Salivary Profile of Recovering Illicit Drug Addicts in Rehabilitation Center of the National Narcotics Board

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Abstract

Drug abuse may cause some changes to the oral cavity, such as hyposalivation, alteration in salivary pH, and buffering capacity, which may lead to other oral problems. The purpose of this study is to determine the salivary flow rate (SFR), pH, and buffering capacity in recovering drug addicts. This cross-sectional study was conducted on 86 residents from the Hope and Re-entry groups of the rehabilitation centre. The samples used were stimulated (SS) and unstimulated (US) saliva. Saliva was collected using the spitting method for a period of five minutes. Participants chewed paraffin wax prior to the collection of SS samples. SS was analysed for buffer capacity, and US was analysed for pH. The mean values for the Hope and re-entry groups respectively were USFR (ml/min) 0.41 ± 0.17 and 0.45 ± 0.2; SSFR (ml/min) 1.39±0.59 and 1.21 ± 0.59; unstimulated pH 6.86 ± 0.4 and 6.9 ± 0.4; stimulated pH 7.4 ± 0.3 and 7.3 ± 0.3; and buffer capacity 6.8 ± 2.8 and 6.38 ± 2.7. Salivary buffering capacity, which was lower in the Re-entry group, might be related to SSFR, as salivary buffering capacity increased as the SFR increased, and vice versa. A history of illicit drug use did not affect SFR or pH, since both groups had normal SFR and salivary pH. However, it may have affected salivary buffering capacity, as suggested by relatively low buffering capacity in both groups.

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Introduction

Saliva is an exocrine secretion containing water, electrolytes, and proteins. Saliva has many important functions in oral health, which can be organised into the following major categories: lubrication and protection, buffering, antibacterial activity, gustatory and masticatory function, and maintenance of tooth integrity. Saliva is secreted from major and minor salivary glands. Average daily saliva secretion ranges from 1 to 1.5 L.[1] The normal stimulated salivary flow rate (SSFR) ranges from 1 to 3 mL/min, while the normal unstimulated salivary flow rate (USSFR) ranges from 0.25 to 0.35 mL/min.[2,3]

A decrease in the salivary flow rate may be caused by many factors, including physiological conditions with an anticholinergic effect, disease of the salivary gland, systemic disease, radiotherapy, and medications.[4] Drug users often experience oral complaints related to their addiction to drugs, such as caries, periodontal disease, temporomandibular joint discomfort, grinding teeth, and the most common complaint, dry mouth.[5]

Besides a reduction in salivary flow rate, another change related to medication or drug use is a decrease in salivary pH and buffering capacity. It was shown that elderly people who took medications for systemic conditions had a lower salivary pH and buffer capacity.[6] Recovering drug addicts in rehabilitation have

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shown low salivary buffering capacity, but normal salivary pH.[7] Another study showed that in crack cocaine users, salivary pH waslower than normal while buffering capacity was still within the normal range.[8]

This study was conducted in the Rehabilitation Center of the National Narcotics Board of Indonesia. Residents of the rehabilitation centre were mostly recovering from the use of methamphetamine, heroin, cannabis, and cocaine.[7]

This centredoes not use methadone for drugs replacement therapy as a rehabilitation strategy; instead it provides drug-free rehabilitation through detoxification. Rehabilitation in the centre consists of several phases: the primary phase, which lasts four months and includes intermediary steps called Green, Hope, and House of Change, and the Re-entry phase, which takes one month. The purpose of this study is to investigate the salivary profile, including salivary flow rate, pH, and buffering capacity, of recovering illicit drug addicts in the Hope and Re-entry groups, in order to supplement a previous study by Wimardhani et al., which measured the salivary profile in recovering drug addicts in residents from the Green group.[7]

Methods

Ethical clearance for this study was gained by the Ethical Committee of the Faculty of Dentistry, Universitas Indonesia. Data were collected in September 2013 from three groups of rehabilitation called Green, Hope, and Re-entry. This study continues the previously published study by Wimardhani et al. (2016) that described the salivary profile of residents in the Green group in the same centre. All subjects were male, with ages ranging from 17 to 49 years, and they all participated voluntarily. A total of 86 residents from the Hope and re-entry groups participated in this study. Any residents who had physical or psychiatric illnesses were excluded.

The subjects were instructed not to eat, drink, or carry out any oral hygiene procedures for at least one hour before the scheduled saliva collection. To determine the unstimulated salivary flow rate (USSFR) using the spitting method, subjects were asked to expectorate saliva into 15 ml centrifuge tubes every 60 seconds for five minutes. The collection of stimulated salivary flow rate (SSFR) was performed by the subjects chewing paraffin wax to stimulate secretion, and then expectorating saliva into 15 ml centrifuge tubes every 60 seconds for five minutes. The paraffin wax, pH measuring paper, and buffer strips were included in the GC Saliva-Check Buffer Kit package (900200 GC, America, Inc.).

Salivary pH and buffer capacity were both measured using GC Saliva-Check Buffer Kit (900200 GC, America, Inc.). The measurement of salivary pH was performed using saliva from the USSFR and SSFR samples. A strip of pH measuring paper was dipped into a small amount of saliva from each sample and analysed using colour matching, as per the manufacturer's instructions. Buffer capacity was measured by dropping a small amount of SSFR onto a buffer strip using the pipette provided in the kit; these were also analysed using colour matching.

Results

This study showed the mean USSFR and SSFR for the Hope group (n=60) to be 0.41 ± 0.17ml/min and 1.39 ± 0.59ml/min respectively. Most of the residents (83.3%, n=50) showed normal USFR and SSFR, while 16.7% (n=10) showed hyposalivation. The mean USFR and SSFR for the re-entry group (n=26) were 0.45 ± 0.2ml/min and 1.21 ± 0.59ml/min respectively. In this group, 96.2% (n=25) had a normal salivary flow rate, and 3.8% (n=1) showed hyposalivation (Table 1).

Salivary pH was measured using samples of unstimulated and stimulated saliva. For the Hope group, the pH measurements of the unstimulated and stimulated saliva were 6.86 ± 0.4 and 7.4 ± 0.3 respectively. In this group, 38 participants (63.3%) showed normal salivary pH and 22 (36.7%) showed acidic salivary pH. The mean salivary pH measurements of unstimulated and stimulated saliva for the re-entry group were 6.9 ± 0.4 and 7.3 ± 0.3 respectively. In the re-entry group, 17 subjects (65.4%) had normal salivary pH while 9 (34.6%) had acidic salivary pH. The mean salivary buffering capacities for the Hope and re-entry groups were 6.8 ± 2.8 and 6.38 ± 2.7 respectively. Most subjects from both groups showed low buffering capacity: 50(83.4%) in the Hope group and 23 (88.5%) in the re-entry group (Table 1).

Table 1. Unstimulated and stimulated salivary flow rates, salivary pH, and buffer capacity in the Hope and Re-entry groups

Salivary variables	Groups	Mean ± SD
Unstimulated SFR	Hope	0.41±0.17
	Re-entry	0.45±0.2
Stimulated SFR	Hope	1.39±0.59
	Re-entry	1.21±0.59
Unstimulated salivary pH	Hope	6.86±0.4
	Re-entry	6.9±0.4
Stimulated salivary pH	Hope	7.4±0.3
	Re-entry	7.3±0.3
Buffer capacity	Hope	6.8±2.8
	Re-entry	6.38±2.7

Discussion

Saliva plays several important roles in the maintenance of oral health. Medications like antihypertensive, as well as psychiatric drugs and illicit drugs, may decrease the production of saliva.[9,10] Each illicit drug can cause dry mouth for a different reason. For example, for a cannabis user, dry mouth is the result of the drug's parasympatholytic effect; for a methamphetamine user, dry mouth can be caused by a combination of the drug's effect in increasing sympathetic activity in the central nervous system and the user's decrease in fluid intake while under the drug's influence.[11]

This study showed that most of the residents in rehabilitation who participated in the study had a normal salivary flow rate. This result is in accordance with the study by Wimardhani et al., which showed a normal salivary flow rate in residents from the Green group of the same rehabilitation center.[7] There are several possible reasons for this result. One reason may have been that since the participants were already in rehabilitation and no longer using drugs, their salivary functions had recovered. Another reason may have been that the rehabilitation centre did not offer methadone for drug substitution therapy. Methadone is known to cause dry mouth, and residents' salivary flow rates may have improved in its absence.[12]

The third possible reason for the results was that the centre gave residents up to five cigarettes per day as part of their drug substitution therapy.[7] In a study by Singh et al., long-term smoking significantly reduced salivary flow rate in smokers who had 10-15 cigarettes a day.[13]

Normal salivary pH ranges from 6.5 to 7.4. This study showed that 55 participants in both groups (64%) had salivary pH within the normal range, while the other 31 participants (36%) showed acidic pH. An explanation for this result may be that the discontinuation of illicit drug use resulted not only in a cessation of exposure to acidic drug ingredients, but also in better dental hygiene and a reduced consumption of sugary products.[14] The normal results might also have resulted from not using methadone, which is syrup-based, as a drug substitution. It has been reported that the pH of a 1% water solution of sugar-based methadone is 4.5 to 5.5, suggesting that taking methadone could increase oral acidity.[15] Prolonged retention of sugary products is known to decrease salivary pH, thus creating a more acidic oral environment.[12]

The study showed low buffering capacity in both groups. Possible explanations for this result may include salivary flow rate, the activity of an hydrase IV in saliva, disturbances to the salivary buffering system, and the condition of salivary glands due to a history of illicit drug use.[7] The buffering capacity results in this study were matched with the SSFR results. Buffer capacity was higher in the Hope group, which also had higher SSFR, than in the Re-entry group. Buffer capacity involves three major components: bicarbonate, phosphate, and protein systems.

The most important of these is the bicarbonate system. Saliva bicarbonate increases salivary pH and buffer capacity, especially during stimulation. The phosphate buffering system contributes to extending buffer capacity at a low flow rate. Bicarbonate concentration is dependent on secretion rate: the salivary buffering capacity increases as the salivary flow rate increases, and vice versa.[9,16] During stimulated saliva secretion, the concentration of bicarbonate ions is higher, salivary pH rises, and buffering capacity increases.[3]

Conclusion

Based on the findings in this study, it can be concluded that illicit drug users in rehabilitation have normal salivary flow rates and normal salivary pH; however, the results showed a low buffering capacity of stimulated saliva.

These findings may contribute to advancing the research about the salivary profile in recovering drug users in other rehabilitation centres in Indonesia.

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