Research Article

The Oral Health Status of the Gozitan Community

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Abstract. The objectives of this study is to assess the oral health status and treatment needs of Gozo residents – a geographically isolated community. A cross-sectional study of 332 Gozitan attendees on the Mobile Dental Unit was carried out during a three-month period in 14 localities in Gozo. The participants attended for a dental check-up and indices were used to record caries, plaque, calculus, erosion, soft tissue pathologies and number of dental functional units. Of the 332 participants 76.8% presented with plaque deposits, 78% require either restorative or periodontal treatment while signs of erosive wear were present in 28% of participants. In younger age bands (0–9 and 10–19) untreated carious lesions amount to 1.34 and 1.0 (DT portion of DMFT) respectively, care index FT (filled teeth)/DMFT was 0.37 overall. Most participants in 50+ age bands had less than 10 remaining functional units. Thus, the oral health status of the Gozitan community shows a high level of unmet dental treatment needs. This underscores the need for provision of better dental services in Gozo, re-orientation of existing services to focus on prevention, and introduction of evidence-based preventive strategies in school-children.

Keywords: Gozo, oral health, outreach, mobile dental unit, DMFT, BEWE, functional units

Abbreviations

MDU – Mobile Dental Unit; DMFT – Decayed, Missing and Filled Teeth; WHO – World Health Organisation; CPITN-E – Community Periodontal Index of Treatment Needs - Epidemiology; ICDAS – International Caries Detection and Assessment System; BEWE – Basic Erosive Wear Examination.

1 Introduction

The Mobile Dental Unit (MDU) is a project designed and launched by the Faculty of Dental Surgery (University of Malta) in September 2015. This Unit is a truck converted into a dental clinic and is equipped to function as a stand-alone clinic on wheels. It has endless uses such as outreaches, domiciliary dentistry and reaching people who are unable to commute to other clinics for treatment, preventive dentistry and advice, education and research.

Oral diseases are highly prevalent worldwide and their repercussions are significant. Dental diseases are the fourth most expensive diseases to treat (Glick et al., 2012) and they have a great impact on people's quality of life, nutrition, function, aesthetics, speech, general health, pain and missed school and work days (Santucci & Attard, 2015, 4; Sheiham, 2005; Petersen, Bourgeois, Ogawa, Estupinan-Day & Ndiaye, 2005; Kramer et al., 2013).

In the National Oral Health Survey on children carried out during 2014/15 and in a recent study performed by Gatt et al. (2017), there were many indications that the oral health status in Gozitan children was poorer in comparison to their Maltese counterparts and when compared to that of other European countries. The Gozitan population can be considered to be a geographically isolated community in Malta's archipelago with its own health profile and requirements.

The need was therefore felt to focus on Gozo and bet-

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ter understand the situation of the island, so as to be able to propose evidence-based recommendations. The aim was to explore possible niches for better prevention and treatment services in Gozo. The ultimate aim of this being an improvement of the health of the population as a whole by starting youngsters on a positive health trajectory and providing means to help them maintain their health throughout the life-course (WHO, 2017). During Summer 2017, the Mobile Dental Unit toured Gozo providing free dental check-ups in all localities, while also promoting oral health. This study presents the findings of this cross-sectional survey.

2 Methodology

2.1 Study Sample

Patients attending for a dental check up on the Mobile Dental Unit (MDU) during a three-month campaign in Summer 2017. A convenience sample of 332 patients were screened in 14 different localities in Gozo on 17 instances.

These MDU dental visits were publicised throughout the Gozitan community through various entities namely: The Ministry for Gozo, the parish churches through the help of the Gozo Diocese, the MDU website, via respective local councils and announced verbally during our visits.

Inclusion Criteria: Residents on the island of Gozo visiting the MDU and consenting to a free dental check-up were recruited in this survey.

Exclusion Criteria: Residents who did not attend for a check-up.

2.2 Research Protocol

A detailed research protocol was prepared abiding to all the requirements as stated in the World Medical Association Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects, WMA General Assembly, 2008. This was submitted for consideration, guidance and approval to the Faculty of Dental Surgery Research Ethics Committee and subsequently to the University of Malta Research Ethics Committee (DENT 02_2016).

Calibration of examiners: Internationally renowned researchers in the field carried out training and calibration of examiners and scribes. Programmes organised by the Faculty of Dental Surgery included seminars, discussions and both simulation lab and clinical sessions over several days. Further calibration sessions were carried out involving duplication of examination of clinical cases in order to assess intra- and inter-examiner reliability.

An inter-rater reliability analysis using the Kappa statistic was performed to determine consistency among examiners.

2.3 Clinical Examinations

The screening was carried out inside the Mobile Dental Unit. A standardised light source, Daray X200LED examination light giving an 8.000 lx at 1 m and 32.000 lx at 0.5 m (Daray Lighting Ltd., Leighton Buzzard, Luton, UK) present on the MDU was utilised during the examination of patients.

Examiners wore individual protection equipment while carrying out dental examinations using sterile wrapped packs containing a front surface reflecting mirror and ball-ended WHO CPITN-E probe. Trained scribes recorded data onto number-coded data input sheets.

Participants were asked about their medical history, medications, smoking history, oral hygiene and dietary habits. They were then screened for number of teeth present and their condition, including restorations, dental caries, trauma, erosive tooth wear, number of functional units present, prosthetics, periodontal status including presence of plaque and calculus, and soft tissues and oral mucosal conditions.

The dental treatment needs of every individual patient were determined and patients were referred for treatment according to their need and eligibility.

2.4 Indices

Dental caries and status of teeth: The International Caries Assessment and Detection System (ICDAS) was utilised as a means of detecting and classifying carious lesions present.

ICDAS scores were later converted to DMFT for comparison with other Maltese and European values (Patel, 2012; WHO, 2016).

Plaque and Calculus were scored using the BASCD (British Association for the Study of Community Dentistry) criteria, as follows:

Plaque scores: 0- No plaque present
                  1- Plaque present following probing
                  2- Plaque present visibly

Calculus scores: 0- No calculus present
                  1- Calculus present following probing or visible

Functional Units: A count of pairs of anterior and posterior natural or restored teeth in occlusal contact.

Erosive tooth wear: The Basic Erosive Wear Examination Index (BEWE) was used to score an index value per participant.

2.5 Data Analysis

The data gathered from screening was inputted into Microsoft Excel©. Statistical tests were carried out with

the aid of SPSS 20.0 software (IBM Company, Chicago, IL, USA). The level of statistical significance was set at $p < 0.05$.

3 Results

3.1 Epidemiology

From a study sample of 332 participants, 182 (55%) were female and 150 (45%) were male. Average age was 36 ($+/-$ 26) from 14 different localities in Gozo namely: Rabat (San Franġisk), Rabat (taċ-Ċawsli), Xewkija, Sannat, Għarb, Kerċem, San Lawrenz, Xagħra, Għajnsielem, Nadur, Qala, Munxar, Żebbuġ, Għasri.

3.2 Smoking and General Health

Only 8% of participants admitted to being smokers, while 41% (136) were on different medications. The average number of medications per day was 2.36 per person with a standard deviation of 1.5 and a range of 1–9 medications/day.

3.3 Oral Hygiene in Participants

Out of all study participants, 76.8% had plaque present on their teeth at the time of examination: 52.4% had plaque present on probing (score 1) whilst 36.7% had visible plaque present (score 2); 62% of participants had calculus deposits, and 1.97% presented with soft tissue pathologies.

3.4 Decayed, Missing and Filled Teeth (DMFT)

Figs. 1 and 2 present the DMFT and distribution of the sub-scores according to the age cohorts. It can be observed that DMFT is seen to increase with age with a peak at the 60–69 year-old age band with an average DMFT of 16. More specifically Fig. 2 presents the DMFT individual components, displaying the proportions of decayed, missing or filled teeth in each age band. It can be observed that untreated caries decreases with age and tapers beyond the age of 50 years. The inverse is true for the missing teeth component. It increases with age indicating that the care being provided is extractions rather than maintenance of the teeth through restorative procedures. Furthermore, this data gives an indication of the level of care in each group. The Care index (FT/DMFT) is on average only 0.37 or 37%. In 12 year-olds, it amounts to only 33%. This care index is lowest at the extremes of age, the 0–9 and the 80+ age groups.

Fig. 3 illustrates how most carious lesions charted across the age bands were cavitated lesions requiring direct restorative intervention. However, 28% of lesions are still in the early reversible stage of the carious process. The younger age bands have higher percentages of reversible lesions with a maximum percentage of such lesions being that of 52 in the 40–49-year-old age band.

3.5 Missing Teeth and Functional Units

Table 1 presents the percentage of patients with missing teeth. Out of the adult population (20 yrs+; $N = 211$ patients) 139 patients (66%) had missing teeth. 24% of these patients were wearing fixed and/or removable prostheses to replace the missing teeth. The average age of the patients wearing prostheses was 64 yrs (SD 26yrs; Range 27–77 yrs).

No. of missing teeth	Percentage (no. of participants)
1–5	23.7% (79)
6–10	11.4% (38)
10+	9.9% (33)

Table 1: Percentage of patients with missing teeth.

Fig. 4 shows the gradual loss of functional units, defined as pairs of teeth in contact, over the years. The reader should be aware that reduced functional units do not necessarily signify missing teeth. Open bites are significant contributors to less functional units. We can observe this in this sample, within the 20–29 years old age bracket where we observed that a number of patients presented with anterior open bites, underscoring the need for orthodontic treatment.

There is an evident decline of all functional units (teeth in occlusion) from 40 years onwards. With only the average of number of functional units in the 70+ age group amounting to only 6.11 (of which only 3 are posterior). This shows a significant reduction in masticatory efficiency with age.
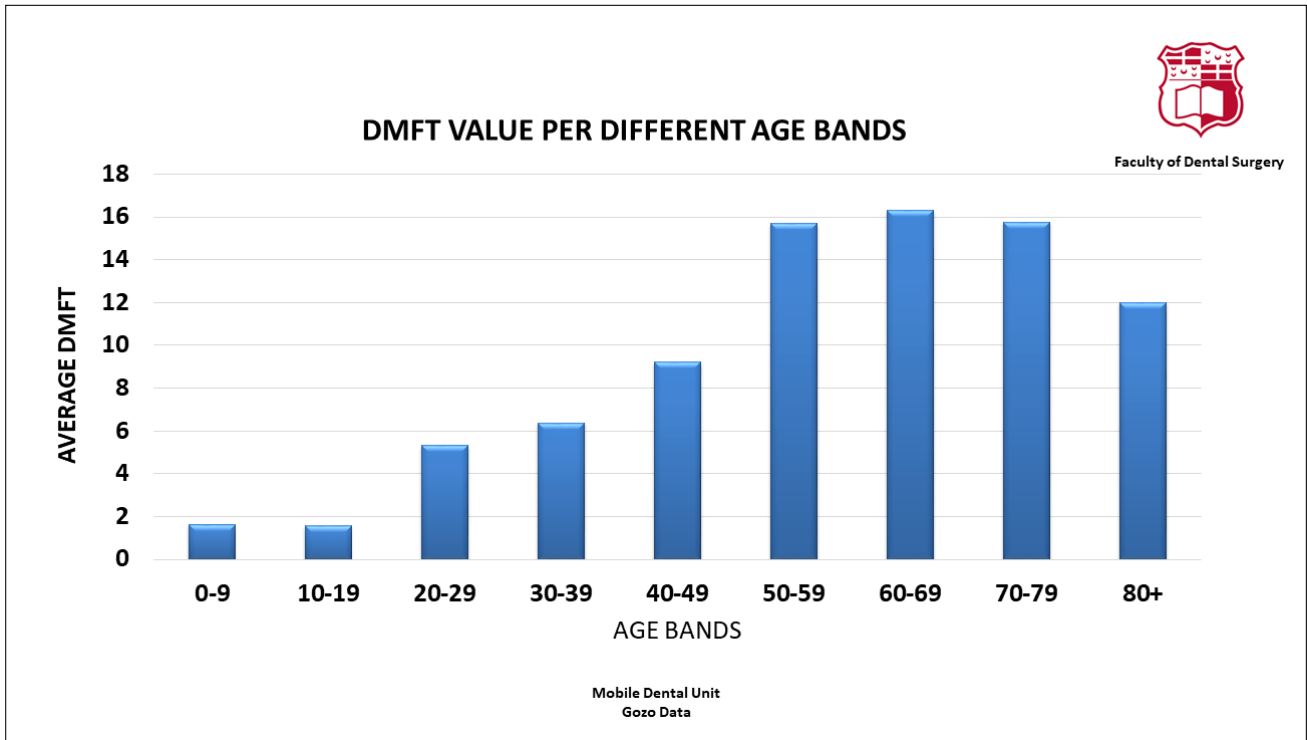
Figure 1: Average DMFT value for each age band in the Gozitan population.
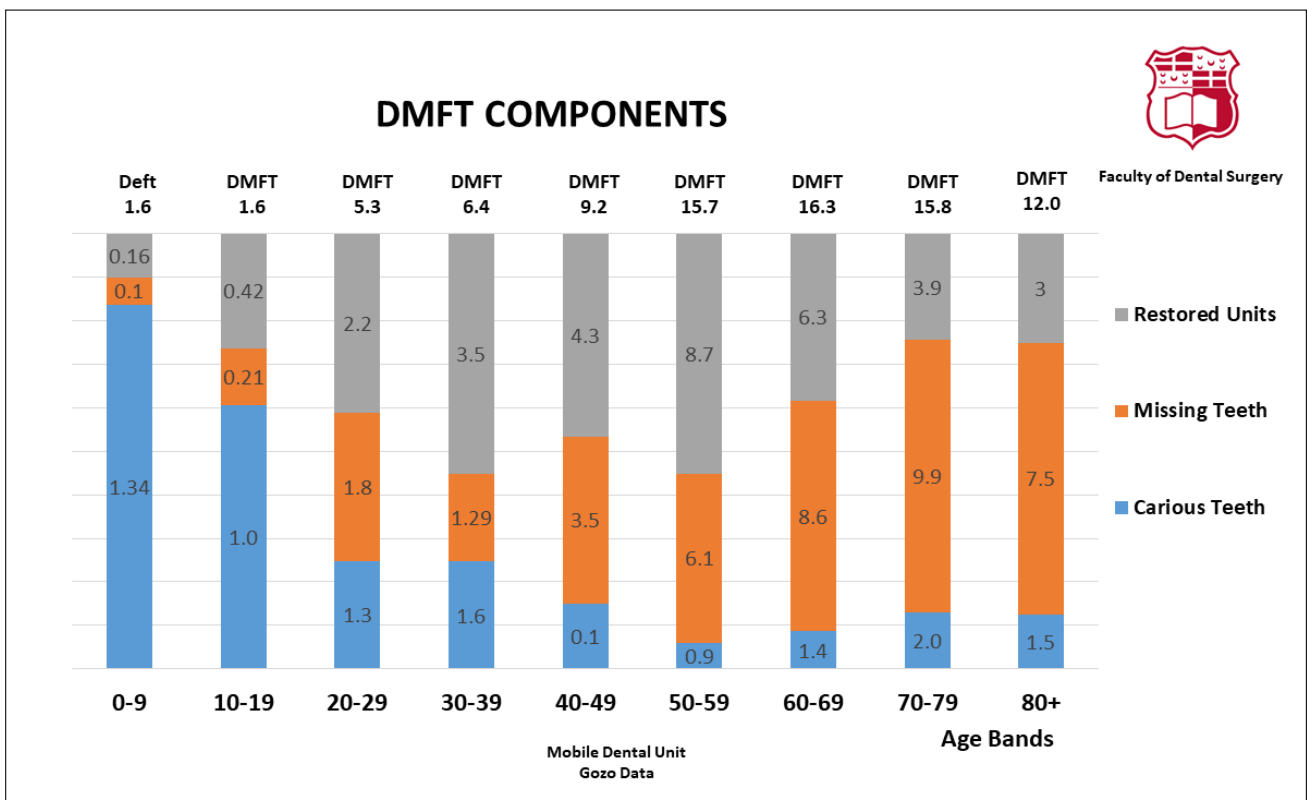

Figure 2: DMFT (decayed, missing and filled – teeth) components for each age band of the participants.
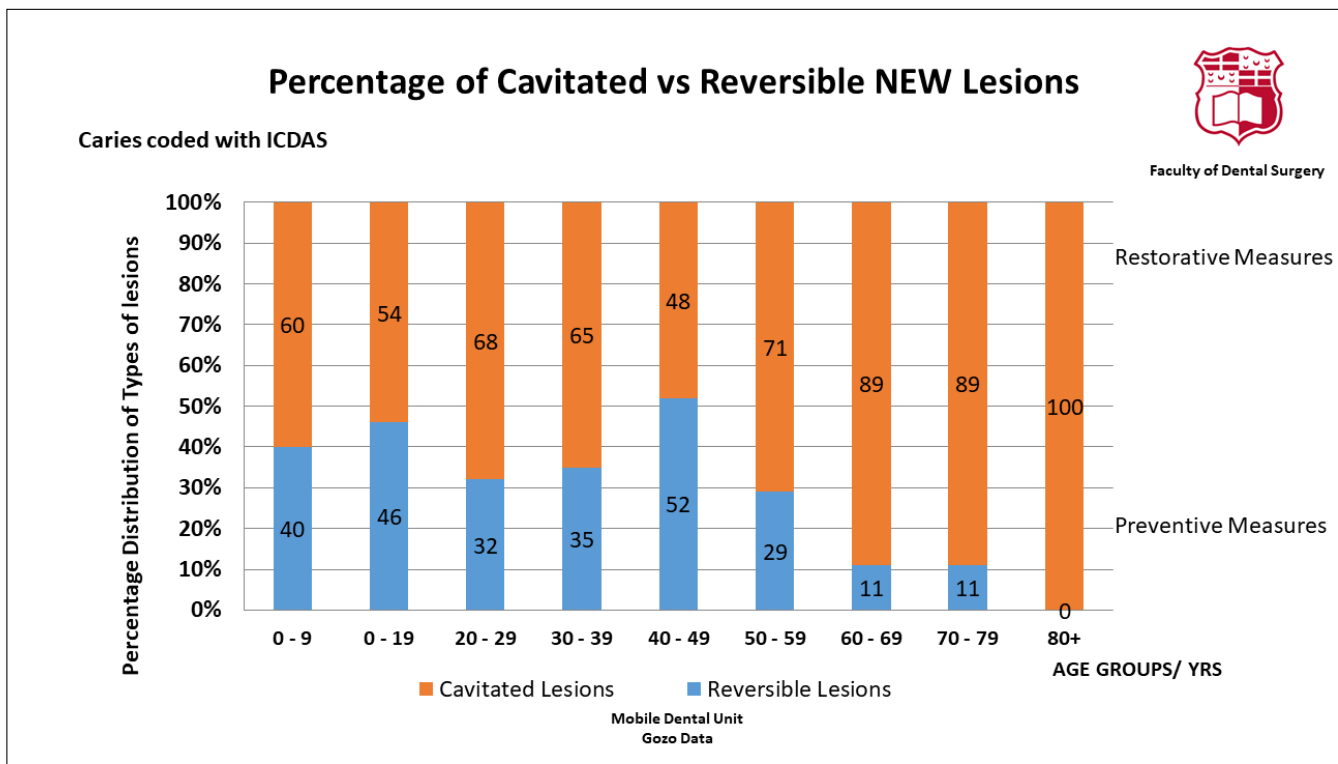
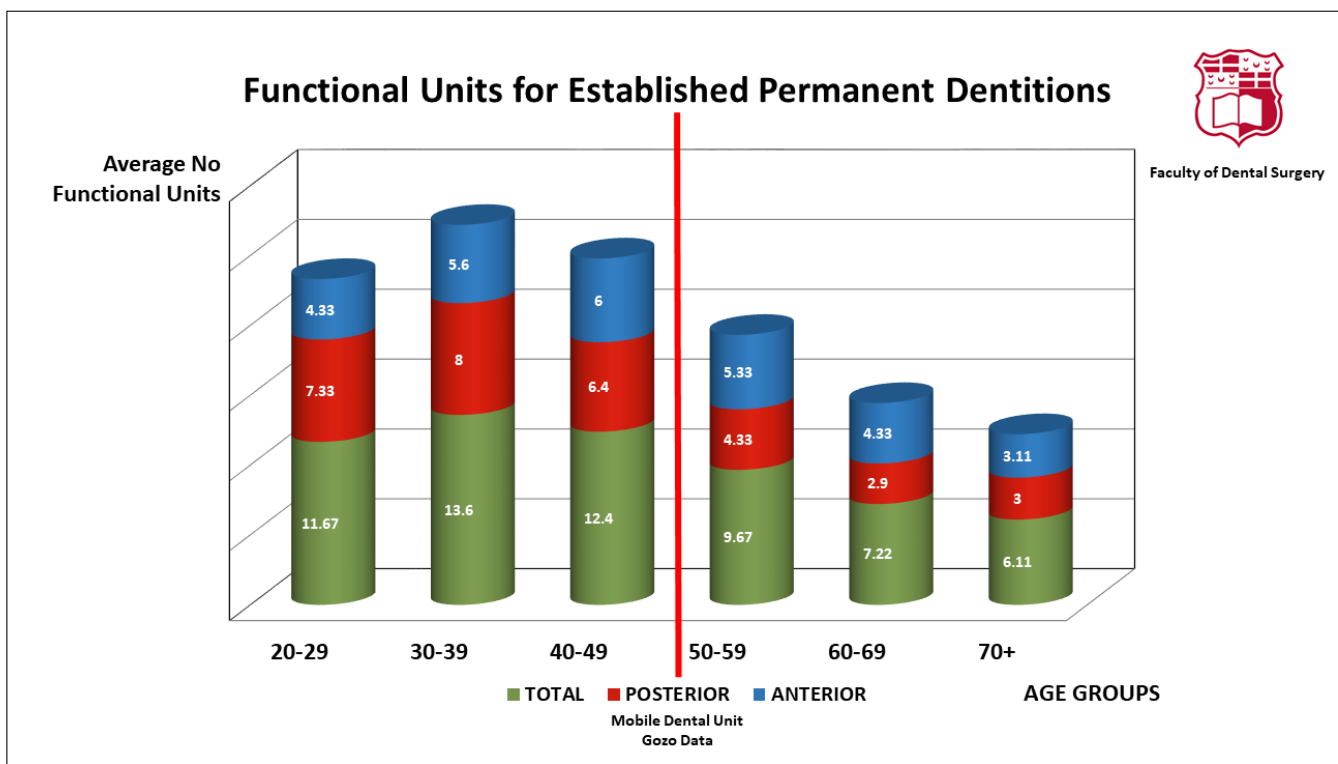**Figure 3:** Percentage of cavitated and reversible new carious lesions.

Figure 4: Average number of functional units per age band (anterior, posterior and total).

3.6   Erosion

Fig. 5 presents the erosive tooth wear, as measured with the BEWE index. It can be observed that erosion increases with age. 28% of the participants screened exhibited signs of erosive wear. Interestingly 21% ($N = 39$) presented with BEWE scores ≥ 9, (signifying a need for restorative treatment) of which 64% ($N = 25$) had a maximum BEWE score of 18.

3.7   Treatment Needs

Of all the participants screened, 78% required non-urgent treatment (which includes periodontal or non-urgent restorative treatment), 19% required routine maintenance (routine check-ups and oral hygiene instructions) and 3% required urgent care. The latter were immediately referred for emergency treatment at Gozo General Hospital or Mater Dei Hospital.

4   Discussion

The aim of this outreach exercise, as mentioned previously, was to research the oral health status of Gozitan residents. Upon assessing Gozo as a community when compared to Malta, the social determinants of health such as income, education, social capital and occupation may not be very different to those of the mainland population. However, other social determinants such as the community structure and availability of health services, and larger forces such as structural inequality, cultural beliefs and attitudes may be different and may be interacting with choices in individual risk behaviours, environmental exposures and perceived access to health resources (David et al., 2006). This is being reflected as a reduced level of oral health for this population in the findings of this study.

Although the sample of participants in our study is not randomised, (it is described as a convenience sample due to the fact that whoever was interested in a dental check-up was recruited), the information gathered still has enormous ramifications. Keeping in mind Malta's own oral health goals for its population for 2020 (Department of Health Promotion and Disease Prevention, 2010), these results indicate that the oral health status in Gozo is lacking and is not reaching the goals described. To be able to reach any conclusions, however, other (randomised) studies need to be conducted.

Moreover, it is pertinent to presume that the participants who actually attended for the said check-up are the ones who are interested enough in their oral health to do so. So, although these results cannot be generalised to the whole Gozitan population, one might suggest that the oral health of the general population might actually be worse.

4.1   Oral Hygiene Habits

76% of the participants screened had plaque on their teeth at presentation. This means that their oral hy-

giene routine is not completely effective – a result of days of ineffective tooth brushing. Moreover, almost two thirds presented with calculus on their teeth – mineralised plaque after weeks of ineffective removal. This shows that the majority of participants and indeed the population still do not brush their teeth frequently or effectively enough.

4.2   DMFT

The results obtained indicate that despite having a lower DMFT value in the younger age groups, there is also a low level of restorative care resulting in a high level of untreated decay. Such a scenario leads to the presence of several open cavities in a child's mouth leading to the possibility of pain, infection and interferences/interruption of normal daily activities including eating, playing, sleeping and school attendance. The presence of untreated decay is also associated with a high oral bacterial count (Alaluusua, Kleemola-Kujala, Nystrom, Evalahti & Gronroos, 1987). This leads to an increased susceptibility to further or new decay in the same mouth. Restorative care returns the patient to a healthier, more fibrous diet, better function and the relief of pain and infection besides reducing the risk of further decay.

A large number of carious lesions were found to be at the reversible stage of the carious process. Such lesions are amenable to preventive measures that would arrest the lesions preventing cavitation. Timely preventive intervention, improved oral hygiene measures and dietary habits in all these cases avoid the need for more invasive and costly restorative intervention. Besides the economic cost in terms of direct cost, once should consider all indirect costs in order to provide and maintain the restorations for life, as well as the biologic costs.

In the 0–9 age band, caries is seen to be dealt with by restorations or extractions in equal frequency. Extractions at this age are probably of primary teeth. This leads to forward migration of adjacent posterior teeth leading to space loss and to disorders of occlusion necessitating orthodontic intervention at a later date.

With increasing age, the data illustrates that the choice of treatment for tooth decay was predominantly extraction rather than restorative care. This might also be a reflection of clinical decisions taken by dental surgeons who might still be favouring extractions rather than restorative treatment for carious teeth. The removal of teeth is not the end of dental problems but rather is the initiator of further complications. Tooth loss allows for the migration of adjacent teeth and over-eruption of opposing teeth resulting in a disruption of occlusion.

Furthermore, it leads to the ongoing and cumulative process of residual ridge resorption (Tallgren, 1972,
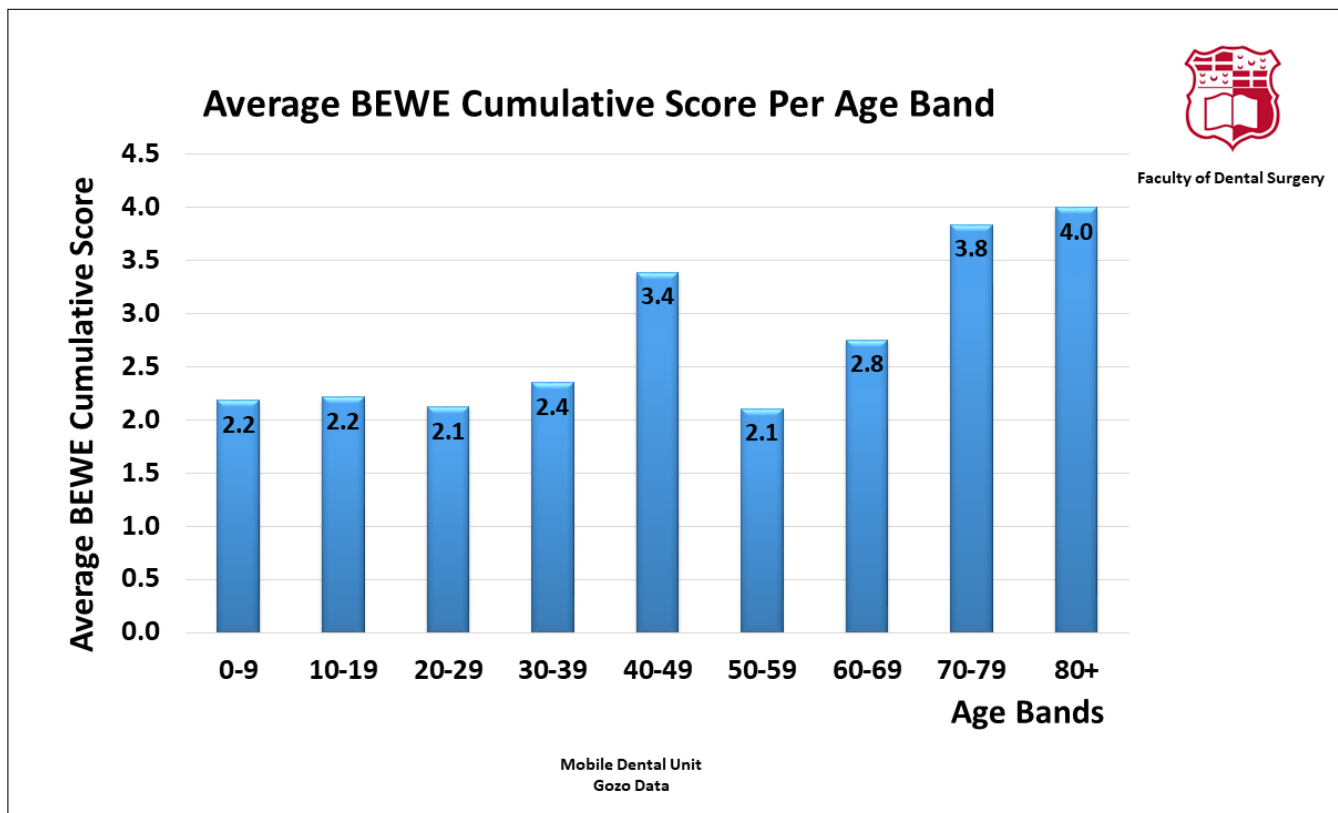
Figure 5: Tooth wear (erosion) scores per age bracket.

2003) which is further compounded in the older adults by frailty, illnesses and reduced capability to adapt to new dentures. All these factors result in the patients becoming prosthetically maladaptive due to a reduced capacity to adapt to full dentures. Chewing performance decreases, with a decline in the number of teeth present affecting the choice of food, with preference for soft food rich in saturated fats and cholesterol whilst avoiding food rich in dietary fibre (Brodeur, Laurin, Vallee & Lachapelle, 1993). Recent evidence also suggests that tooth loss was independently associated with the physical and cognitive decline in older adults. It was proposed that tooth loss is a potential early marker of decline in older ages (Tsakos, Watt, Rouxel, de Oliveira & Demakakos, 2015).

4.3 Functional Units and Anterior Open Bites

It was not determined why so many anterior open bites were encountered. This could be because the patients decided not pursue treatment at an earlier stage, they lacked awareness of their need or possibly they were not aware that orthodontic treatment is offered for free for individuals under 16 years of age.

4.4 Care Index

This would be calculated as the number of restored (filled) teeth divided by the whole DMFT value. The care index value was found to be low throughout all age groups. Overall, it was found to be 37% whilst in the 10–19 year age band this amounted to 33% - a far cry from the 70% target for Malta in 2020 (Department of Health Promotion and Disease Prevention, 2010). In fact, a glance at these treatment needs shows that most of the participants screened needed to be referred for treatment, some even urgently.

This shows that most caries is being left untreated, especially in younger age groups. This is also true in the 70+ age groups where most teeth were either decayed or extracted teeth rather than restored.

To expand even further on this point, there were almost half the participants with missing teeth (48%) with older cohorts (60+) having on average less than 10 functional units in total, with those who are 70+ having an average of 6. This is less than the 10 functional units (20 teeth in occlusion) recommended by the WHO (Petersen, 2009) for adequate mastication and a good quality of life.

4.5 Erosion

This type of tooth wear has become an increasing concern in the Maltese population, especially in preschool and school children. Recent studies also reported this

erosive wear to be significantly associated with an increased consumption of carbonated drinks, flavoured water and packaged juices (Gatt et al., 2017; Schembri & Attard, 2017).

4.6   Reversible Versus Irreversible Carious Lesions

The index used to measure caries during the study was the ICDAS which allows for an easy distinction between reversible (re-mineralizable) carious lesions - needing only preventive interventions, and irreversible carious lesions which would have progressed to a stage where restorative treatment is needed. As seen in Fig. 3, a high percentage of diagnosed lesions, especially in the younger age groups, were at the reversible stage. This highlights two points, namely: the importance/relevance of preventive interventions especially in younger age groups and the importance of early screening for early diagnosis due to the distinct visible gradual progress of carious lesions.

Another peak was seen in the 40–49 age band. This result was quite unexpected as usually in adults and older age groups the carious process occurs at a much slower rate. This could be due to the poor oral hygiene found in most participants putting even adults in a high-risk category with incipient caries lesions (usually common in children and teens) emerging even later in adulthood.

This emphasizes the importance of focusing on prevention. In dentistry, prevention would include dietary counselling, the promotion of effective tooth brushing with fluoride-containing toothpaste and other oral hygiene products, and the placement of fluoride varnishes and/or fissure sealants by dental professionals.

5   Conclusion

Basic principles for improving dental public health and preventing diseases include focusing on social determinants of health (Marmot & Bell, 2011; Tellez, Zini & Estupiñan-Day, 2014). Focusing on individuals and education alone is ineffective long term. The idea is to change the environment surrounding people making it conducive to health (Watt, 2005). Improvements in social determinants such as economic and educational status, housing and policies that promote oral health all bring about long-term improvements in health in general (Watt, 2005; Watt & Sheiham, 2012).

When taking Malta's health profile into consideration, the country is in the spotlight for high obesity and diabetes prevalence rates (Cuschieri et al., 2016; Grech et al., 2017). These two morbid non-communicable diseases have an important risk factor that is common to dental caries - sugar (diet). It would therefore be desirable, and more effective to implement the Common Risk Factor Approach to prevent multiple diseases by focusing on the common risk factor, in our case mainly sugar, and working with other professionals such as doctors, nutritionists, teachers etc. to bring about a decline in obesity and diabetes along with dental caries (Sheiham & Watt, 2000; Watt & Sheiham, 2012).

Even though this study's sample was not strictly randomised, the long-term implications of this cross-sectional survey are profound. It is prime time that the Gozitan community is provided with a targeted and enduring oral health programme with the aim of mitigating the findings of this study. It is recommended that 1) health services are reoriented to give more importance to early screening and prevention of dental diseases, 2) more hygienists are employed in Gozo to promote oral health and provide preventive interventions, including supervised school preventive interventions, 3) awareness of the accessibility and availability of dental health services in the population is increased and 4) the Common Risk Factor Approach is employed to promote health with particular focus on diet and smoking. Such a programme will address barriers to health care utilization that seem to be present and will leave Gozo with a more enduring oral health legacy.

Acknowledgements

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