Knowledge, Awareness, Perception and Attitude Regarding Anti-USAG-1 Gene Therapy for Tooth Regeneration

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ABSTRACT

Background: Tooth loss remains a major global oral health issue affecting function, aesthetics, and quality of life. Current tooth replacement options, such as implants and dentures, have limitations related to biological integration and cost. Recent advances in regenerative dentistry have identified the anti- USAG-1 (Uterine Sensitization-Associated Gene-1) gene therapy as a promising approach to stimulate natural tooth regeneration. Understanding dental students' knowledge, awareness, perception, and attitude toward this emerging field is essential for integrating regenerative technologies into future clinical practice.

Objective: To assess the knowledge, awareness, perception, and attitude regarding anti-USAG-1 gene therapy for tooth regeneration among undergraduate dental students.

Methods: A cross-sectional questionnaire-based study was conducted among undergraduate dental students. The survey evaluated four domains: knowledge of anti-USAG-1 gene therapy, awareness of its applications in tooth regeneration, perception of its benefits and ethical implications, and attitude toward incorporating gene-based therapies in dentistry.

Results: Most participants demonstrated limited knowledge and awareness of anti-USAG-1 gene therapy, reflecting the novelty of the topic. However, the majority showed a positive attitude and interest in learning about gene therapy as a future treatment modality. Students perceived gene therapy as a potential revolution in regenerative dentistry, though they expressed concerns about cost, ethical considerations, and lack of clinical exposure.

Conclusion: Undergraduate dental students exhibited low knowledge but positive attitudes toward anti-USAG-1 gene therapy for tooth regeneration. Strengthening genetic and molecular biology components within the dental curriculum and conducting workshops or seminars on regenerative biotechnology can enhance preparedness for future clinical integration.

Keywords: Awareness, Anti-USAG-1 gene therapy, Dental Students, Gene Therapy, Knowledge, Tooth Regeneration, Regenerative Dentistry, Perception, Attitude.

Introduction

Tooth loss due to caries, trauma, or periodontal disease remains a significant challenge in oral rehabilitation. Despite advances in prosthodontics and implant dentistry, biological tooth regeneration represents the ultimate goal of restorative sciences. Recent molecular studies have identified the USAG-1 gene as a key regulator inhibiting tooth development. Inactivation or suppression of USAG-1 through gene therapy has shown the potential to induce the growth of new teeth in animal models.

Anti-USAG-1 gene therapy aims to neutralise the inhibitory effects of the USAG-1 protein, thus promoting the activation of bone morphogenetic proteins (BMP) and Wnt signalling pathways crucial for odontogenesis. This innovation could revolutionize dentistry by offering a biological alternative to artificial tooth replacement.

However, successful translation of this therapy from research to clinical application requires not only technological advancement but also adequate awareness and understanding among future dental professionals. Assessing the knowledge, awareness, perception, and attitude (KAPA) of dental students toward anti-USAG-1 gene therapy is essential to identify educational gaps and prepare them for integrating regenerative techniques into practice.

Methodology
Aim

To assess the knowledge, awareness, perception, and attitude regarding anti-USAG-1 gene therapy for tooth regeneration among undergraduate dental students.

Objectives

1. To evaluate the level of knowledge and awareness among dental students regarding anti-USAG-1 gene therapy.
2. To assess students' perception of its effectiveness, safety, and ethical implications.

3. To analyse the overall attitude of students toward the adoption of gene-based regenerative therapies in dentistry.

Study Design and Area

A cross-sectional study was conducted among undergraduate dental students of Mamata Dental College, Khammam, Telangana.

Study Population

The study included 236 undergraduate students from all years of the Bachelor of Dental Surgery (BDS) program.

Study Instrument

A pretested, structured questionnaire was used to collect data. It contained sections on demographic details and 15 questions across four domains: knowledge, awareness, perception, and attitude toward anti-USAG-1 gene therapy.

Sampling Method

Convenience sampling was used.

Inclusion Criteria

Students present on the day of data collection and willing to participate.

Exclusion Criteria

Students who were absent or unwilling to provide consent.
Organising the study: The study was designed in a paper based version of the self-administered questionnaire of 19 questions focusing on knowledge and awareness includes the sections of demographic data.

Result

A Total of 236 students in this study with females 42.8%, males 57.2% AGE of participants ranging from 19 to 26 years in this study males were more likely to demonstrate perception.
Significantly 2nd bds showed greater familiarity with advanced applications than 1st, 3rd and 4th year and intern students.

AGE					
	N	MINIMUM	MAXIMUM	MEAN	STD. DEVIATIONS
Age:	236	19	26	22.57	1.531

Gender		Frequency	Percent
Valid	MALE	135	57.2
	FEMALE	101	42.8
	Total	236	100.0

		Frequency	Percent
Valid	I BDS	51	21.6
	II BDS	67	28.4
	III BDS	45	19.1
	IV BDS	48	20.3
	INTERN	25	10.6
	Total	236	100.0

Distribution and comparison of responses based on gender

Item	Response	Males		Females		Chi-Square value	P value
		n	%	n	%		
Q1	1	0	0	0	0	7.326	0.001*
	2	0	0	0	0		
	3	135	100	101	100		
	4	0	0	0	0		
Q2	1	0	0	0	0	7.326	**0.001***
	2	135	100	101	100		
	3	0	0	0	0		
	4	0	0	0	0		
Q3	1	19	47.5	21	52.5	6.481	0.090
	2	33	48.5	35	51.5		

	3	53	63.9	30	36.1		
	4	29	65.9	15	34.1		
Q4	1	16	42.1	22	57.9	19.818	**0.0001***
	2	15	40.5	22	59.5		
	3	34	50.7	33	49.3		
	4	69	74.2	24	25.8		
Q5	1	16	45.7	19	54.3		
	2	29	46	34	54	10.620	**0.014***
	3	66	62.9	39	37.1		
	4	24	75	8	25		
Q6	1	29	53.7	25	46.3	5.049	0.168
	2	30	47.6	33	52.4		
	3	55	62.5	33	37.5		
	4	21	67.7	10	32.3		
Q7	1	28	57.1	21	42.9	9.489	**0.023***
	2	45	54.9	37	45.1		
	3	37	50	37	50		
	4	24	82.8	5	17.2		
Q8	1	25	50	25	50	10.167	0.017*
	2	35	60.3	23	39.7		
	3	37	48.1	40	51.9		
	4	38	74.5	13	25.5		
Q9	1	34	53.1	30	46.9	1.211	0.750
	2	40	60.6	26	39.4		
	3	41	55.4	33	44.6		
	4	20	62.5	12	37.5		
Q10	1	24	52.2	22	47.8	8.275	0.041*
	2	29	60.4	19	39.6		
	3	35	46.7	40	53.3		
	4	46	69.7	20	30.3		
Q11	1	36	57.1	27	42.9	5.928	0.115

Item	Response	n	%	n	%	Chi-Value	P-Value
	2	29	59.2	20	40.8		
	3	36	48.6	38	51.4		
	4	34	70.8	14	29.2		
Q12	1	20	43.5	26	56.5	6.303	0.98
	2	32	59.3	22	40.7		
	3	61	64.9	33	35.1		
	4	22	52.4	20	47.6		
Q13	1	31	49.2	32	50.8	2.483	0.478
	2	30	62.5	18	37.5		
	3	54	60	36	40		
	4	20	57.1	15	42.9		
Q14	1	21	46.7	24	53.3	3.258	0.350
	2	42	63.6	24	36.4		
	3	53	58.2	38	41.8		
	4	18	54.5	15	45.5		
Q15	1	30	55.6	24	44.4	5.229	0.156
	2	41	50	41	50		
	3	42	68.9	19	31.1		
	4	21	55.3	17	44.7		

P≤0.05 is statistically significant

Distribution and comparison of responses based on year of the study

Item	Response	I BDS		II BDS		III BDS		IV BDS		INTERN		Chi-Value	P-Value
		n	%	n	%	n	%	n	%	n	%		
Q1	1	0	0	0	0	0	0	0	0	0	0	16.114	0.001*
	2	0	0	0	0	0	0	0	0	0	0		
	3	51	100	67	100	45	100	48	100	25	100		
	4	0	0	0	0	0	0	0	0	0	0		
Q2	1	0	0	0	0	0	0	0	0	0	0	16.114	0.001*
	2	51	100	67	100	45	100	48	100	25	100		
	3	0	0	0	0	0	0	0	0	0	0		
	4	0	0	0	0	0	0	0	0	0	0		

Q	Opt	n	%	n	%	n	%	n	%	n	%	χ²	p
Q3	1	12	30	10	25	6	15	6	15	6	15	11.192	0.513
	2	7	25	18	26.5	14	20.6	16	23.5	3	4.4		
	3	14	16.9	28	33.7	18	21.7	14	16.9	9	10.8		
	4	8	18.2	11	25	7	15.9	11	25	7	15.9		
Q4	1	11	28.9	11	28.9	6	15.8	6	15.8	4	10.5	17.051	149
	2	11	29.7	8	21.6	6	16.2	11	29.7	1	2.7		
	3	14	20.9	22	32.8	15	22.4	13	19.4	3	4.5		
	4	15	16.1	25	26.9	18	19.4	18	19.4	17	18.3		
Q5	1	12	34.3	8	22.9	5	14.3	5	14.3	5	14.3	18.317	0.106
	2	11	17.5	17	27	15	23.8	17	27	3	4.8		
	3	19	18.1	37	35.2	16	15.2	22	21	11	10.5		
	4	9	28.1	5	15.6	8	25	4	12.5	6	18.8		
Q6	1	17	31.5	12	22.2	9	16.7	8	14.8	8	14.8	42.592	**0.0001***
	2	14	22.2	17	27	15	23.8	16	25.4	1	1.6		
	3	19	21.6	33	37.5	7	8	20	22.7	9	10.2		
	4	1	3.2	5	16.1	14	45.2	4	12.9	7	22.6		
Q7	1	11	22.4	15	30.6	3	6.1	9	18.4	11	22.4	19.802	0.071
	2	19	23.2	22	26.8	16	19.5	18	22	7	8.5		
	3	18	24.3	19	25.7	20	27	14	18.9	3	4.1		
	4	3	10.3	10	34.5	6	20.7	6	20.7	4	13.8		
Q8	1	12	24	14	28	6	12	9	18	9	18	15.579	0.211
	2	10	17.2	15	25.9	11	19	13	22.4	9	15.5		
	3	21	27.3	25	32.5	13	16.9	15	19.5	3	3.9		
	4	8	15.7	13	25.5	15	29.4	11	21.6	4	7.8		
Q9	1	17	26.6	20	31.2	8	12.5	6	9.4	13	20.3	22.714	0.030*
	2	13	19.7	21	31.8	11	16.7	15	22.7	6	9.1		
	3	17	23	18	24.3	15	20.3	20	27	4	5.4		
	4	4	12.5	8	25	11	34.4	7	21.9	2	6.2		
Q10	1	13	28.3	13	28.3	5	10.9	5	10.9	10	21.7	19.322	0.081
	2	11	22.9	12	25	10	20.8	12	25	3	6.2		
	3	14	18.7	25	33.3	17	22.7	17	22.7	2	2.7		

	4	13	19.7	17	25.8	13	19.7	13	19.7	10	15.2		
Q11	1	18	28.6	11	17.5	8	12.7	11	17.5	15	23.8	25.349	0.013*
	2	11	22.4	16	32.7	8	16.3	11	22.4	3	6.1		
	3	13	17.6	24	32.4	17	23	18	24.3	2	2.7		
	4	9	18.8	14	29.2	12	25	8	16.7	5	10.4		
Q12	1	12	26.1	13	28.3	6	13	5	10.9	10	21.7	29.118	0.04*
	2	11	20.4	22	40.7	10	8.5	7	13	4	7.4		
	3	18	19.1	23	24.5	17	18.1	31	33	5	5.3		
	4	10	23.8	9	21.4	12	28.6	5	11.9	6	14.3		
Q13	1	17	27	16	25.4	6	9.5	13	20.6	11	17.5	14.206	0.288
	2	9	18.8	17	35.4	10	20.8	8	16.7	4	8.3		
	3	20	22.2	23	25.6	18	20	21	23.3	8	8.9		
	4	5	14.3	11	31.4	11	31.4	6	17.1	2	5.7		
Q14	1	12	26.7	17	37.8	6	13.3	4	8.9	6	13.3	24.286	0.019*
	2	11	16.7	16	24.2	7	10.6	21	31.8	11	16.7		
	3	18	19.8	28	30.8	23	25.3	16	17.6	6	6.6		
	4	10	30.3	6	18.2	9	27.3	6	18.2	2	6.1		
Q15	1	13	24.1	20	37	5	9.3	5	9.3	11	20.4	20.340	0.061
	2	17	20.7	18	22	17	20.7	24	29.3	6	7.3		
	3	12	19.7	19	31.1	14	23	12	19.7	4	6.6		
	4	9	23.7	9	23.7	9	23.7	7	18.4	4	10.5		

P≤0.05 is statistically significant

Discussion

This study revealed that while the knowledge and awareness of anti-USAG-1 gene therapy were limited among undergraduate dental students, their perception and attitude were notably positive. This pattern reflects the current global scenario, where regenerative medicine is gaining attention but remains in the early educational stages within dental curricula.

The anti-USAG-1 approach is one of the most exciting developments in regenerative dentistry, as it directly targets the molecular inhibitors of tooth development. Students' enthusiasm toward learning about gene therapy indicates readiness to embrace future advancements once adequate academic exposure is provided.

Similar studies in biomedical and dental fields have shown that early introduction of topics such as stem cell biology, molecular genetics, and regenerative medicine enhances professional competence and innovation-driven learning. Addressing ethical and clinical implications

through seminars and curricular integration will prepare future practitioners for responsible use of gene therapies.

Conclusion

Undergraduate dental students demonstrated low knowledge and awareness but positive attitudes and perceptions regarding anti-USAG-1 gene therapy for tooth regeneration. Integrating genetics and regenerative concepts into dental education, along with practical exposure through research-based learning, will bridge the knowledge gap and promote acceptance of emerging biotechnologies in dentistry.

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