DENTAL CLINICS DATABASE MANAGEMENT SYSTEM

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Dental Clinic Database Management System

Introduction

In a dynamic dental clinic, it is essential to develop an organized database system to manage the daily dental services and focus on providing comprehensive oral health services, starting from routine check-ups to complex treatments, ensuring the clients' satisfaction and optimal health outcomes The involvement with this topic stems from the passion for the healthcare field and the dedication to enhancing operational efficiency within dental practices. With an experience in the Dental Clinic field, an interest was parked to participate in enhancing the management of daily procedures and services, especially with the substituting of physical files system with digital system reducing the clutter in a dental office along with confidentially retrieving of clients' data in a timely manner. That can be implemented through developing an effective database system reflecting a dedication to improving clients' experience along with supporting dental professionals in delivering high-quality care and ensuring confidentiality.

Problem Statement

The need for a database system in a dental clinic arises from the essential need to retrieve multiple documents related to the clients on daily basis, such as lab results, digital imaging, diagnoses, treatment plans, clients' basic information, and insurance and payments. This helps running the dental office smoothly. Not only retrieving documents easily is important, but also this must be achieved completely confidential.

Solution

To support the proposed software application, the following would be developed to enhance efficiency, organization, and patient care:

Clients Management: Ensuring easy access to patient data, and update confirming accuracy

Creating Clients table to store clients' records including clientId, firstName, lastName, phoneNumber, DOB, address, postalCode, city, province**.**

Storing Treatment Plans and History: Ensuring easy retrieving of references during clinical visits and enhancing the continuity of care.

Creating Clients_Treatments table including client's ID, attached medical history document, treatmentDate, prescribed medications, and performed procedures associated with clinic_Id.

Scheduled Appointments: Ensuring easier access to dental appointments which is helpful in sending reminders to the clients. Also, appointments are easily modified, rescheduled, or cancelled.

Creating Appointments table including appointment ID, client's Id, client's name, Dental professional speciality, dental professional ID, scheduled appointment date, appointment time, appointment status.

Records of Payment Process: Ensuring accurate financial procedures, helping the dental practice to run smoothly and reducing administrative errors.

Creating Payment table including client Id, client name, dental professional Id, dental professional name, insurance type, insurance number, payment method, payment status, invoice generated.

Reports and Analysis: Ensuring generating reports as needed to easily analyse patients' cases and contribute to making informed decisions for further procedures.

Creating Reports table including report ID, report title, report type, client's name, generated Date, reportsTo, and description.

Storing Dental Professionals Information: Ensuring accuracy, effective management of multiple dental procedures with different dental specialities.

Creating Dental Professionals table including dental professional Id, dental professional name, speciality, license number, contact email, contact phone number.

Location Management: Ensuring effective booking of special procedures such as dental surgeries, or orthodontics, dental cleaning and hygiene allowing easily access to available rooms and staff.

Creating dental clinics table including clinic_Id, clinic name, address, city, province, and official website.

Requirements:

Generating business reports for the following:

1- Creating a view table of an End-of-Day Report for All Dental Visits and Procedures That Took

Place on August 9.

2- Creating a view table of a list of all patients/clients who are scheduled for dental procedures next week .

from Aug 12 to Aug 18

3- Creating a view table of to summarize all confirmed payment transactions

occurred in August at Healthy Teeth Clinic?

4- Creating a view table of a report summarizing dental clinics located in Toronto. Show

clinic name, Address, postalcode, city, province, phonenumber,website,

dental professionalName, speciality, and licencenumber

Data Normalization

Step 1: Create UNF
- Choosing Table Name
- Listing all data might be needed
- Choose primary key (bolded, underlined)
- Determine repeating groups, surrounded between brackets

UNF:
CLIENTS[**CK PK clientId**, clientName, clientDOB,
 (appointmentDate, appointmentLocation, appointmentReason, appointmentTime), (treatmentName, treatmentCost, prescribedMedication, performedProcedures), (professionalName, licenseNum, languagesSpoken, workingHours, dentalProfessional, dentalSpeciality), (reportTitle, reportType, reportDate, reportsTo, reportDescription, fileFormat), (dentalClinicName, address, city, province),(dentalInsuranceType, insuranceNumber, paymentMethod, paymentStatus)]

Step2: Create 1NF

- Separate repeating groups(multi_valued dependencies) in separate tables
- Choose suitable names for tables
- Choose primary keys, foreign keys

1NF:
CLIENTS[**PK clientId**, firstName, lastName, DOB, insuranceNumber, address, postalCode, city, province]

APPOINTMENTS[**PK appointmentId**, FK clientId, date, time, reason, FK professionalId, FK clinic_Id]

TREATMENTS[**PK treatmentId**, treatmentName, cost, FK clientId, prescribedMedication, treatmentDate, performedProcedure]

DENTALPROFESSIONALS[**PK professional_Id**, firstName, lastName, licesnceNumber, speciality, workingHours, languageSpoken]

REPORTS[**PK reportId**, title, type, issueDate, FK reportFrom, FK reportsTo, client_Id, fileFormat, description]

DENTALCLINIC[**PK clinicId**, name, address, city, province, licenseNumber]

PAYMENTS[**PK paymentId**, FK paidBy, paymentMethod, processedBy, amount, date] //paidBy "clientId"

DENTAL_CLINIC_PROFESSIONALS[**PK uniqueId**, FK clinicId, FK professionalId]
_____-

Step 3: Create 2NF
- ✓ Eliminate partial dependencies
    - ○ Ensure that each table's non-key attributes are fully dependent on the primary key only.

TREATMENTS[**PK treatmentId**, treatmentName, cost, FK clientId, prescribedMedication, treatmentDate, performedProcedure]

This table has partial dependencies. It has composite key(treatmentId and clientId), all non-key attributes depend on part of each key. For example, treatmentDate is associated with the clientId and the treatmentId not on the primary key fully. TreatmentName is associated with the treatmentId that was provided to specific client (clientId).

Solution:
Removed the clientId and other dependent attributes and created CLIENTS_TREATMENTS table that has primaryKey, where all non-key attributes are fully dependent on the primary key only.

TREATMENTS[**PK treatmentId**, treatmentName, cost]

CLIENTS_TREATMENTS[**PK clientTreatmentId**, FK clientId, FK treatmentId, prescribedMedication, treatmentDate, performedProcedure]

2NF:
1. CLIENTS[**PK clientId**, firstName, lastName, DOB, insuranceNumber, address, postalCode, city, province]

2. APPOINTMENTS[**PK appointmentId**, FK clientId, date, time, reason, FK client_Id, FK professional_Id, FK clinic_Id]

3. TREATMENTS[**PK treatmentId**, treatmentName, treatmentCode, cost]

4. DENTALPROFESSIONALS[**PK professional_Id**, firstName, lastName, emailAddress, phoneNumber, licesnceNumber, speciality]

5. REPORTS[**PK reportId**, title, type, issueDate, FK fk_reportFrom, FK fk_reportsTo, client_Id, description]
   **reportTo a dental professional (professional_Id), reportFrom a dental professional (professional_Id)

6. DENTALCLINICS[**PK clinicId**, name, address, phoneNumber, website]

7. PAYMENTS[**PK paymentId**, paymentMethod, amount, date, FK client_Id, processedBy]

8. DENTAL_CLINIC_PROFESSIONALS[**PK dental_Id**, FK clinicId, FK professionalId]

9. CLIENTS_TREATMENTS[**PK clientRxId**, FK clientId, FK treatmentId, treatmentDate, performedProcedure, prescribedMedications]

Step 4: Relationships and cardinalities Between:

CLIENTS and DENTAL_PROFESSIONALS: many to many
- Every patient can have multiple appointments with different professionals and every professional can see multiple patients.
    o Linking table: APPOINTMENTS table.

CLIENTS and TREATMENTS: many to many
- Each client can receive multiple treatments, and each treatment can be provided to multiple clients.
    o Linking table: PAYMENTS
    o Linking table: CLIENTS_TREATMENTS table

CLIENTS and REPORTS: one-to-many
- Each client can have multiple reports, but each report is issued to one addressing one client.

DENTAL_CLINICS and CLIENTS_TREATMENTS: one-to-many
- Each dental clinic is associated with multiple client treatments occur in, and each dental treatment is associated with one dental clinic

DENTAL_PROFESSIONALS and REPORTS: one-to-many
- Each dental professional can issue many reports, but each report is issued by one dental professional

CLIENTS and DENTAL_CLINICS: many-to-many
- A client can have appointment at multiple dental clinics (for example needs multiple speicalities in various clinics).
- A dental clinic is visited by multiple clients
    o Linking table: APPOINTMENTS

DENTAL_CLINICS and DENTAL_PROFESSIONALS: many_to_many
- Each dental professional can work for more than one clinic, and each clinic can have multiple dental Professional.
    o Linking table: DENTAL_CLINIC_PROFESSIONALS

Entity Relationship Diagram_ERD
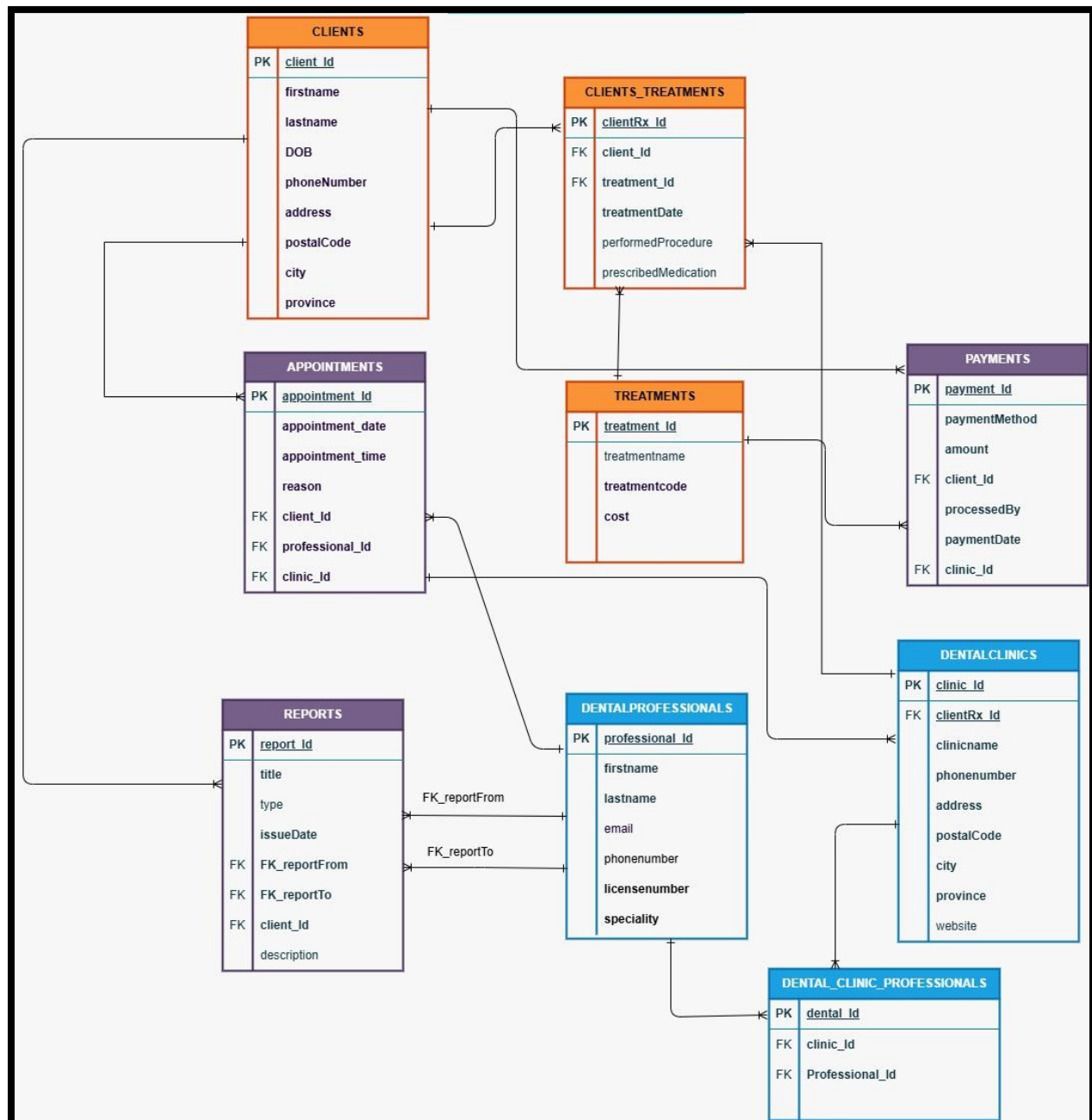
Data Dictionary

TABLE: Clients
CLIENTS[PK_clientId, firstName, lastName, phoneNumber, DOB, address, postalCode, city, province]

Column	Data Type	Size Precision	Default	PK/FK	Required	Range	Sample Data	Notes
client_Id	NUMBER	4		PK	✓	1-9999	1001	
firstname	String	30			✓		"John"	
lastname	String	30			✓		"Mark"	
DOB	Date				✓		30/07/2010	Date of Birth (YYYY/MM/DD)
phoneNumber	String	15			✓		647-777-888	Assuming North American phone number
address	String	50			✓		"90 Link Road"	
postalCode	String	7			✓		'M2J 4E3'	
City	String	50			✓		North York	
province	String	2			✓		ON	Consider all data in canada

TABLE: Appointments
APPOINTMENTS[PK appointment_Id, FK client_Id, date, time, reason, FK professional_Id, FK clinic_Id]

Column	Data Type	Size, Precision	Default	PK/FK	Required	Range/validation	Sample Data	Notes
appointment_Id	NUMBER	6		PK	✓	1-999999	200123	
Appointment_date	DATE				✓		'2024-08-07'	Date
Appointment_time	VARCHAR2	5			✓		'02:30'	Time HH24:MIN
reason	String	100			✓		"Consultation"	
client_Id	NUMBER	4		FK (CLIENTS)	✓	1-9999	1004	
professional_Id	NUMBER	4		FK (DentalProfessionals)	✓	1-9999	4009	
Clinic_Id	NUMBER	3		PK	✓	1-999	601	

TABLE: TREAMTENTS
TREATMENTS[PK treatmentId, treatmentName, treatmentCode, cost]

Column	Data Type	Size, Precision	Default	PK/FK	Required	Range/validation	Sample Data	Notes
Treatment_Id	NUMBER	4		PK	✓	1-9999	3004	
treatmentName	String	100					"Root canal"	
treatmentCode	varchar	10			✓	Unique	"D0120"	
cost	NUMBER	9,2	0.00		✓	1.00-10000	234.56	Monetary Value

TABLE: DentalProfessionals
DENTALPROFESSIONALS[PK professional_Id, firstName, lastName, emailAddress, phoneNumber, licenceNumber, speciality]

Column	Data Type	Size, Precision	Default	PK/FK	Required	Range/validation	Sample	Notes
Professional_Id	NUMBER	4		PK	✓	1-9999	4321	
firstName	String	30			✓			
lastName	String	30			✓			
email	String	100	Null					
phoneNumber	String	15	Null					
licenceNumber	Varchar	10			✓	Unique	"D1234567"	
Speciality	String	50			✓		"Family Dentist"	

TABLE: REPORTS
REPORTS[**PK reportId**, title, type, issueDate, FK reportFrom, FK reportsTo, FK client_Id, description]

Column	Data Type	Size,Precision	Default	PK/FK	Required	Range/Validation	Sample	Notes
report_Id	NUMBER	4		PK	✓	1-9999	5003	
title	String	100			✓		"Treatment Plan"	
type	String	100	Null				"Clinical Report"	
issueDate	Date				✓			
FK_reportFrom	NUMBER	4		FK (dentalProfessionals)	✓	1-9999	4003	
FK_reportTo	NUMBER	4		FK (dentalProfessionals)	✓	1-9999	4005	
Client_Id	NUMBER	4		FK (clients)	✓	1-9999	1006	
description	String	100	Null					

TABLE: DentalClinics
DENTALCLINICS[**PK clinic_Id**,clinicName, phoneNumber, address, postalCode, city, province, website, FK clientRx_Id]

Column	Data Type	size	Default	PK/FK	Required	Range/Validation	Sample Data	Notes
Clinic_Id	NUMBER	3		PK	✓	1-999	602	
clinicName	String	50			✓		"North York Dental Clinic"	Clinic name
address	String	100			✓			
postalCode	String	7			✓		"90 Link Road"	
City	string	50			✓			
province	string	2			✓		'654-387-3445'	
phoneNumber	String	15			✓			

website	String	50	Null					
clientRx_Id	NUMBER	4		FK (clients_treatments)	✓	1-9999	9001	

TABLE: Payments

PAYMENTS[PK paymentId, paymentMethod, amount, FK client_Id, processedBy, paymentDate]

Column	Type	Size	Default	PK/FK	Required	Rang/ Validation	Sampel Data	Notes
Payment_Id	NUMBER	4		PK	✓	1-9999	7001	
paymentMethod	String	30			✓		"Debit"	
amount	NUMBER	9,2	0.00		✓			
client_Id	NUMBER	4		FK (CLIENTS, client_Id)	✓	1-9999	1005	
processedBy	String	50			✓		"John Mark"	
paymentDate	Date				✓			

TABLE: DentalClinicProfessionals

DENTAL_CLINIC_PROFESSIONALS[PK dental_Id, FK clinicId, FK professionalId]

Column	Type	Size	Default	PK/FK	Required	Range/ Validation	Sample Data	Notes
Dental_Id	Varchar	10		PK	✓	DC000-DC999	DC001	
Clinic_Id	NUMBER	3		FK (DENTAL CLINICS)	✓	1-999	602	
Professional_Id	NUMBER	4		FK (DENTAL PROFESSIONALS)		1-9999	4001	

TABLE: ClientsTreatments

CLIENTS_TREATMENTS[PK clientRxId, FK clientId, FK treatmentId , treatmentDate, performedProcedure, prescribedMedication]

Column	Type	Size	Default	PK/FK	Required	Range/ Validation	Sample Data	Notes
clientRx_Id	NUMBER	4		pk	✓	1-9999	9001	Unique record
client_Id	NUMBER	4		FK (CLIENTS)	✓	1-9999	1234	
Treatment_Id	NUMBER	4		FK (TREATMENTS)	✓	1-9999	3004	
date	Date				✓			Date of Treatment
performedProcedure	String	100	Null					
prescribedMedications	String	100	Null					

Business Reports

1- Generate End-of-Day Report for All Dental Visits and Procedures That Took
Place on August 8th.

Purpose: This report summarizes all dental visits and procedures that occurred
on August 8th. It is important for end-of-day reconciliation and
for providing oversight of the day's clinic activities. It also helps assessing the productivity of the dental
staff.

	APPOINTMENT_ID	CLIENT_ID	PROFESSIONAL_ID	REASON	CLIENTRX_ID	TREATMENTDATE	PERFORMEDPROCEDURE
1	20005	1005	4002	Dental crown	9005	08/AUG/24	Dental crown
2	20006	1006	4003	Teeth whitening	9006	08/AUG/24	Braces installation
3	20007	1007	4001	Braces fitting	9007	08/AUG/24	Teeth whitening
4	20013	1013	4001	Fillings	9013	08/AUG/24	Sedation
5	20014	1014	4002	Check-up	9014	08/AUG/24	X-rays

2-List all clients who are scheduled for dental procedures next week .
from Aug 12 to Aug 18 providing, all appointment details, clinic_Id, clinicName, address details, and
clients' name.
Purpose:
Summarizing information about the next week procedures, which has benefits in many aspects such as:
- follow-up scheduling and ensure sending reminders to clients which contributes in patient care.
- Ensuring quality control in assessing the quality of care provided and identifies any process need
  to be addressed.
- Managing the clinic resources such as preparing and sterilizing dental instruments needed for
  specific procedure, and tracking dental supplies stock.
- Assisting in planning staffing speciality needed based on the dental procedure and location.

	APPOINTMENT_ID	APPOINTMENT_DATE	APPOINTMENT_TIME	REASON	CLIENT_ID	PROFESSIONAL_ID	CLINIC_ID	CLINICNAME	ADDRESS	POSTALCODE	PROVINCE	CLIENTNAME
1	20004	18/AUG/24	08:30	Root canal	1004	4001	601	Sunny Smiles Dental Clinic	1010 Dental Street	M5A 1B1	ON	Michael Williams
2	20001	15/AUG/24	09:00	Routine check-up	1001	4001	601	Sunny Smiles Dental Clinic	1010 Dental Street	M5A 1B1	ON	John Doe
3	20002	16/AUG/24	10:30	Tooth extraction	1002	4002	602	Bright Future Dental	2020 Health Avenue	V6B 3B3	BC	Jane Smith
4	20003	17/AUG/24	14:00	Cavity filling	1003	4003	603	Montreal Dental Care	3030 Smile Road	H3A 1A1	QC	Emily Johnson

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3- Create a view to summarize all confirmed payment transactions
occurred in August at Healthy Teeth Clinic?
Purpose:
To summarize information for monthly reconciliation at a specific dental clinic in specific month. Helps
tracking payments performed and addresses any issues may arise. I also assist in tracking revenue
generated by the clinic.

PAYMENT_ID	PAYMENTMETHOD	PAYMENTDATE	AMOUNT	CLIENT_ID	PROCESSEDBY	CLIENTNAME	PERFORMEDPROCEDURE	CLINICNAME
1	7004 Credit Card	01/AUG/24	500	1004 David Black	Michael Williams	Root canal	Healthy Teeth Clinic
2	7005 Cash	01/AUG/24	800	1005 Eva Blue	Olivia Brown	Dental crown	Healthy Teeth Clinic
3	7010 Credit Card	05/AUG/24	1200	1010 Jack Wilson	Aiden Lee	Veneers	Healthy Teeth Clinic
4	7011 Cash	06/AUG/24	1500	1011 Karen Moore	Mia Wilson	Implant	Healthy Teeth Clinic
5	7012 Debit Card	06/AUG/24	3500	1012 Leo Anderson	Daniel Anderson	Invisalign	Healthy Teeth Clinic

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4- Generate a report summarizing dental clinics located in Toronto. Show
clinic name, Address, postalcode, city, province, phonenumber,website,
dental professionalName, speciality, and licencenumber.

Purpose: Retrieving detailed information about dental professionals associated
with dental clinics in Toronto. This report can be used for statistics purposes,
to gather detailed information which is helpful in managing dental professional resources such as
identifying staff shortage and increasing hiring process. It provides detailed information important for
customer service information supporting the community members, such as finding clinics located in
Toronto with specific postal code.

	PROFESSIONAL_ID	CLINICNAME	PHONENUMBER	ADDRESS	POSTALCODE	CITY	PROVINCE	WEBSITE	FULLNAME	SPECIALITY	LICENCENUMBER
1	4014	Smile Bright Clinic	416-555-7890	7070 Dental Avenue	M5A 1D3	Toronto	ON	www.smilebrightclinic.ca	Nate Martinez	Orthodontist	LIC12345
2	4019	Metro Dental Centre	416-555-8901	1010 Oral Avenue	M5A 1E4	Toronto	ON	www.metrodentalcentre.ca	Sam Lewis	Orthodontist	LIC67890
3	4020	Metro Dental Centre	416-555-8901	1010 Oral Avenue	M5A 1E4	Toronto	ON	www.metrodentalcentre.ca	Tina Walker	Prosthodontist	LIC78901
4	4013	Smile Bright Clinic	416-555-7890	7070 Dental Avenue	M5A 1D3	Toronto	ON	www.smilebrightclinic.ca	Mia Thomas	Endodontist	LIC01234
5	4001	Sunny Smiles Dental Clinic	416-555-4567	1010 Dental Street	M5A 1B1	Toronto	ON	www.sunnysmiles.ca	Alice Brown	Periodontist	LIC12350
6	4007	Healthy Teeth Clinic	416-555-6789	4040 Care Lane	M5A 1C2	Toronto	ON	www.healthyteethclinic.ca	Grace Johnson	Oral Surgeon	LIC4578
7	4008	Healthy Teeth Clinic	416-555-6789	4040 Care Lane	M5A 1C2	Toronto	ON	www.healthyteethclinic.ca	Henry Taylor	Endodontist	LIC5679

5- Create view table listing all dental clinics details located in Ontario province. Show clinicName, Address,
postalCode, city, province, website and contact phoneNumber.
Purpose:
Identifying shortage in health care facilities in a specific province which is important to support the
community by planning and executing increasing dental clinics where are needed.

	CLINIC_ID	CLINICNAME	ADDRESS	POSTALCODE	CITY	PROVINCE	WEBSITE	PHONENUMBER
1	601	Sunny Smiles Dental Clinic	1010 Dental Street	M5A 1B1	Toronto	ON	www.sunnysmiles.ca	416-555-4567
2	604	Healthy Teeth Clinic	4040 Care Lane	M5A 1C2	Toronto	ON	www.healthyteethclinic.ca	416-555-6789
3	607	Smile Bright Clinic	7070 Dental Avenue	M5A 1D3	Toronto	ON	www.smilebrightclinic.ca	416-555-7890
4	610	Metro Dental Centre	1010 Oral Avenue	M5A 1E4	Toronto	ON	www.metrodentalcentre.ca	416-555-8901
5	613	Urban Dental Clinic	4040 Health Lane	M5A 1F5	Toronto	ON	www.urbandental.ca	416-555-3456
6	616	Parkview Dental Clinic	7070 Dental Drive	M5A 1G6	Toronto	ON	www.parkviewdental.ca	416-555-5678
7	619	Central Dental Clinic	1010 Oral Street	M5A 1H7	Toronto	ON	www.centraldental.ca	416-555-6789