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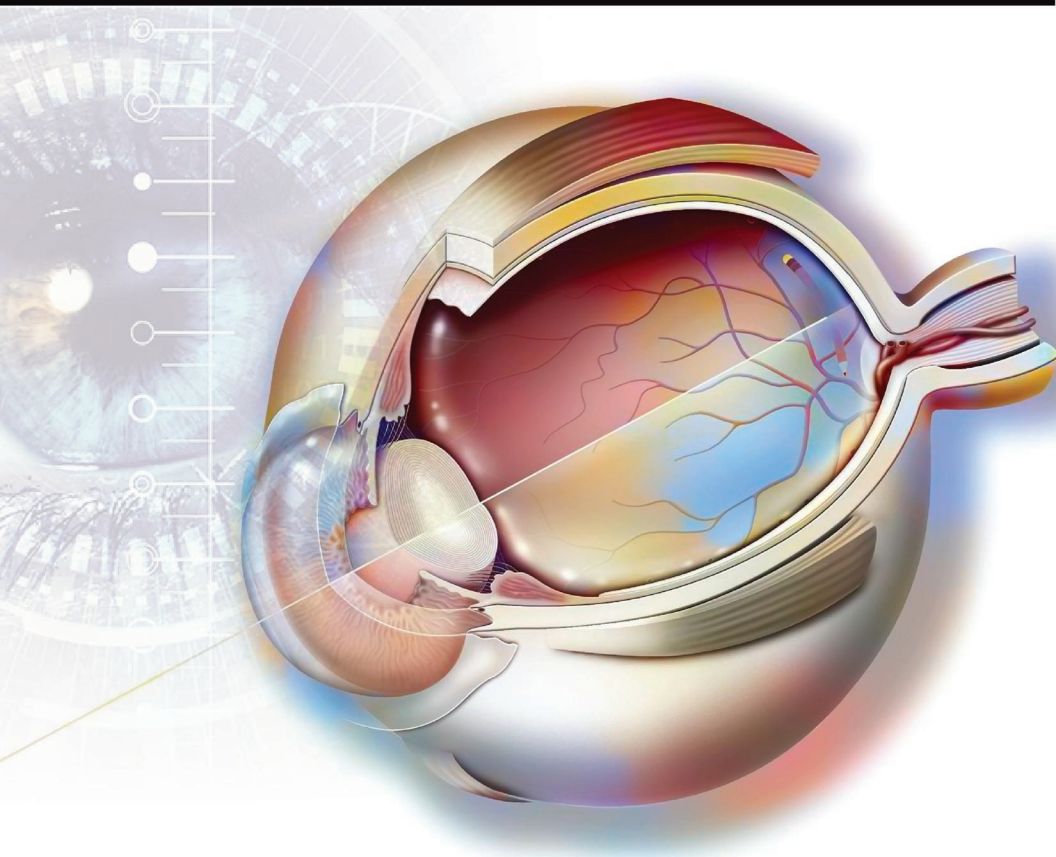

A Manual of Clinical Refraction Guide

3rd Edition

Ajay Kumar Bhootra

JAYPEE

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6 CHAPTER

Fundamentals of Clinical Refraction

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CHAPTER OUTLINE

- Laws of Clinical Refraction
- Goal of Clinical Refraction
- Cardinal Principles of Clinical Refraction
- Clinical Refraction: An Intellectual Procedure
- Methods of Clinical Refraction
- Correction of Refractive Error
- Trial Framing

Clinical refraction refers to a set of clinical procedures applied to measure refractive error or determine the refractive state of the eye and arrive at a clinical decision as to the prescription for corrective lenses. The procedure is the part of the total eye care examination that provides an intimate opportunity for the examiner to know the patient and his visual system—how exactly his visual system is behaving. The methods adopted to measure the refractive error are numerous. The practitioners often have their preferences for specific techniques. The diversity in methods reflects the evolving nature of clinical refraction, allowing for a personalized approach tailored to individual patient needs. It is important to note that what is measured during clinical refraction may not always align precisely with what is ultimately prescribed. This variation underscores the nuanced nature of determining the most suitable corrective lenses for an individual, considering factors beyond just numerical measurements.

Clinical refraction is best approached as a problem-solving procedure. Finding a suitable solution for the problem can be accomplished by following the basic rules of the problem-solving

approach, which includes diagnosing and determining the presence of the problem, evaluating the implications of what has been diagnosed and determined, and finally implementing and following up on the solution. In light of the above, clinical refraction can be defined as an art and science that includes:

- ❖ Assessing the refractive state of the eye and measuring the refractive error
- ❖ Prescribing the appropriate refractive corrections
- ❖ Counseling the patient as to the use of refractive correction

A good refraction requires patience and a good connection with the patient. The lenses that are prescribed must address the patient's problem, and at the end, it is the patient's satisfaction, not the precise prescription for refractive correction, which is of paramount significance.

The examiner must apply his knowledge of optics, ocular structure, their functioning, and techniques of measurement together with a combination of other skills and intellectual processes to examine the eyes and visual system of an individual with the objective of prescribing a suitable correction so that he is able to perform his visual task comfortably. Practice and experience add to the skills of the examiner.

Additionally, the examiner must be congenial and a little talkative to understand the patient in terms of his profession, work, hobbies, and special interests, be able to elicit the visual needs, understand his concern, and thereafter apply his clinical judgmental ability to prescribe the appropriate correction to meet the objective. Finally, an explanation and binocular demonstration of what he prescribes always help to win patient's confidence.

Refraction is done in a clinical setting with the help of a set of trial lenses, a visual acuity test chart, and other equipment. Room illumination and test distance are two critical elements that are specific to the test employed. The patient needs to be relaxed; sitting on a chair throughout the procedure, and the clinician may either stand beside the patient or sit right in front of him, depending on his own comfort.

LAWS OF CLINICAL REFRACTION (TABLE 6.1)

There are innumerable tests and techniques used in the examination of the eye for the determination of the refractive error. These procedures include tests for assessing various visual functions like

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Table 6.1: Laws of clinical refraction.	
	All tests and techniques applied for the purpose of assessment of refractive state of the eye can be categorized in three broad categories for the purpose of understanding their implications.
	All patients that we see in the clinical practice for the purpose of assessment of refractive state of the eye can also be classified in three broad groups for the purpose of driving the objective driven clinical procedure.
	A routine procedure comprising a set of tests and techniques may be devised for an individual practice that may be applied in each case as a part of basic routine procedure.
	Additional tests or techniques may be adopted on case-to-case basis.

visual acuity, tests for accommodative function, detection and refinement of spherical and cylindrical correction, a near vision test, the binocular coordination of the eye, and others as needed. Each function can be examined by a number of tests, and for each test there are specific equipment, tools, and charts that are used. It is not possible to apply all tests to each patient, nor is it possible for a clinician to possess equal competence in all tests. Most clinicians therefore select their own preferred tests and techniques for their day-to-day practice and apply them to their patients. The refractive state of the eye can be determined objectively by a retinoscope or an auto-refractometer, and then it is verified subjectively by trial lenses using a trial frame or phoropter together with Snellen's test charts. Subjective method may be manifest monocular subjective refraction, fogging method of refraction, or other. When the results of the refraction are attained, the measured correction is normally refined using refinement tests.

There are different types of patients that are seen in clinical practice, differing because of age, gender, occupation, and intellectual level. The specific vision requirements of each individual patient may

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vary because of these factors. Moreover, different patients present with different types of symptoms. Blurring of vision is the most common symptom. Blurring may be at distance vision or it may be at near. Blurring may be intermittent, or it may be transient. The ciliary muscle may give up any attempt to focus or go into spasm, and the image may become indistinct. Also, the external muscles may also fail to work together, and the transient diplopia may result or the convergence function may fail, and therefore the letters may seem to run together. Pain is another common symptom. Ocular pain, not related to inflammation, is almost always muscular in origin and is due to fatigue. The reflective symptoms may arise from eye strain and may include headache, mild vertigo, and a host of other manifestations. In most cases, the vision may be affected, which may add to the difficulties.

Several factors affect the refractive correction of the eye. Ocular disease, systemic disease, medications, psychological state, physical health, occupational need—all of these factors must be considered before prescribing the correction. Visual fatigue has a profound effect on the visual system, especially when the visual demand exceeds the visual skills. Therefore, nothing is more detrimental than the routine correction of optical defects by rule-of-thumb methods. Not only is the eye to be treated as an optical system, but it ought to be considered an integral part of the body, sharing with other organs in its constitutional variations.

The above explanation clearly states that vision is affected by multiple factors, and when things go wrong with the visual system, it can have a profound effect on everything that we do. Therefore, the objective of clinical refraction is not to treat the eyes but to treat the patient as a whole. It is important to analyze previous corrections and the current visual status of the visual system and understand the visual needs of the patient before prescribing the new correction, and the decision to change the correction should be considered based upon the patient's lifestyle, profession, working environment, and other related factors. It is prudent to avoid large changes in prescription. In the event that it becomes necessary, it is crucial to conclude with a thorough explanation to the patient. This should include detailed information about the potential for initial difficulties and the expectation of a brief adaptation period.

Occasionally, there are temporary and sudden changes in the refraction due to local or systematic reasons, as has been observed

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in cases of accommodative paralysis, accommodative spasm, uveitis, changes in crystalline lenses, diabetes, and other ocular and systemic conditions. The examiner must adopt a different approach in such cases to address the symptoms resulting from such conditions. The prescription for the lenses should always be regulated by the physician's grasp of the organic condition underlying the symptom.

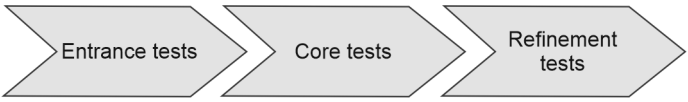
Hence, the prescription of refractive correction necessitates a thoughtful intellectual process that considers various aspects of the patient's life, activities, occupational demands, and individual traits such as personality and intelligence. This holistic approach is crucial in tailoring the refractive correction to align with the patient's specific needs and lifestyle. Building upon this understanding, fundamental laws of clinical refraction can be formulated, as presented in **Table 6.1**. These laws serve as a foundation upon which an effective clinical assessment methodology can be devised for each individual patient. This methodology takes into account not only the numerical measurements of refractive error but also the broader context of the patient's daily life, work commitments, and personal characteristics. The goal is to provide a comprehensive and personalized prescription that optimally addresses the visual requirements and preferences of the specific patient.

All tests and techniques applied for the purpose of assessment of refractive state of the eye can be categorized in three broad categories for the purpose of understanding their implications.

The clinical refraction starts with an extensive history of the individual and ends with an individualized prescription and appropriate management provided to the patient. A quick and efficient refraction involves a number of procedures that, if done in a logical order, really provide the most predictable results. In order to develop one's own strategy, the clinician may categorize all tests into three broad categories, as shown in **Flowchart 6.1**.

Entrance tests are the first procedure performed to initiate the whole process of clinical refraction. They are relatively simple

Flowchart 6.1: Classification of tests used for the purpose of clinical refraction.



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procedures and help assimilate preliminary data and set up the goal of clinical refraction. Core tests are routine procedures that are applied almost in every case for the purpose of refractive error assessment after the completion of entrance tests. They can be viewed as the tests that verify and establish the error detected at the entrance test level. The clinician's practice philosophy and demographic characteristics of patients influence what tests will be included in the core tests. It is, therefore, possible to see the overlapping of different tests between the two categories in different practices. The end point of the whole process aims to refine the results as derived and verified from the aforementioned two sets of test procedures. This seems to be a meaningful categorization as it entails spontaneously strong concentration and attention towards each test.

All patients that we see in the clinical practice for the purpose of assessment of refractive state of the eye can also be classified in three broad groups for the purpose of driving the objective-driven clinical procedure.

The hypothesis is that all the patients who visit the practitioner for the purpose of assessment of refractive error, irrespective of age, gender, and occupation, may be divided into three broad categories, and therefore, specific goals and objectives for each category may be set to achieve out of the whole process of clinical refraction. The objective is to apply the relevant tests, which may be termed minimum tests needed, to achieve the desired objectives. In this age of managed health care, there is no scope to perform all the tests on every patient simply to collect data. It is important that the problem is detected efficiently within minimum possible time, allowing probing each problem with more specific tests. It is important to keep in mind that both patients and practitioners want a positive interaction to ensure the best possible health outcome, as time spent in consultations is valuable for both parties. The author's opinion as to such a classification is given in **Flowchart 6.2**.

This categorization proves advantageous as it allows for a targeted approach in guiding the clinical assessment of the refractive state of the eye within each category, ensuring that the specific objectives for routine examinations, symptomatic cases, and non-adaptation instances are effectively addressed. For example, in the first category, where patients visit the practice for routine examinations, they are usually asymptomatic. The procedure for clinical refraction may be

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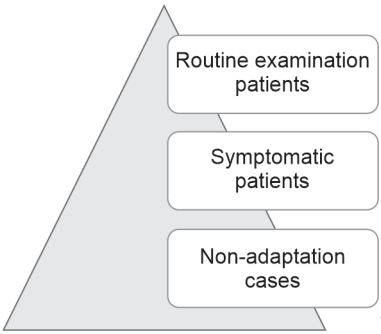
Flowchart 6.2: Categorization of patients.



carried out with a simple routine set of tests to determine the state of the refractive error of the eye and to detect the early symptoms of any abnormality. In the second category, the primary objective is to diagnose the cause of the symptoms. The clinician's primary obligation is to understand the symptoms and apply relevant tests so that he can treat the patient's symptoms. However, for the third category of patients, the clinician must think beyond the paradigm of the routine process and drive all the tests and procedures to alleviate the patient's complaints and restore his lost confidence. The straight-forward understanding is that a set of different mechanics of refraction is warranted in each of these categories to achieve the desired objectives.

A routine procedure comprising of a set of tests and techniques may be devised for an individual practice that may be applied in each case as a part of basic routine procedure.

The assumption here is that there are multiple tests for the assessment of each element of visual skill. A clinician may be more comfortable with one particular test than another. Patients also walk into the clinic with a set of beliefs and expectations affected by their personality, perceptions, and their own knowledge about the test procedures. They may also have had negative experiences and previous disappointments within the healthcare system that may be challenging to overcome and may generate some mistrust. They may feel that the clinician has not applied all the relevant tests before arriving at the conclusion or has not given him sufficient time to hear

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his complaints. Such circumstances can, understandably, make a patient feel anxious, worried, hopeless, and uncertain about their health, which can be displayed as disappointments and negative reactions towards the practitioner. Patients seek professional help because they are in pain or are concerned. The clinician must consider such factors that are not only critical to establishing the practice but also critical for patient satisfaction. Therefore, he must set up his practice model in such a manner that it delivers comprehensive care. All that is needed is to develop a routine set of tests that must be applied to all the patients who visit the practice. Thoroughness is the key, i.e., doing little things as though they were the greatest things in the world. The practitioner must feel the patient's pain, and at the same time, never forget that he is in the professional practice.

Additional tests and techniques may be adopted on case-to-case basis.

There may be situations when the patient needs a problem-specific test that is equally important as the main procedure. When indicated, the clinician should be prepared to take a 'side trip', i.e., he must perform tests that are supplemental to the main tests. When the clinician follows the sequential flow of the procedure, he will be easily able to understand when the additional tests are indicated. Once the additional tests are completed, he should return to his main route and complete the examination. Sometimes, for the sake of efficient delivery of a specific test, the clinician may need to refer the case to an appropriate professional. There should not be any hesitation. The entire practice must be built around three factors: care, concern, and conviction.

GOAL OF CLINICAL REFRACTION

The laws of clinical refraction clearly state that setting up a precise goal for a patient is very critical for the effective application of a refraction procedure. The theoretical goal of the clinical application of a refraction procedure may be to prescribe a pair of lenses that ensure the retina is in conjugate with optical infinity. However, while correcting the refractive error, the practitioner should always remember that the patient will use the correction in real life to navigate through his occupational and visual needs. So, the importance of the real-life objective should be more important than the theoretical objective. In real life, during day-to-day activities, the process of vision

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has to be a subconscious function. The patient's visual satisfaction manifests only when he is able to cope with his occupational needs unconsciously and develops a positive feeling with his correction. If that happens, he continues with it comfortably for a prolonged period of time. Therefore, the true objective must be set for each patient individually before embarking on the procedure for assessing the refractive state of the eye. In general, the true objective of clinical refraction is always to prescribe correction that provides the patient with clear and comfortable vision to which he adapts quickly and also allows him to work for a longer period of time without any symptoms.

The law also states that there are three different categories of patients, and they must be treated to achieve specific objectives, which means goals may also vary accordingly. The objective behind setting up the objectives is to apply the mechanics of refraction that not only aim to enhance the vision but also focus on minimizing the disadvantage, if any. 6/6 or 20/20 is the end point of the procedure, which is usually achieved in most cases but not all.

CARDINAL PRINCIPLE OF CLINICAL REFRACTION

At the most fundamental the principle of clinical refraction states that the clinician should always keep in mind during clinical refraction that he should follow the principle of keeping the sleeping dog lie, i.e., he should avoid interfering with the lens prescription that is currently causing no difficulties but may cause difficulties if altered for no reason. This makes clinical refraction an art, a skill, and a science. It should also be understood that vision is a complex phenomenon. Achieving single, clear, and comfortable binocular vision is a task that is too demanding. Although the new sophisticated, technologically driven equipment have changed the way the refraction was done before and is done now, they could not yet replace clinical judgment of the clinician which is intellectually driven process.

Clinical judgment plays a critical role in clinical refraction, as it involves the clinician's subjective assessment and interpretation of the patient's visual needs, visual environment, responses and habitual correction. Clinical judgment also allows the clinician to tailor the refraction process to each patient's individual needs and provide the best possible visual correction. The cardinal principles of clinical refraction involve a series of steps that the clinician follows to determine a patient's refractive error and prescribe the

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appropriate corrective lenses. The following explanation sets out the key principles:

Principle 1: Pretest the Patient

Before beginning the measurement of refractive error, it is important to assess the patient's visual acuity, eye health, and current refractive status; take a complete case history; measure the patient's habitual glasses or contact lens prescription; and measure uncorrected visual acuity. This is important to gather initial data and rule out any ocular pathology before getting into process clinical refraction. It is also important that the clinician makes full attempt to build rapport with the patient during initial stage of interaction.

Principle 2: Proceed with a Purpose

Use a systematic and methodical approach to measure the refractive error. Every action and decision must be in line with the goal of clinical refraction. Avoid changing more trial lenses. A lengthy procedure creates boredom and fatigue, which can result in poor subjective responses. Do not offer more choices than are necessary to establish the endpoint. Remember that the differentiating gets harder as we get closer to the end point.

Principle 3: Measure Refractive Error Using Appropriate Tests

Use the appropriate tools, equipment and techniques to obtain accurate and reliable measurements. This includes using trial frame or a phoropter, with appropriate testing charts in appropriate environment for the respective test including test distance and room illumination.

Principle 4: Verify and Confirm What is Measured

Use a systematic and methodical approach to measure the refractive error of the patient and keep verifying the results at every stage. For example, the results of the objective refraction must be verified subjectively, and the results of the subjective refraction must be refined before prescribing using both techniques of refinement: monocular and binocular.

Principle 5: Prescribe to Treat Symptoms

Measuring refractive error and prescribing refractive correction are best approached as problem-solving procedures. It is, therefore, not

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necessary that what is measured is prescribed always. All decisions taken to prescribe refractive correction and counsel patient should be taken and executed in light of treating the patient's symptoms. If needed, for the sake of efficient management of specific symptoms, the clinician may need to refer the patient to an appropriate professional. Not only is the eye treated as an optical instrument, but it should always be considered as an integral part of the body, sharing with other organs in its constitutional variations and in the effects of the ills with which it may be afflicted.

Principle 6: Be Proactive as well as Reactive

As an optometrist, it is important to be both proactive and reactive in order to provide the best care to the patients. As a part of a proactive approach, he should educate patients on the importance of eye health, regular eye checkups, advice on the right solution, and the importance of preventive treatment. Being reactive means responding to patients' needs when they are experiencing eye problems or conditions.

This can include diagnosing and treating eye conditions as well as prescribing glasses or contact lenses to correct vision problems. By combining both proactive and reactive approaches seamlessly, the optometrist can help their patients maintain good eye health throughout their lives, and also provide effective treatments and support when issues do arise.

Principle 7: Avoid Making Large Changes

Making larger changes in the refractive correction may lead to non-adaptation and may also cause discomfort and even confusion in the patient. It is, therefore, prudent to follow a logical guideline for making changes in the spherical, cylindrical, and cylinder axes. Changes in near addition must be based on considering the changes made in distance correction so that the resultant change is within acceptable limits.

Principle 8: Be Empathetic to the Patient

Empathy involves understanding and sharing the patient's feelings, thoughts, and experiences, and being sensitive to their needs and concerns. During a clinical refraction, the patient may feel anxious or uncertain about the process or their visual health. It is important to create a safe and welcoming environment and to listen carefully to

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the patient's concerns. Communicate clearly and effectively with the patient throughout the refraction process. Keep explaining each step and the rationale behind it. It is important to note that the clinician should also take into account the patient's comfort level and any signs of eye fatigue or strain during the refraction. This will help to build trust and confidence in the patient and ensure that they are satisfied with their final prescription.

Principle 9: Allow Time for the Patient to Respond

Rushing to complete the procedure is never advisable. When changing a trial lens, it is important to wait for the patient to adjust to the new lens and give feedback on how the lens is affecting their vision. The patient may take some time. The process of changing a trial lens should be swift and deliberate, with ample time given to the patient to observe and evaluate the effect of the new lens. The clinician should also inform the patients when they have responded incorrectly on the Snellen's Visual Acuity Test chart in the most supportive and encouraging manner. By doing so, the clinician can help the patient understand the importance of providing accurate responses.

Principle 10: Record Everything that you Measure and Prescribe

Document all measurements and prescriptions accurately and legibly in a standard manner and include any relevant notes or observations. This will ensure that the information is available for future reference and can be used to monitor changes in the patient's visual status over time.

Principle 11: Counsel and Follow-up with the Patient

While prescribing the appropriate correction, the optometrist must counsel the patient to explain the prescription and the appropriate solution. Also, advise them on a follow-up program to ensure that the lenses are providing the intended visual correction. If necessary, make adjustments to the prescription or recommend further testing to address any unresolved visual issues.

The end point of clinical refraction is the clinical judgment of the clinician. It is important to keep in mind that the endpoint of clinical refraction is subjective and can vary between patients. It is essential to work with the patient to ensure that the final prescription provides

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