1999).

In 2013, Bartlett *et al.*, systematic reviews have proven that TW is a prevalent condition which is augmented with the age in primary and secondary dentation (Bartlett *et al.*, 2013). TW prevalence is increasing as 77% of anterior teeth are affected by it in dentate adults. Additionally, the rate of tooth wear is increasing in younger age groups. The reports of such condition are increasing by dentists (El Wazani, Dodd and Milosevic, 2012).

Furthermore, tooth wear might make a change in the appearance of teeth and make it shorter or irregular, which may lead to the patient's discomfort. Besides, the advanced case of tooth wear as a consequence of this condition will lead to functional problems, though, the occurrence of compensatory mechanisms will keep trying to preserve the contact between the teeth when tooth wear has presence. As a result, when the proportion of tooth wear and compensatory mechanisms are altered and the rate of TW become more than the rate of the compensatory mechanisms. Then, functional problems will appear (El Wazani, Dodd and Milosevic 2012). Physiologically, tooth wear is an age-related route. Yet, the pathological status is a result of severe tooth wear which may affect the appearance and/or the functionality of teeth (Wei *et al.*, 2016). Tooth wear prevalence has a different appearance throughout the world, as aetiological causes are multifactorial (Fareed and Omar, 1990).

Bishop *et al.*, state that the term of TW is used to describe dental hard tissue loss which is raised from roughness amid the occlusal teeth surfaces or amid a food and occlusal teeth surfaces in both masticatory and non-masticatory jaw movements, without the interaction of tooth trauma or caries. Additionally, the report of three main patterns of TW abrasion, attrition and erosion are reported as below (Bishop *et al.*, 1997):

1. Dental attrition is considered a physiological tooth enamel wear during contact between the teeth itself, instead of foreign objects interposition.

2. Dental abrasion is considered pathological enamel wear during strange mechanical contact that occurs between foreign objects and dental enamel.

3. Dental erosion is the loss of dental hard tissues by chemical contact between enamel or dentin and acidic action of non-bacterial origin.

Eisenburger in 2003 reported that concurrent abrasion with erosion is seen in around fifty percent more tooth wear than abrasion and erosion (Eisenburger *et al.*, 2003). Moreover, Pavone showed that the habits of grinding and clenching formed strange forms of occlusal wear, while in 2000 Christensen noted, that people who are suffering from bruxism showed four times more wearing rate than people who are free from such habit (Pavone, 1985; Christensen, 2000).

Furthermore, Ibiyemi *et al.*, stated that diet constituency, abrasive chewable diets, unglazed enamel appearance and selected environmental/occupational factors, such as dust and grit exposure in farming happenings is considered as risk factors of the abrasive pattern of tooth wear (Ibiyemi *et al.*, 2010).

Management strategy of tooth wear phenomenon and the protocol of diagnosis for such condition are highly related to the understanding and knowledge of the multifactorial action of TW and its related factors (Tomasik, 2006). Finally, if tooth wear progression is extreme, it may present as tooth hypersensitivity, visible dentin, tooth shortening and exposure of dental canal which lead to inflammation of pulpal tissue and pulp necrosis (Donachie and Walls, 1996).

2.2.1 Prevalence of tooth wear

Throughout the last few decades, many authors are focusing on the aetiology and the prevalence of TW especially acid action performance on erosive type of tooth wear. The reported prevalence varies widely. Presently, wearing of tooth structure is observed globally as a real increasing condition that affects all age group especially in the elderly, as it highly occurs in this age group (Jaeggi, Gruninger and Lussi, 2006). In 2009 Van't Spijker *et al.*, noted in his systematic review that dental wear which raised from all different aetiology, shows the prevalence of adult age group who are presented with severe TW starting from three percent in 20 years old to seventeen percent in 70 years old patients, with a propensity to progress more and more tooth wear with age (Van't Spijker *et al.*, 2009).

Many epidemiological studies in the recent years have concentrated on the causative factors and the prevalence of TW in adults. Tooth wear reported in many countries throughout the world and the prevalence is very high and diverges widely. Occlusal tooth wear and the effects of sex, age and tooth position on the of severity TW in the general population of Germany was measured in 836 persons from 6-point ordinal rating scale in upper and lower jaws cast. The prevalence score of both male and female and all teeth is 2.9. While dentin exposure appeared in 23.4% of the examined teeth. The mean tooth wear is associated with entrants' age. The level of tooth wear amid females shows 0.15 units less than amid males and the anterior wear shows 0.59 units more than molar and or premolar teeth (Schierz *et al.*, 2014).

In Japan, about 1108 participants aged from 15 to 89 years old, 26.1% show evidence of erosive wear. In Northern India, the prevalence is 71.1% had tooth wear from a sample of 965 men who are working at fertilizer factory with an age range from 19 to 58 years old (Wei *et al.*, 2016).

The commonness and the effectiveness factors of tooth wear in northwest China among elderly people in a cross-sectional analytic questionnaire and clinical study of 704 examined patients who had a mean age of 46.5 ± 0.2 . The males were 367 (52.13%) the females were 337 (47.87%) in the upper jaw of the entrants, tooth wear rate was varied from, 87.22% in incisor group, 100.0% in canine group, 89.77% in premolar group and 85.51% in molar group. While the lower jaw shows a prevalence of 91.19%, 100.0%, 88.92% and 86.36% respectively (Liu *et al.*, 2014).

The recurrence of the undesirable condition of TW on the palatal/lingual and facial/buccal surfaces of tooth structure and the corresponding aetiological factors in the Europe sample of young adults with the age range between 18 to 35 years old. Moreover, basic erosive wear examination (BEWE) was used on samples aged between 18 to 35 years old, 3187 young adults were enlisted from 7 Countries (700 from United Kingdom; 700 from France; 675 from Italy; 344 from Finland; 342 from Latvia; 304 from Spain and 122 from Estonia). The highest score is zero for 1368 participants which consist of 42.9% out of all participants, one for 883 participants which consist of 27.7% from the total and two out of 831 participants which form 26.1% out of all. While score three is seen in 105 participants which consist of only 3.3%.

Furthermore, the top tooth wear prevalence is detected in the United Kingdom as the result showed more than fifty percent of their sample scored either 2 or 3 (Bartlett *et al.*, 2013).

TW signs and symptoms in 290 participants who went to the Dental Hospital of Liverpool University in the United Kingdom, the wear were significantly high in males regarding females with a ratio of 2.3:1. According to the severity, the men are significantly more obtainable with a severe level of tooth wearing than women. The esthetic factor is the most presenting complaint ($n=59$). Moreover, tooth sensitivity scored the second highest complaint ($n=40$). Pain and functional problems showed less common frequent at 14% - 17% correspondingly. Furthermore, applicants with posterior teeth loss showed statistically significant severe tooth wear mainly on anterior teeth (El Wazani, Dodd and Milosevic, 2012).

The prevalence of tooth wear and effectiveness indicators in 720 participants in Wuhan City China, aged from 35 to 49 years old and 50 to 74 years old, in 2014. 360 participants were included in each age group, with a percentage of 50% females and 50% males. TW prevalence in this study is 67.5% in 35–49 age group and 100% in 50–74 age group. Dentin exposure present in a prevalence of 64.7% in 35–49 age group and 98.3% in 50–74 age group. Furthermore, significantly greater TW prevalence and dentin disclosure are reported in older age group than in younger age group (Wei *et al.*, 2016).

Consumption of beverages that related to the frequency and severity of TW in the United States among a sample of 3,773 participants with age starting from 20. The results showed that 80% of the entrants had

aetiological risk factors of TW. Additionally, the most frequent beverage drunk by the amid participants were soft drinks. Okunseri *et al.*, mentioned in his study in 2015, the effects of the interactions of age, gender and drinking fruit beverages are considerably related to TW severity (Okunseri *et al.*, 2015).

TW series in a group of sixty-three participants, twenty women and forty-three men with an average age 39.1 years old. The statistical record showed a high trend towards tooth wear in patients with gastric risk factors ($p < 0.05$). Moreover, the most frequently teeth that affected by tooth wear shown in this study are the upper incisor teeth and the lower molars. Furthermore, the severely appeared more in upper central incisors and lower molars (Rodriguez, Austin and Bartlett, 2012).

The prevalence of TW in various cohort's age in Dutch society and the statement of TW tabulation by 5 age cohorts (25 to 34, 35 to 44, 45 to 54, 55 to 64 and 65 to 74 years old), socioeconomic status (SES), sex and teeth groups. In Dutch adult society, the prevalence data showed that the most frequent outcome is mild to moderate tooth wear. Severe TW or extreme one is a very rare condition. As a conclusion, TW prevalence in Dutch society has raised from 2007 to 2013 to be more prevalent. The aging groups have more tooth wear found in all teeth groups and males showed more wear than females in all teeth groups. Furthermore, more tooth wear is detected on subjects with low SES than those people with a good socioeconomic status (Wetselaar *et al.*, 2016). Malaysia showed enhancement in the social environment, health care and the economic status of Malay citizen changed their pattern of lifestyle. As a result, the diet

altered to be readymade canned or packaged foods rather than households diet which contribute the level of tooth wear and erosive type of tooth wear is the most affected pattern by these lifestyle changes (Zero, 1996). As an example, a study done in Kelantan region of Malaysia, show that tooth wear among children of sixteen years old showed 100% of this sample are affected by tooth wear which appears commonly in tooth enamel (Saerah *et al.*, 2006).

A recent study amid Icelandic young adults age between nineteen to twenty-two years old stated that erosive type of tooth wear with dentine association in 39% of the people involved in this study. 32% and 22% for 18-year-old Norwegian adolescents and eighteen to nineteen years old Swedish teenagers, respectively. These differences may attributable when using other scales and recording structures to detect dental erosion (Isaksson *et al.*, 2014).

Table 2.1 Tooth wear and its prevalence (summary of articles)

Authors/ year	Objective	Method	Conclusion
Pavone (1985)	- For diagnosis and treatment of bruxism that inefficiently defined and poorly understood.	Overview study.	- Bruxism is multiple and varied presentations that appear as TMJ pain and dysfunction, head and neck pain, mobility, TW, destructive of periodontal ligaments, esthetics problems and muscle fatigue.
Fareed and Omar (1990)	- To study the prevalence and severity of occlusal tooth wear among the adults Saudi population.	- Occlusal wear was evaluated on a tooth-by-tooth basis on study casts. By using an ordinal scale. - 206 dental students were involved.	- Incisor, maxillary canines and mandibular molars showed the highest wear score. - In comparison with Western studies of a same-aged displayed a more extensive pattern of wear in the present sample.