

# Death Rate of Dental Anaesthesia

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## ABSTRACT

Death was the most important side effect of anaesthesia in dentistry. In this article we reviewed more than 20 studies with adequate data focusing on death associated with dental procedures since 1955 and found 218 deaths out of 71,435,282 patients (3 deaths per 1,000,000 persons) with the mortality rate of 1:327,684. In addition, mortality rate per million has dropped to half (6.2 per 1,000,000 vs. 3 per 1,000,000) since 1955 till the last report in 2012 without any sex predilection. In children, most cases died in the age of two to five years. Hypoxia was the most common cause of death, and cardiovascular, respiratory, and endocrine disorders, hepatic cirrhosis, septicaemia, and bacterial endocarditis were the most frequent underlying systemic disease in deceased patients. Although rare death following general anaesthesia in dentistry, is a critical side effect mostly seen in patients with compromised health condition. Therefore, appropriate case selection in regard with patients' general health status as well as standard technical and equipment conditions are mandatory to diminish the risk of death during dental anaesthesia.

**Keywords:** Dentistry, Morbidity, Mortality, Sedation

## INTRODUCTION

Nowadays dental visit is regarded as a routine and generally pleasant experience for most of people, and 62% of the population has at least one visit to a dentist annually [1]. However, fear of pain and anxiety impede regular dental care in some patients. For this group, as well as uncooperative young children and adults, general anaesthesia or more recently conscious sedation techniques have been implemented before dental procedures [1,2]. First administration of general anaesthesia in dentistry dates back to 11<sup>th</sup> December 1844 when a dental extraction was accomplished under the influence of nitrous oxide. In 1846, ether was used to facilitate dental extraction successfully [3,4]. Albeit local anaesthesia was introduced during the advent of the 20<sup>th</sup> century it remained an empirical technique until the presentation of lidocaine in the 1940s.

Due to cultural expectation, having safe and effective local anaesthetics has not diminished an ongoing demand for general anaesthesia [4]. In 1970s and 1980s, numerous deaths among healthy children undergoing simple dental procedures under general anaesthesia were documented. Presumably, administration of anaesthesia in substandard conditions in terms of monitoring, assistance, resuscitation equipment, and poor preparation for anaesthesia and surgery was the reason. However, currently there is a global trend toward paediatric dentistry under general anaesthesia [3,5]. Lee HH in a study, evaluated deaths among children during dental anaesthesia and found 44 mortality out of 997 reports [6]. General anaesthesia carries the most critical risk in terms of morbidity and mortality, however dental practitioners should bear in mind that other situations such as swallowing or aspiration of foreign bodies including dental instruments, postoperative infections (mostly endocarditis), anaphylactic reactions to dental medications, and other factors might result in death in dental office as well [1,7].

The aim of this narrative review was to detect the mortality rate of dental anaesthesia and its characteristics in the period of 1955-2012.

## Search Strategy

Electronic searches through PubMed, MEDLINE, Cochrane Database, and Google Scholar were accomplished, and a reference list of relevant articles were undertaken. Among them, English-language papers with available full texts focusing on mortality during dental procedures were chosen. The keywords used were mortality, morbidity, anaesthesia, sedation, dentistry.

## Indications and Complications of Dental Anaesthesia

Most of dental procedures can be performed under local anaesthesia which is safe in nature. Decisions regarding general anaesthesia can only be made according to each patient's condition, but its use in dentistry should be restricted to: 1) Acute infection such as acute dento-alveolar abscess and severe pulpitis, which preclude to achieve appropriate local anaesthesia, and pain relief during dental treatment. Meanwhile, in these circumstances medications or drainage procedures are failed due to local change in pH and a risk of spreading infection; 2) Small children who may not tolerate dental procedures under local anaesthesia or those who experienced failures of previous attempts using local anaesthesia constitute a majority of outpatient general anaesthesia in dentistry. It is recommended that administration of general anaesthesia to very young children be accomplished only by paediatric anaesthetists; 3) Mentally compromised patients are unlikely to allow safe completion of treatment under local anaesthesia because of problems related to physical/mental disability; therefore they might need general anaesthesia; 4) Dental phobia: patients suffering from long-term dental phobia are best managed under general anaesthesia in the first visit with the aim of gradual shift to local anaesthesia, conscious sedation and behaviour management techniques respectively; 5) Allergy to local anaesthetic ingredients mostly the preservative methyl paraben can cause allergic reactions, which should be differentiated with vasovagal attacks; 6) Extensive dentistry and maxillofacial surgery: local anaesthesia is unable to provide pain relief in an alert patient during extensive procedures [3,4]. D'Eramo, in three studies in 1999, 2003, and 2008 demonstrated that the most common complication related to dental anaesthesia was syncope (up to 80%)

followed by laryngospasm, phlebitis, dysrhythmia, bronchospasm, and hypotension [2,8,9]. Death was one of the most crucial side effects of anaesthesia in dentistry most commonly caused by hypoxia according to Tomlin PJ. Hypoxia can mimic a syncope attack with a low blood pressure, and a low cardiac output state with severe bradycardia [10]. According to review of the literature, the mortality rate associated with dental office anaesthesia has been estimated to be between 1:1639 to 1: 1,733,000 [9,11].

## DISCUSSION

In this article we reviewed more than 20 studies focusing on death related to dental anaesthesia [2,8-29], and found 218 deaths in 71,435,282 patients (3 deaths per 1,000,000 persons) with the mortality rate being 1:327,684. In addition, mortality rate per million has been dropped to half since 1955 till 2012 (6.2 per 1,000,000 vs. 3 per 1,000,000) [Table/Fig-1] most probably as a result of modern advances in anaesthetic techniques.

Meanwhile, several studies regarding mortality rate of anaesthesia in general medicine revealed a decrease in death rate over a 60-year-period since 1940 (1 death in 1000 people) to early 2000s (1 in 100000 people) [30-33]. According to [Table/Fig-1] different modalities of anaesthesia can lead to death especially general anaesthesia. In a

Author	Type of anaesthesia	Death: People	Approximate mortality rate	Mortality rate per 1000000
Seldin [12]	General	15:2429148	1:161943	6.2
Seldin [13]	General, Local	59:7956627	1:134858	7.4
Driscoll [14]	General	5:1575000	1:315000	3.2
Driscoll [15]	General, Sedation, Local	11:5285570	1:480506	2
Tomlin [10]	General, Sedation, Local	29:7956000	1:274344	3.6
Lytle [16]	General	3:1295000	1:431666	2.3
Lytle [17]	General	0:1285000	0:1285000	-
Coplans [18]	General	56:14473000	1:258446	3.9
Lytle [19]	General	7:4700000	1: 672000	1.4
D'Eramo [20]	General, Sedation, Local	2:2082805	1:1000000	0.9
Flick [21]	General, Sedation	1:151355	1: 151355	6.6
Nkansah [22]	General, Sedation	4:2830000	1:707500	1.4
Hunter [23]	General	0:1126	0: 11226	-
D'Eramo [8]	General, Sedation	0:1588365	0:1588365	-
Deegan [24]	General, Sedation	19:14206923	1: 747000	1
D'Eramo [2]	General, Sedation, Local	2:1706100	1:853000	1.1
Lee [25]	General	0:22615	0: 22615	-
Rodgers [26]	Sedation	0:2889	0: 2889	-
Flick [27]	General, Sedation	2:115940	1: 57970	17
D'Eramo [9]	General, Sedation, Local	1:1733055	1: 1733000	0.5
Braidy [28]	Sedation	0:1167	0:1167	-
Rodgers [29]	Sedation	0:3320	0: 3320	-
Qiam [11]	General	2:34277	1:1639	610
Total	General, Sedation, Local	218: 71435282	1:327684	3

**[Table/Fig-1]:** Comparison of dental anaesthesia- related mortality rates since 1955 [2,8-29].

study by Lee HH et al., on dental children's dental death rate, it was found that more than 50% of deaths occurred between the age of two to five years and more frequently under sedation [6]. Gonzalez LP et al., in a systematic review on paediatric mortality rate due

to general anaesthesia (not only related to dental procedures) demonstrated higher death rates among children in developing countries (10.7-15.9 per 10,000 anaesthesia) as compared to developed countries (0.41-6.8 per 10,000 anaesthetics) [34]. In addition, 73% of deaths were observed during extraction (41%) and restorative (32%) procedures. Furthermore, Lee HH et al., showed that only 15% of cases were administered general anaesthesia or sedation by anaesthesiologist, and 70% of deaths happened in the dental offices followed by surgery centers and hospitals [6]. These findings were in accordance with Cote CJ's study [35]. However, in a comparable study by Krippaehne JA and Montgomery MT, it was revealed that about 60% of deaths occurred following general anaesthesia [36]. The most commonly used anaesthetics and adjunctive agents in dental practice are: nitrous oxide (87%-97%), midazolam (48%-91%), methohexital (46%-90%), diazepam (36%-79%), fentanyl (38%-74%), propofol (3%-58%) and ketamine (7%-50%). On the other hand, lidocaine with epinephrine (83%-89%), mepivacaine (69%-76%), bupivacaine with epinephrine (44%-64%), and lidocaine without epinephrine (23%-35%) were among the most frequently used local anaesthetics in dentistry [2,8,9].

Coplans MP found no significant difference between men and women in terms of death associated with dentistry, and also showed that 50% of patients who died as a result of general anaesthesia were in supine position followed by upright and reclining positions [18]. However, according to an epidemiologic study by Li G et al., death rate due to general anaesthesia (not only dental procedures) per million population per year was twice as common in men (1.45) than women (0.77), which was 8.2 deaths per million hospital surgical discharges (11.7 for men and 6.5 for women) [37]. On the other hand, 46 out of 71 deceased patients in Coplans' study had at least one systemic condition such as cardiovascular, respiratory, and endocrine disorders, hepatic cirrhosis, septicaemia, and bacterial endocarditis [38].

## CONCLUSION

Although rare, death following general anaesthesia in dentistry is a critical side effect mostly seen in patients with compromised health condition. Therefore, appropriate case selection in regard with patients' general health status as well as standard technical and equipment conditions are mandatory to diminish the risk of death during dental anaesthesia.

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