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A Cross-Sectional Study to Assess the Risk Factors for Hypoesthesia after Repair of Facial Fractures

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Hypoesthesia occurs as a result of injuries resulting in injury to the nerve fibres. The causes of injury include direct harm from the needle injections, around the nerve fibres, mechanical injuries resulting in an indirect pressure into the mandibular canal, during the dental surgical procures, as well as the toxicity of the local anaesthetic agents.

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Methods: This cross-sectional research was conducted by recruiting N=79 adult individuals (>18 years), who had visited the district hospital for acquiring clinical assistance and treatment of facial muscles or nerve-related complications in August 2020. Data collection for this research was carried out by using a specially designed questionnaire, which facilitated in acquiring data related to aetiology of trauma, identification of the hypoesthesia area, as well as the clinical complications experienced by the respondents. The clinical reports of the patients were also collected for analysing the hypoesthesia area. SPSS was utilised for data analysis, and statistical tests were conducted for assessing the risk factors for hypoesthesia after repair of facial fractures.
Results: The statistical tests revealed that only a small percentage of the sample population, i.e., (N=9) or 11.8% experienced the facial bone fracture, male respondents had more exposure to the facial bone fractures, as compared to the females (Mean=1.81, SD= 0.397), and the individuals below 25 years of age had high exposure of facial bone fracture (Mean=1.78, SD= 0.428). A significant majority of hypoesthesia cases were at mandible, and orbit region.
Conclusion: The dental treatment resulting in nerve manipulation results in nerve elongation, nerve compression, contributing to transient hypoesthesia. Hypoesthesia might also lead to other clinical complications.

Keywords: Risk factors; hypoesthesia; facial fractures; injuries; cross-sectional study.

1. INTRODUCTION

A considerable percentage of these facial fractures and maxillofacial injuries can be managed without surgical interventions. [1,2]; however, the surgical intervention might be essential for managing the mandible fractures, which is a result of anatomical complexity. The surgical procedure for the repair of facial fractures giving rise to multivariate clinical complications such as hardware exposure or extrusion, surgical site infection, wound dehiscence, bony nonunion or malunion, along with a range of other clinical complications. [3] Some of the complications associated with surgical procedures carried out for the management of facial bone fractures also include asymmetry, infection, disturbed healing of wound, malocclusion, and malar depression.[4] However, hypoesthesia is regarded one of the most common complexities occurring after the after repair of facial fractures.

Hypoesthesia is most likely to occur in correlation with the motor dysfunction in the location, as well as the time of onset.[5] Face constitutes of a high density of the peripheral receptors; therefore, the likelihood of sensory deterioration due to trauma lies between from 70% to 80%. [4] Evidence reported that the neurosensory disturbances after the extraction of lower third molar occurs in 0.3% to 8.4% of the cases.[6] In most of the cases, the condition of hypoesthesia is temporary, such that the rate of incidence of the refractory hypothesis is less than 1%.[7] The outcomes of research conducted by considering approximately 2528 mandibular third molar extractions revealed that temporary hypoesthesia occurred in almost 1.5% of the cases, whereas, refractory hypoesthesia was recorded in 0.6% of cases within the duration of fewer than 6 months.[7]

Hypoesthesia occurs as a result of injuries resulting in injury to the nerve fibres. The causes of injury include direct harm from the needle injections, around the nerve fibres, mechanical injuries resulting in an indirect pressure into the mandibular canal, during the dental surgical procures, as well as the toxicity of the local anaesthetic agents.[8] Nerve injury, soft tissue oedema caused due to incision as well as dissection of tissues, in addition to traction from the surgical instruments are some of the most significant causes of the post-traumatic hypoesthesia.[9] The previously conducted studies have investigated the impacts of hypoesthesia after the repair of facial fractures; however, there is a gap in the literature regarding the analysis of risk factors for hypoesthesia, after the repair of facial fractures. This research aims to assess the risk factors for hypoesthesia after repair of facial fractures. It also aims to determine the age group and gender, which is most likely to be affected by hypoesthesia.

2. MATERIALS AND METHODS

2.1 Study Design

This research was conducted by using the cross-sectional research design, which is referred to as

a research approach facilitating the investigators in analysing the outcomes, as well as the exposure in the sample population at the same time.[10] This research was conducted by recruiting N=76 adult individuals, who had visited the district hospital in August 2020. The sample population for the cross-sectional studies is selected on the basis of an inclusion or exclusion criteria, and the assessment of exposure and outcomes leads the process of selection of research participants. [10] For this reason, the sample population was employed through effective usage of the inclusion and exclusion criteria. Adult individuals (>18 years), visiting the hospital for acquiring clinical assistance and treatment of facial muscles or nerve-related complications were selected through the inclusion criteria.

Contrarily, individuals who were visiting the hospital for acquiring assistance for the complications other than facial muscles or nerves problems were excluded via exclusion criteria. The patient information, as well as the clinical records, and radiographic measurements of the respondents, were assessed to analyse the degree of hypoesthesia. The patients having incomplete clinical records were also excluded from this research.

2.2 Research Variables

The research variables comprised of the demographic characteristics of patients, including, age, and gender, clinical history, the site of fracture, and the complications experienced by the patients as a result of trauma.

2.3 Data Collection

Data collection for this research was carried out by using a specially designed questionnaire comprising of the demographic section, and section including questions regarding nature, degree, and complications related to of hypoesthesia experienced by the patients. The demographic variables included age, and gender of the population, whereas, the data related to the aetiology of trauma included the type of fracture, the hypoesthesia experiences, identification of the hypoesthesia area, as well as the clinical complications experienced by the respondents. Along with the collection of data via the questionnaire, the clinical reports of the patients were also collected for analysing the hypoesthesia area of the respondents.

2.4 Data Analysis

SPSS was utilised for data analysis, and different statistical tests were conducted for assessing the risk factors for hypoesthesia after repair of facial fractures.

3. RESULTS

3.1 Demographic Characteristics

Fig. 1 presented that the sample population for this research comprised of N=76 participants, such that the highest number of participants, i.e. approximately (N=18) 23.7% of the individuals were below the age of 25 years. Moreover, (N=14) 18.4% of the individuals were 36-40 years old, (N=11) 14.5% were 41-45 years old, and (N=10) 13.2% of the individuals were 26-30 years old. Whereas (N=10) 13.2% of the individuals were 46-50 years old, and only (N=4), 5.3% of the individuals were above 50 years (refer to Fig. 1). Whereas, Fig. 2 presented the gender-wise distribution of the respondents, and revealed that N=39 (51.3%) of the respondents were females, and N=37 (48.7%) were males.

3.2 Exposure to Repair Facial Bone Fracture

In response to the questions whether the respondents were exposed to repair a facial bone fracture, only N=9 (11.8%) respondents replied in affirmative, whereas, N=67(88.2%) of the respondents demonstrated that they had not experienced facial bone fracture Fig. 3. Table 1 presented that with reference to gender distribution, the male respondents were more exposed to repair the facial bone fracture, as compared to the female population (Mean=1.81, SD= 0.397). The analysis of exposure to the repair facial bone fractures revealed that out of all age groups included within the research, the individuals below 25 years of age had high exposure of facial bone fracture (Mean=1.78, SD= 0.428).

Table 1. Gender-wise distribution and repair facial bone fracture
Were you exposed to repair facial bone fracture?

Gender	Mean	N	Std. Deviation
Female	1.95	39	.223
Male	1.81	37	.397
Total	1.88	76	.325

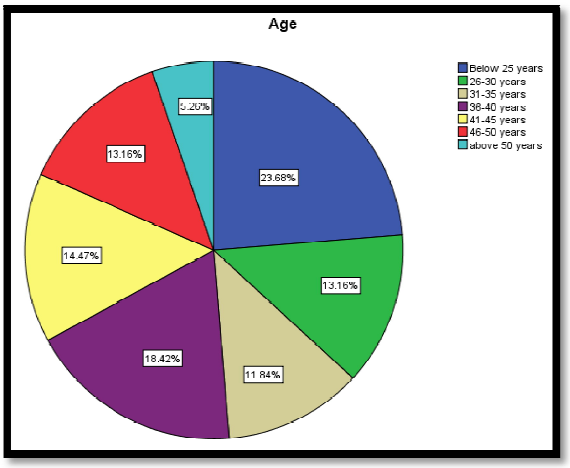

Fig. 1. Age

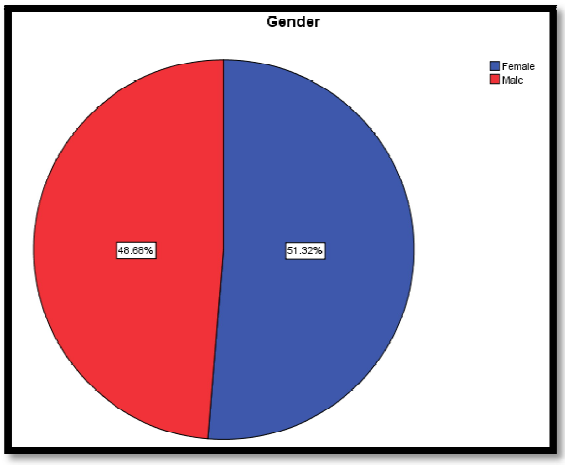

Fig. 2. Gender-wise distribution

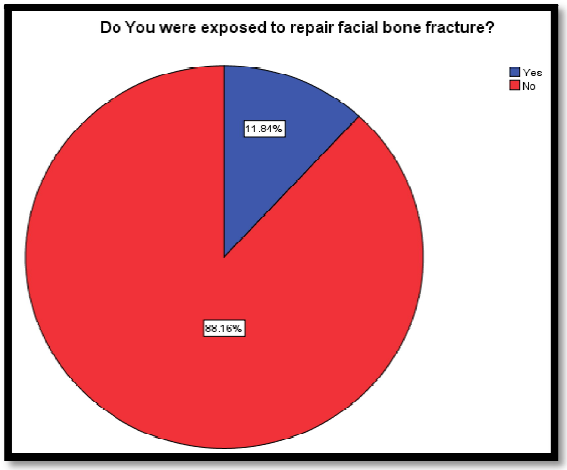

Fig. 3. Exposure to facial bone fracture

Table 2. Age-wise distribution and repair facial bone fracture
Were you exposed to repair facial bone fracture?

Age	Mean	N	Std. Deviation
Below 25 years	1.78	18	.428
26-30 years	1.80	10	.422
31-35 years	1.89	9	.333
36-40 years	1.93	14	.267
41-45 years	2.00	11	.000
46-50 years	2.00	10	.000
above 50 years	1.75	4	.500
Total	1.88	76	.325

3.3 Incidence of Hypoesthesia and Identification of the Hypoesthesia Area

The analysis of the incidence of hypoesthesia among the respondents revealed that a small percentage (N=5) 6.6% of the respondents experienced a loss of sensation or hypoesthesia, whereas, a considerable percentage (N=66) 86.8% of the population did not experience hypoesthesia. Whereas, N=5 (6.6%) of the respondents were not sure whether they had experienced hypoesthesia Fig. 4.

Fig. 5 presented the facial region, at which the respondents experienced the hypoesthesia. In response to the questions regarding the hypoesthesia area, (N=4) 5.3% of the respondents reported experiencing hypoesthesia at the mandible region, whereas, the same percentage of the respondents, i.e. (N=4) 5.3% of the respondents reported to experience hypoesthesia at the orbit region. Moreover, only (N=2), 2.2% of the respondents experienced hypoesthesia in the maxilla region.

3.4 Clinical Complications Experienced by the Respondents

Table 3 illustrated the clinical complications experienced by the respondents, and it was found that a considerable majority (N=56), 73.3% of the population did not experience the clinical complications. On the contrary, N=12 (15.8%) of the respondents reported to undergo dental surgeries, N=4 (5.3%) experienced tumour, N=3 (3.9%) of the respondents experienced neve compression, whereas, N=1 (1.3%) of the respondents experienced decompression. Table 3 presented that out of all clinical complications, the individuals living with nerve compression experienced severe hypoesthesia (Mean=1.67; SD=0.577). Thus, with reference to the clinical outcomes, the population having nerve compression are at an increased risk of experiencing hypoesthesia.

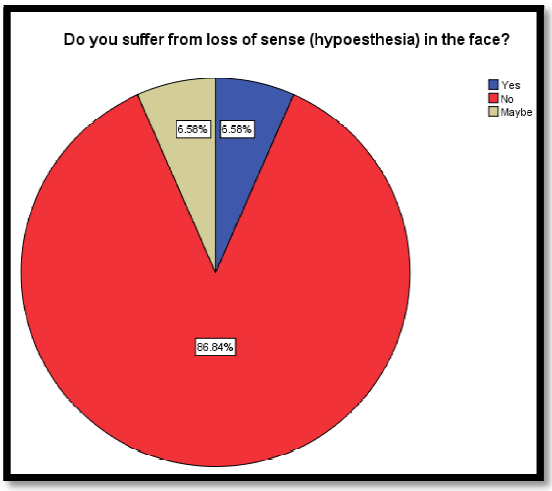

Fig. 4. Loss of sensation

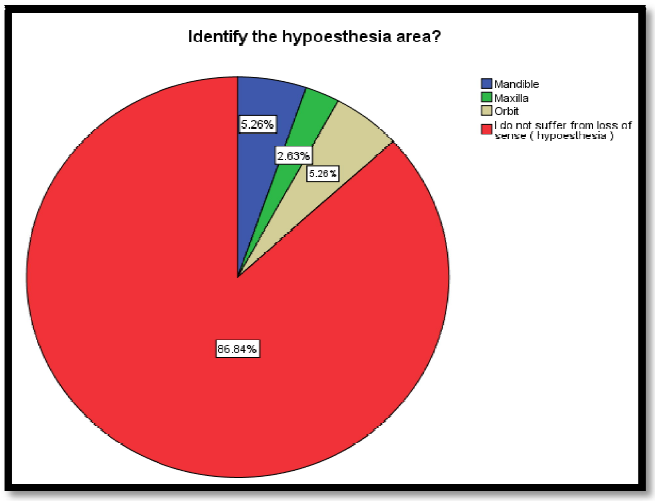

Fig. 5. Hypoesthesia area

Table 3. Clinical complications experienced by the respondents
Do you suffer from one of the following diseases?

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Nerve compression	3	3.9	3.9	3.9
	Tumor	4	5.3	5.3	9.2
	Dental surgeries	12	15.8	15.8	25.0
	Decompression sickness.	1	1.3	1.3	26.3
	Nothing	56	73.7	73.7	100.0
	Total	76	100.0	100.0	

Table 4. Nerve compression and increased risk of hypoesthesia
Were you exposed to repair facial bone fracture?

Nerve compression	Mean	N	Std. Deviation
Yes	1.67	3	.577
No	1.89	73	.315
Total	1.88	76	.325

4. DISCUSSION

In this research, we investigated the risk factors to hypoesthesia after repair of facial fractures by recruiting the sample population comprising of (N=79) males and females of different age groups. The outcomes of the statistical tests revealed that only a small percentage of the population, i.e., (N=9)11.8% experienced a facial bone fracture. The gender-wise comparison of the incidence of repair facial bone fracture illustrated that the male respondents had more exposure to the facial bone fractures, as compared to the females (Mean=1.81, SD= 0.397). On the contrary, with reference to the age-wise distribution, the individuals below 25 years of age had high exposure to facial bone fracture (Mean=1.78, SD= 0.428). The previously published evidence reported that older individuals acquiring dental treatment are most likely to experience permanent nerve injuries; however, older age cannot be declared as a risk factor to hypoesthesia.[6] The previously published evidence reported that similar to the rate of incidence of hypoesthesia, the rate of recovery is significantly higher among young individuals, which is also illustrated in the present research.[6] The statistical analysis revealed that among the sample population, hypoesthesia was present in a small percentage (N=5) 6.6% of the respondents. The prognosis of hypoesthesia identified in the present research is comparatively lower than the incidences reported within the previous studies.[4] One of the most

significant reasons behind low prognosis of hypoesthesia among the sample population is that some of the respondents were not sure about the incidence of hypoesthesia.

The analysis of the region at which the patients experience hypoesthesia revealed that 5.3% of the population was reported to have hypoesthesia at the mandible region, whereas, an equal percentage of the population had hypoesthesia at the orbit region. These outcomes are similar to the outcomes of previously published studies, which reported that a significant percentage of the population is likely to experience hypoesthesia at the mandible region, as compared to other regions.[1] The evidence reported that most often, the mandibular angle fractures leads towards hypoesthesia at the mandible region[1]; however, the incidence is significantly influenced by the factor including the severity of the fracture, the clinical complications experienced by the patients, along with other factors. With reference to other evidence, the risk of hypoesthesia in the orbital region is significantly higher than the other facial regions. [4]

The analysis of the clinical complications experienced by the respondents, which might put them at risk of hypoesthesia revealed that dental surgeries were the most common clinical complication experienced by N=12 (15.8%) of the respondents. The research outcomes are similar to the outcomes of the previous studies, which reported that surgical dental procedure, including the orthognathic surgery, and the implant surgery are some of the most significant causes of hypoesthesia.[11] It was also reported that the local anaesthetic agents, which are utilised for the dental procedures contribute to hypoesthesia [12]; therefore, the incidence of hypoesthesia was high among the individuals having the clinical history of dental treatment. The present research revealed that tumour was another most significant clinical complications experienced by 5.3% of the respondents, whereas 3.9% of the respondents experienced neve compression. The previously published evidence also reported that tumour and the surgical procedure carried out for the removal of tumours are significant causes of hypoesthesia.[13] The surgical procedures which are carried out for dental treatment, and specifically repairing of the mandibular fracture, results in significant damages to the mandibular and mental nerve. The nerve manipulation and damage is likely to result in nerve elongation, nerve compression or crushing, and the effects of nerve damage range from mild transient hypoesthesia to trigeminal neuralgia or neuropathic pain, and several other clinical complications.[14]

5. LIMITATIONS

This research provided a significant insight regarding the risk factors for hypoesthesia after repair of facial fractures, and the age group, and gender, which is most likely to be affected by hypoesthesia. However, there are a number of limitations to this research. The cross-sectional study was conducted by considering N=79 individuals, and the sample population did not comprise an equal number of individuals from all age groups, which is a significant research limitation. Moreover, despite recruiting the individuals who had experienced facial bone fractures, this research also included the individuals who had not experienced a facial bone fracture, influencing the generalizability of research. The future research needs to strictly recruit the individuals who had experienced facial bone fractures for determining the risk factors to hypoesthesia, and the analysis of age group, and gender which is most likely to be affected by hypoesthesia, after the repair of facial fractures.

6. CONCLUSION

This cross-sectional research was conducted to assess the risk factors for hypoesthesia after repair of facial fractures. It also aims to determine the age group and gender, which is most likely to be affected by hypoesthesia. It was reported that a considerable percentage of facial fractures can be managed without surgical interventions; however, in some of the cases, it is essential to undergo surgical intervention for managing the mandible fractures. The surgical procedure for the repair of facial fractures might give rise to a range of clinical complications including hypoesthesia, hardware exposure or extrusion, surgical site infection, asymmetry, infection, disturbed healing of the wound, wound dehiscence, bony nonunion or malunion, malocclusion, malar depression, and several other complications. However, hypoesthesia is one of the most common complications occurring after the after repair of facial fractures.

The research outcomes reported that the male respondents had more exposure to the facial bone fractures, as compared to the females,

whereas, with reference to the age-wise distribution, the individuals below 25 years of age had high exposure of facial bone fracture.

The statistical analysis revealed that the risk of hypoesthesia at the orbital and mandible region is significantly higher than the other facial regions. The analysis of the clinical complications experienced by the respondents, which might put them at risk of hypoesthesia revealed that dental surgeries and the toxicity of local anaesthetic agents are significant risk factors contributing to hypoesthesia. Moreover, the surgical procedure carried out for the removal of a tumour and repairing of the mandibular fracture results in significant damages to the mandibular nerve. The nerve manipulation and damage result in nerve elongation, nerve compression or crushing, and the effects of nerve damage is transient hypoesthesia, which might also lead towards neuropathic pain and several other clinical complications.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL CONSIDERATIONS

This research was conducted after acquiring ethical approval from the Institutional Review Board.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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