SUTARTIS Nr. 14-21-0094

Klaipėda, **2021 m.** 12 **mėn.** 13 **d.**

1. Sutarties esmė

VšĮ Klaipėdos universitetinė ligoninė atstovaujama vyriausiojo gydytojo V. Janušonio (toliau vadinama "Pirkėju") ir UAB „Graina" atstovaujama direktoriaus komercijai A. Daragano, veikiančio pagal 2021-01-04 d. įgaliojimą Nr. 21-3-2 (toliau vadinama "Pardavėju") sudarėme šią sutartį.

"Pardavėjas" įsipareigoja sutartyje numatytomis sąlygomis, pristatyti atvirame tarptautiniame konkurse (569424) laimėtą plyšinę lempą SL 115 Classic, Carl Zeiss Meditec, Vokietija, kurios vnt. kaina yra 5.575,68 Eur (penki tūkstančiai penki šimtai septyniasdešimt penki eurai 68 cnt.) ir pateikti "Pirkėjui" pagal šią specifikaciją:

Plyšinė lempa SL 115 Classic, Carl Zeiss Meditec, Vokietija

Eil. Nr.	Parametras	Parametro reikšmė	Siūlomo parametro atitikimas, konkreti parametro reikšmė ir atitikimo patvirtinimas (psl. pasiūlyme, puslapyje pabraukiant kiekvienos pozicijos kiekvieną atitikimą, nurodant pozicijos numerį pagal prašomas specifikacijas)
1	Reikalavimai įrangos konstrukcijai	Stacionarus prietaisas, susidedantis iš Galilėjo tipo konverguojančio binokulinio mikroskopo su apšvietimo sistema iš apačios (Zeiss tipo arba lygiaverte). Sumontuojamas ant specialaus stalelio.	Stacionarus prietaisas, susidedantis iš Galilėjo tipo konverguojančio binokulinio mikroskopo su apšvietimo sistema iš apačios (Zeiss tipo). Sumontuojamas ant specialaus stalelio **MT01**. (brošiūra „SL 115 Classic Slit Lamp" 6 psl.; brošiūra „Eye Examination with slit lamp", 6 psl.)
2	Padidinimai	Perjungiami, ne mažiau kaip trys: (8x, 12x, 20x) ± 5%	Perjungiami, trys: 8x, 12x, 20x (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
3	Stebimo lauko diametro keitimo (priklausomai nuo pasirinkto padidinimo) ribos	Ne siauresnės kaip nuo 25 mm iki 10 mm	Nuo 25 iki 10 mm diametro (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
4	Okuliarai	Plataus lauko, 10x ± 5%	Plataus lauko: nuo 10 net iki 25 mm, 10x (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
5	Okuliarų dioptrinis paderinimas (okuliarų ametropijos kompensacija)	≥ ± 8 D	±8D (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
6	Reguliuojamas plyšio plotis	1. Tolygiai didėjantis; 2. Apatinė riba ne daugiau 0 mm; 3. Viršutinė riba ne mažiau 14 mm.	1. Tolygiai didėjantis; 2. Apatinė riba 0 mm; 4. Viršutinė riba 14 mm. (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
7	Reguliuojamas plyšio ilgis	1. Tolygiai reguliuojamas nuo ≤ 1 mm iki ≥ 14 mm; 2. Fiksuotos padėtys: (0.5, 3.5, 8, 14 mm) ± 5%.	1. Tolygiai reguliuojamas nuo 1 iki 14 mm ribose 2. Fiksuotos padėtys: 0.5, 3.5, 8, 14 mm (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
8	Galimybė pakreipti plyšį kampu	≥ ± 90° tolygiai	± 90°, tolygiai (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
9	Plyšio decentracija	≥ ± 4° horizontaliai, fiksuota padėtis ties 0°	± 4° horizontaliai, fiksuota padėtis ties 0° (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
10	Plyšio projektoriaus pasukimo sritis	≥ ± 180°, kampinio skirtumo skalė,	180°, kampinio skirtumo skalė, fiksacija ties 0°

		fiksuota padėtis ties 0°	(brošiūra „SL 115 Classic Slit Lamp“ 6 psl.)
11	Kritimo kampas	0°, horizontaliai	0°, horizontaliai (brošiūra „SL 115 Classic Slit Lamp“ 6 psl.)
12	Filtrai	1. Mėlynas; 2. Žalias (beraudis); 3. Karštį atspindintis; 4. Uždanga difuziniam apšvietimui; 5. Barjerinis (geltonas); 6. UV apsauginis.	1. Mėlynas, 2. Žalias (beraudis), 4. Karštį atspindintis, 4. Uždanga difuziniam apšvietimui, 5. Barjerinis filtras (geltonas) 6. UV apsauginis. (brošiūra „SL 115 Classic Slit Lamp“ 6 psl.)
13	Darbinis atstumas	70 ± 3 mm nuo prizmės iki paciento akies	73 mm nuo prizmės iki paciento akies (brošiūra „SL 115 Classic Slit Lamp“ 6 psl.)
14	Instrumento bazės eiga	1. Vertikaliai: ≥ 30 mm; 2. Lateraliai (x-ašis): ≥ 110 mm; 3. Išilgai (y-ašis): ≥ 90 mm.	1. Vertikaliai: 30 mm 2. Lateraliai (x-ašis): 110 mm, 3. Išilgai (y-ašis): 90 mm, (brošiūra „SL 115 Classic Slit Lamp“ 6 psl.)
15	Atramos smakrui vertikali eiga	≥ 55 mm	59 mm (brošiūra „SL 115 Classic Slit Lamp“ 6 psl.)
16	Apšvietimo lempa	Halogeninė, 10-15 W galingumo (arba lygiavertė)	Halogeninė 10 W (brošiūra „SL 115 Classic Slit Lamp“ 6 psl.)
17	Apšviestumo reguliavimas	Tolygus	Tolygus (brošiūra „SL 115 Classic Slit Lamp“ 6 psl.)
18	Elektros maitinimas	Iš 230 V, 50 Hz elektros tinklo	100 .... 240 V± 10%, savaime nusistatanti 50/60 Hz (brošiūra „SL 115 Classic Slit Lamp“ 6 psl.)
19	Specialus stalelis plyšinei lempai	1. Skirtas plyšinės lempos sumontavimui; 2. Elektriškai keičiamo aukščio.	Specialus stalelis MT01 plyšinei lempai, Medinstrus Lietuva. 1. Skirtas plyšinės lempos sumontavimui; 2. Elektriškai keičiamo aukščio. (brošiūra „Staliukas MT01“)
20	Žymėjimas CE ženklu	Būtinas. Kartu su pasiūlymu būtina pateikti žymėjimą CE ženklu liudijančio galiojančio dokumento (CE sertifikato arba EB atitikties deklaracijos) kopiją.	Kartu su pasiūlymu konkursui pateikiame EB atitikties deklaracijos kopiją.
21	Kartu su prekėmis pateikiama dokumentacija	Naudojimo instrukcija lietuvių kalba	Naudojimo instrukcija lietuvių kalba
22	Garantinis laikotarpis	≥ 12 mėn.	12 mėn.

2. Sutarties vertė

Sutarties (iki 2 vnt.) vertė – 11.151,36 Eur (vienuolika tūkstančių šimtas penkiasdešimt vienas euras 36 cnt.).

Į sutartyje nurodytą kainą įskaityta:

2.1. Pervežimo į pirkėjo nurodytą vietą Lietuvos Respublikos teritorijoje išlaidos.

2.2. Draudimo pervežant išlaidos.

2.3. Garantinio laikotarpio (12 mėnesių) turėtos išlaidos.

2.4. Naudojimo instrukcija lietuvių kalba 2 egzemplioriai.

2.5.Techninė dokumentacija lietuvių kalba medicinos technikui.

2.6. Išlaidos, susijusios su personalo apmokymu, tame tarpe ir medicinos techniko.

2.7. Pridėtinės vertės mokestis.

2.8. Įvedimas į eksploataciją.

2.9. Informacinės sistemos E.sąskaita naudojimo išlaidos.

3. Apmokėjimo sąlygos

3.1. „Pirkėjas“ sumoka už pateiktas prekes per 30 (trisdešimt) kalendorinių dienų nuo dienos, kai užsakovas gauna prekes arba paslaugas bei sąskaitą faktūrą arba lygiavertį dokumentą. Mokėjimo terminas gali būti pratęsiamas dar 30 dienų, jeigu vėluojama atsiskaityti ligoninei už suteiktas asmens sveikatos priežiūros paslaugas, tačiau mokėjimo laikotarpis negali viršyti 60 kalendorinių dienų nuo prekių gavimo dienos.

3.2. Jeigu "Pirkėjas" neatsiskaito per minėtą laiką po prekių pristatymo, "Pardavėjas" gali reikalauti 0,02% netesybų už kiekvieną uždelstą dieną nuo neapmokėtos sumos.

3.3. Atsiskaitymas vykdomas naudojantis tik informacinės sistemos „E.sąskaita“ priemonėmis.

4. Garantijos

4.1. "Pardavėjas" garantuoja, kad prekės, nepriklausomai nuo joms būdingos išvaizdos ar pagaminimo būdo yra tikrai naujos ir pagamintos iš reikalingų medžiagų bei pilnai atitinka techniniuose dokumentuose numatytus reikalavimus.

4.2. "Pardavėjas" įsipareigoja pataisyti ar pakeisti defektines prekes (ar jų dalis) per 1 mėnesį, garantinio remonto trukmė iki 1 mėnesio nuo defekto nustatymo. "Pardavėjas", jei tas būtina, atsiunčia savo specialistus pas "Pirkėją", kad išsiaiškintų sutrikimo priežastis, ar pataisytų defektą. Pataisytos arba naujos dalys bus pristatytos "Pirkėjui" nemokamai ir joms bus suteiktas naujas garantinis laikotarpis.

4.3. Jeigu firmos specialistai nustatys, kad gedimo negalima pašalinti "Pardavėjas" įsipareigoja pakeisti visą aparatą.

4.4. Garantinis laikotarpis prasideda nuo įrangos perdavimo – priėmimo akto pasirašymo dienos.

5. Prekių pristatymas

5.1. "Pardavėjas" pristato "Pirkėjui" nurodytas prekes į jo buveinę laike 30 (trisdešimt) dienų nuo užsakymo pateikimo dienos.

5.2. Pristatyta įranga laikoma nuo to momento, kai yra pasirašyta įrangos priėmimo-perdavimo aktas, sąskaita-faktūra, kai apmokytas personalas, pateikta naudojimo instrukcija lietuvių kalba ir užpildytas įrangos techninis pasas.

5.3. Prekių pervežimą, draudimą, pervežimo metu organizuoja ir apmoka "Pardavėjas".

5.4. Jeigu "Pardavėjas" per minėtą laikotarpį nepateikia prekių, "Pirkėjas" gali reikalauti 0,02% netesybų nuo netiekiamų prekių sumos už kiekvieną uždelstą dieną.

6. Prekių įpakavimas

6.1. Prekės supakuotos atsižvelgiant į jų pobūdį ir transportavimo saugumo reikalavimus.

6.2. "Pardavėjas" garantuoja, kad prekės nebus pažeistos transportavimo metu.

7. Sutarties nutraukimas

7.1.Sutartis įsigalioja nuo Sutarties pasirašymo dienos ir galioja 12 mėnesių.

7.1. Sutartis gali būti nutraukta vienu iš šių būdų:

7.1.1. šalių susitarimu;

7.1.2. vienos iš šalių iniciatyva, apie tai raštu informavus kitą šalį ne vėliau kaip prieš 30 (trisdešimt) kalendorinių dienų.

7.2. Pirkėjas turi teisę, įspėjęs Pardavėja prieš 30 (trisdešimt) dienų, vienašališkai nutraukti šią Sutartį dėl esminio jos pažeidimo. Esminiu šios Sutarties pažeidimu bus laikomas bet kurio įsipareigojimo pagal Sutartį neįvykdymas arba netinkamas įvykdymas.

7.3. Pardavėjas turi teisę vienašališkai nutraukti sutartį apie tai prieš 30 (trisdešimt) kalendorinių dienų raštu pranešdama kitai sutarties šaliai.

7.4. Sutarties nutraukimas neatleidžia vienos šalies nuo įsipareigojimų kitai šaliai, kuriuos ji prisiėmė pagal sutartį iki sutarties nutraukimo dienos.

8. Ginčai

8.1. Ginčo ir nesutarimo atveju, sutarties rėmuose abi pusės stengiasi susitarti taikiu būdu. Nepavykus susitarti derybų keliu, ginčas nagrinėjamas Lietuvos Respublikos įstatymų nustatyta tvarka.

9. Baigiamosios nuostatos

9.1.Kiekvieną ginčą, nesutarimą ar reikalavimą, kylantį iš šios Sutarties ar susijusį su šia Sutartimi, jos sudarymu, galiojimu, vykdymu, pažeidimu, nutraukimu, Šalys spręs derybomis. Ginčo, nesutarimo ar reikalavimo nepavykus išspręsti derybomis, ginčas bus sprendžiamas teisme pagal Užsakovo buveinės vietą.

9.2. Pirkimo sutartis jos galiojimo laikotarpiu gali būti keičiama neatliekant naujos pirkimo procedūros vadovaujantis Viešųjų pirkimų įstatymo 89 straipsniu.

9.3. Sutartis sudaryta dviem vienodą teisinę galią turinčiais egzemplioriais lietuvių kalba, po vieną kiekvienai Šaliai.

9.4. Bet kokie pranešimai, informacija, dokumentacija ar korespondencija dėl Sutarties nevykdymo ar jos vykdymo turi būti įforminta raštu lietuvių kalba ir išsiųsta registruotu paštu per kurjerį, faksu ar elektroniniu paštu. Jeigu informacija perduodama faksu ar elektroniniu paštu, ji laikoma tinkamai perduota tik tuo atveju, jeigu Šalis, kuriai skirta tokia informacija, faksu arba elektroniniu paštu patvirtina jos gavimo faktą.

9.5. Pasikeitus Šalies buveinės adresui, banko sąskaitos numeriui ar kitiems rekvizitams, Šalis privalo apie tai pranešti kitai Šaliai. Neįvykdžius šių reikalavimų Šalis neturi teisės reikšti pretenzijų ar atsikirtimų, kad kitos Šalies veiksmai, atlikti, vadovaujantis paskutine turima informacija, neatitinka Sutarties sąlygų, arba kad ji negavo pranešimų, siųstų pagal paskutinius turimus rekvizitus.

9.6. Sutarčiai ir iš jos kylantiems Šalių santykiams bei jų aiškinimui taikoma Lietuvos Respublikos teisė.

9.7.Sutarties Šalims yra žinoma, kad ši Sutartis yra vieša, išskyrus joje esančią konfidencialią informaciją. Konfidencialia informacija laikoma tik tokia informacija, kurios atskleidimas prieštarautų teisės aktams. Šalys neskelbia tretiesiems asmenims informacijos apie konfidencialias sutarties sąlygas ir vykdymą, taip pat užtikrina, kad minėta informacija bei visi perduoti duomenys ir dokumentai nepateks tretiesiems asmenims, išskyrus Lietuvos Respublikos įstatymuose nustatytas išimtis.

9.8. Tiekėjas negali perleisti tretiesiems asmenims visų ar dalies savo teisių, susijusių su Sutartimi, įskaitant reikalavimo teisę į Pirkėjo mokėtinas sumas, be išankstinio rašytinio Pirkėjas sutikimo. Be Pirkėjo išankstinio rašytinio sutikimo sudaryti sandoriai dėl teisių ar pareigų pagal šią Sutartį perleidimo laikytini niekiniais ir negaliojančiais nuo jų sudarymo momento.

10. Šalių rekvizitai ir juridiniai adresai

"Pirkėjas"	**"Pardavėjas"**
VšĮ Klaipėdos universitetinė ligoninė	UAB „Graina"
Liepojos 41,	Durpyno g. 22
92288 Klaipėda	Panevėžys, LT-36237
A/S LT 827180500000120325	A/S LT637044060002635618
AB "Šiaulių bankas"	AB SEB bankas
Klaipėdos filialas	Panevėžio filialas
Banko kodas 71805	Banko kodas 70440
Įmonės kodas 190468035	Įmonės kodas 147736647
Vyriausiojo gydytojo pavaduotoja infrastruktūrai Nijolė Motuzienė	

LIETUVOS RESPUBLIKA VIEŠOJI ĮSTAIGA KLAIPĖDOS UNIVERSITETINĖ LIGONINĖ KLAIPĖDA

UAB „GRAINA" akcinė bendrovė PANEVĖŽYS

Sprendimai medicinai

Uždaroji akcinė bendrovė „GRAINA“

Įmonės kodas 147736647, PVM mokėtojo kodas LT477366410, Durpyno g. 22, LT-36237 Panevėžys,
A.s. LT58 7181 5000 4446 7652, AB Šiaulių bankas, Banko kodas 71815, Tel.845 57 06 05, Faks.845 43 35 40

VšĮ Klaipėdos universitetinė ligoninė

PASIŪLYMO FORMA

DĖL PLYŠINĖS LEMPOS PIRKIMO

2021-11-24
Vilnius

Tiekėjo pavadinimas	UAB „Graina“
Tiekėjo adresas	Durpyno g. 22, LT-36237 Panevėžys
Įmonės kodas	147736647
Už pasiūlymą atsakingo asmens vardas, pavardė	Edita Štuopienė
Telefono numeris	8 5 2338258
Fakso numeris	8 5 2135558
El. pašto adresas	info@graina.lt
Atsiskaitomoji sąskaita, banko rekvizitai	A.s. LT58 7181 5000 4446 7652 , AB Šiaulių bankas, Panevėžio KAC, Banko kodas: 71815

/Pastaba. Pildoma, jei tiekėjas ketina pasitelkti subrangovą (-us), subtiekėją (-us)~~,~~ ar subteikėją (-us)/

Subrangovo (-ų), subtiekėjo (-ų) ar subtiekėjo (-ų) pavadinimas (-ai)	
Subrangovo (-ų), subtiekėjo (-ų) ar subtiekėjo (-ų) adresas (-ai)	
Įsipareigojimų dalis (procentais), kuriai ketinama pasitelkti subrangovą (-us), subtiekėją (-us) ar subteikėją (-us)	

1. Šiuo pasiūlymu pažymime, kad sutinkame su visomis Konkurso sąlygomis, nustatytomis:
- tarptautinio atviro Konkurso skelbime;
- tarptautinio atviro Konkurso sąlygose;
- kituose pirkimo dokumentuose.

Kartu su pasiūlymu pateikiami šie dokumentai:

Eil. Nr.	Pateiktų dokumentų pavadinimas	Dokumento puslapių skaičius
1	Pasiūlymas	5
2	EBVPD KONF.	13
3	RC Elektroninis sertifikuotas israsas 20-01-17 3 lapai.KONF.pdf	3
4	RC jungtine pazyma 21-11-17.KONF.pdf	2
5	Įgaliojimas pasirašyti dokumentus KONF.pdf	1
6	CE_SL_15_Classic_2021-07-08.pdf	5
7	CE_MT01.pdf	1

8	Brosiura_SL_115_Classic_Slit_Lamp.pdf	6
9	Brosiura_Eye_Examination_with_slit_lamp.pdf	44
10	Brosiura_MT01.pdf	2

Pasiūlymas galioja iki termino, nustatyto pirkimo dokumentuose.

Eil. Nr.	Pirkimo objekto pavadinimas	Viso pasiūlymo kaina EUR su PVM
1	Plyšinė lempa **SL 115 Classic**, Carl Zeiss Meditec, Vokietija. (2 vnt.)	11.151,36

Ši pasiūlyme nurodyta informacija yra konfidenciali */perkančioji organizacija šios informacijos negali atskleisti tretiesiems asmenims/*:

Eil. Nr.	Pateikto dokumento pavadinimas (rekomenduojama pavadinime vartoti žodį „Konfidencialu“)	Dokumentas yra įkeltas šioje CVP IS pasiūlymo lango eilutėje („Prisegti dokumentai“ arba „Kvalifikaciniai klausimai“ prie atsakymo į klausimą)
1	EBVPD KONF.	2
2	RC Elektroninis sertifikuotas israsas 20-01-17 3 lapai.pdf	3
3	RC jungtine pazyma 21-11-17.pdf	4
4	Įgaliojimas pasirašyti dokumentus KONF.pdf	5

Pastaba. Tiekėjui nenurodžius, kokia informacija yra konfidenciali, laikoma, kad konfidencialios informacijos pasiūlyme nėra.

Administratorė VP specialistė		Edita Štuopienė
(Tiekėjo arba jo įgalioto asmens pareigų pavadinimas*)	(Parašas*)	(Vardas ir pavardė*)

Pasirašoma atskirai elektroniniu parašu tuo atveju, kai dokumente nurodytas kitas nei visą pasiūlymą pasirašantis asmuo.

TECHNINIAI REIKALAVIMAI PLYŠINEI LEMPAI

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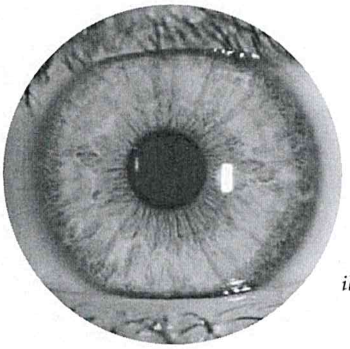
8	Galimybė pakreipti plyšį kampu	≥ ± 90° tolygiai	± 90°, tolygiai (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
9	Plyšio decentracija	≥ ± 4° horizontaliai, fiksuota padėtis ties 0°	± 4° horizontaliai, fiksuota padėtis ties 0° (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
10	Plyšio projektoriaus pasukimo sritis	≥ ± 180°, kampinio skirtumo skalė, fiksuota padėtis ties 0°	180°, kampinio skirtumo skalė, fiksacija ties 0° (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
11	Kritimo kampas	0°, horizontaliai	0°, horizontaliai (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
12	Filtrai	1. Mėlynas; 2. Žalias (beraudis); 3. Karštį atspindintis; 4. Uždanga difuziniam	1. Mėlynas, 2. Žalias (beraudis), 4. Karštį atspindintis, 4. Uždanga difuziniam apšvietimui,

		apšvietimui; 5. Barjerinis (geltonas); 6. UV apsauginis.	5. Barjerinis filtras (geltonas) 6. UV apsauginis. (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
13	Darbinis atstumas	70 ± 3 mm nuo prizmės iki paciento akies	73 mm nuo prizmės iki paciento akies (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
14	Instrumento bazės eiga	1. Vertikaliai: ≥ 30 mm; 2. Lateraliai (x-ašis): ≥ 110 mm; 3. Išilgai (y-ašis): ≥ 90 mm.	1. Vertikaliai: 30 mm 2. Lateraliai (x-ašis): 110 mm, 3. Išilgai (y-ašis): 90 mm, (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
15	Atramos smakrui vertikali eiga	≥ 55 mm	59 mm (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
16	Apšvietimo lempa	Halogeninė, 10-15 W galingumo (arba lygiavertė)	Halogeninė 10 W (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
17	Apšviestumo reguliavimas	Tolygus	Tolygus (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
18	Elektros maitinimas	Iš 230 V, 50 Hz elektros tinklo	100 .... 240 V± 10%, savaime nusistatanti 50/60 Hz (brošiūra „SL 115 Classic Slit Lamp" 6 psl.)
19	Specialus stalelis plyšinei lempai	1. Skirtas plyšinės lempos sumontavimui; 2. Elektriškai keičiamo aukščio.	Specialus stalelis MT01 plyšinei lempai, Medinstrus Lietuva. 1. Skirtas plyšinės lempos sumontavimui; 2. Elektriškai keičiamo aukščio. (brošiūra „Staliukas MT01")
20	Žymėjimas CE ženklu	Būtinas. Kartu su pasiūlymu būtina pateikti žymėjimą CE ženklu liudijančio galiojančio dokumento (CE sertifikato arba EB atitikties deklaracijos) kopiją.	Kartu su pasiūlymu konkursui pateikiame EB atitikties deklaracijos kopiją.
21	Kartu su prekėmis pateikiama dokumentacija	Naudojimo instrukcija lietuvių kalba	Naudojimo instrukcija lietuvių kalba
22	Garantinis laikotarpis	≥ 12 mėn.	12 mėn.
23	Tiekėjas privalo pateikti gamintojo katalogus (prekių aprašymus), kuriuose būtų nurodyta prekių kodai bei visa kita informacija, pagrindžianti prekės atitikimą konkurso specifikacijai. Kataloge turi būti pabrauktas ir pažymėtas atitikimas reikalaujamiems parametrams t. y. pabraukti kiekvienos pozicijos kiekvieną atitikimą, nurodant pozicijos numerį pagal prašomas specifikacijas. Katalogai (prekių aprašymai) turi būti	Būtina	Pateikiame gamintojo katalogus (prekių aprašymus), kuriuose yra nurodyta prekių kodai bei visa kita informacija, pagrindžianti prekės atitikimą konkurso specifikacijai. Kataloge yra pabrauktas ir pažymėtas atitikimas reikalaujamiems parametrams t. y. pabraukti kiekvienos pozicijos kiekvieną atitikimą, nurodant pozicijos numerį pagal prašomas specifikacijas. Katalogai (prekių aprašymai) yra anglų kalba. ***Pateikiamos skaitmeninės dokumentų kopijos.***

	lietuvių kalba arba anglų kalba. ***<u>Pateikiamos skaitmeninės dokumentų kopijos.</u>***		
24	Perkamas kiekis	Iki 2 vnt.	**2 vnt.**
25	PVM tarifas procentais		**21%**
26	Vnt. kaina Eut su PVM		**5.575,68**
27	Viso kaina Eur su PVM		**11.151,36**
28	Firminis pavadinimas, gamintojas		Plyšinė lempa **SL 115 Classic**, Carl Zeiss Meditec, Vokietija.

High detail resolution

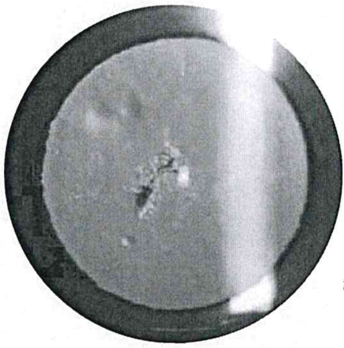
Optical brilliance without compromise – this is guaranteed by the legendary ZEISS brand. The outstanding features of the SL 115 Classic Slit Lamp include its high-contrast resolution and fine, highly precise slit. You benefit from the exceptional image detail, allowing reliable diagnoses and excellent contact lens fitting.



Overview in diffuse illumination

Excellence comes standard

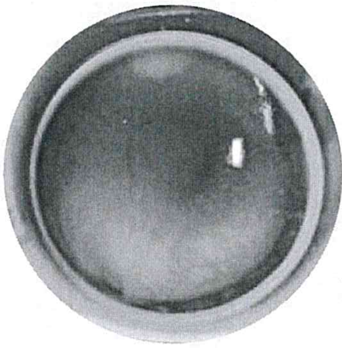
A swing-in yellow filter for fluorescence examinations and contact lens fitting is a standard feature of the system. The super high eyepoint eyepieces ensure that eyeglass wearers can also work comfortably and conveniently.



Christmas tree cataract in retro-illumination

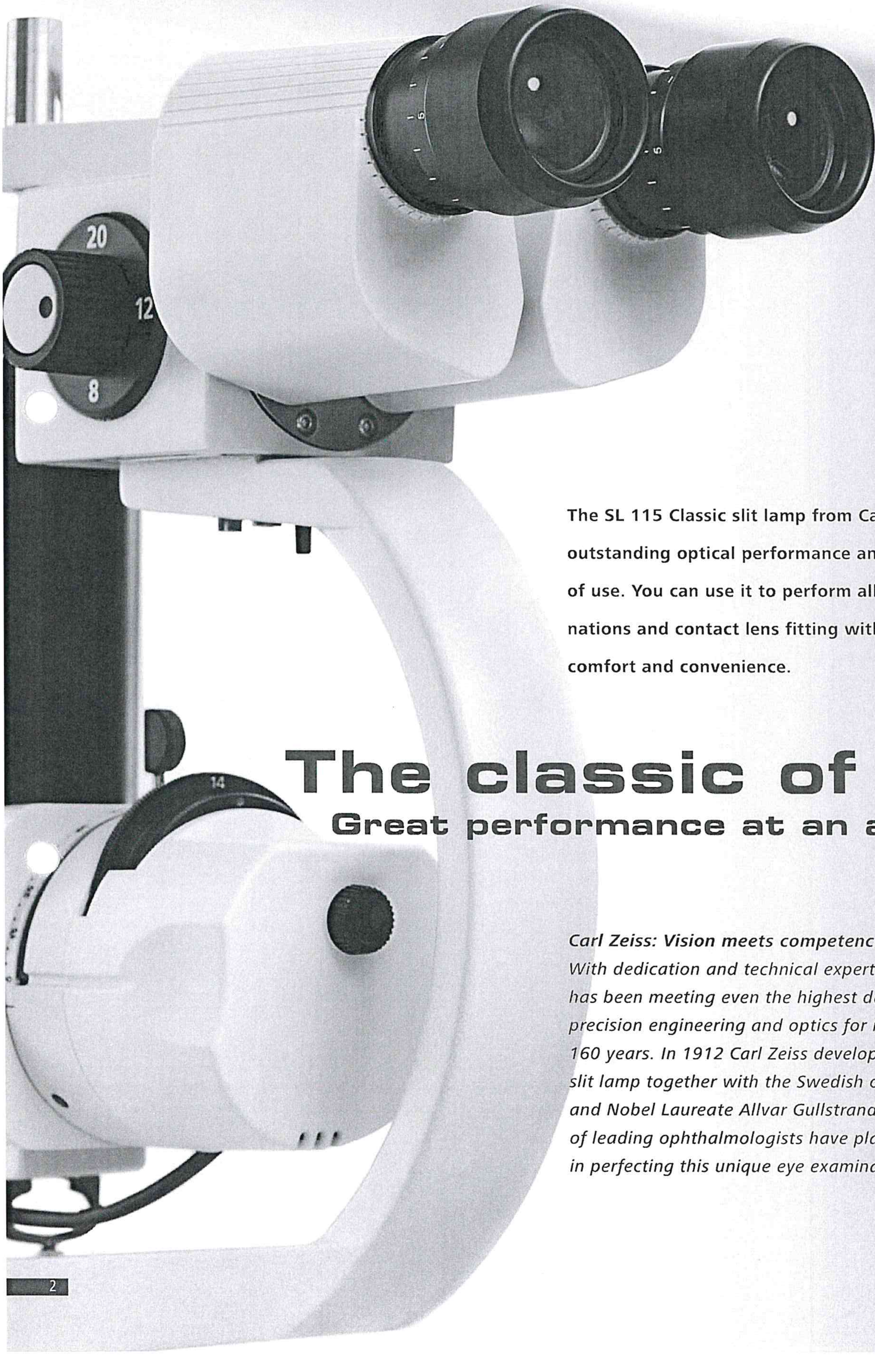
Everything in view

The SL 115 Classic is ideally suited for contact lens fitting. A large illuminated field allows observation of the entire anterior segment, permitting reliable assessment of soft contact lenses.



Assessing a soft contact lens with fluorescein

Precision	for optimum results
Performance	for smooth treatment routines
Patient Care	for satisfied patients
Productivity	for efficient office management



The SL 115 Classic slit lamp from Carl Zeiss offers outstanding optical performance and superb ease of use. You can use it to perform all routine examinations and contact lens fitting with the ultimate comfort and convenience.

The classic of slit la

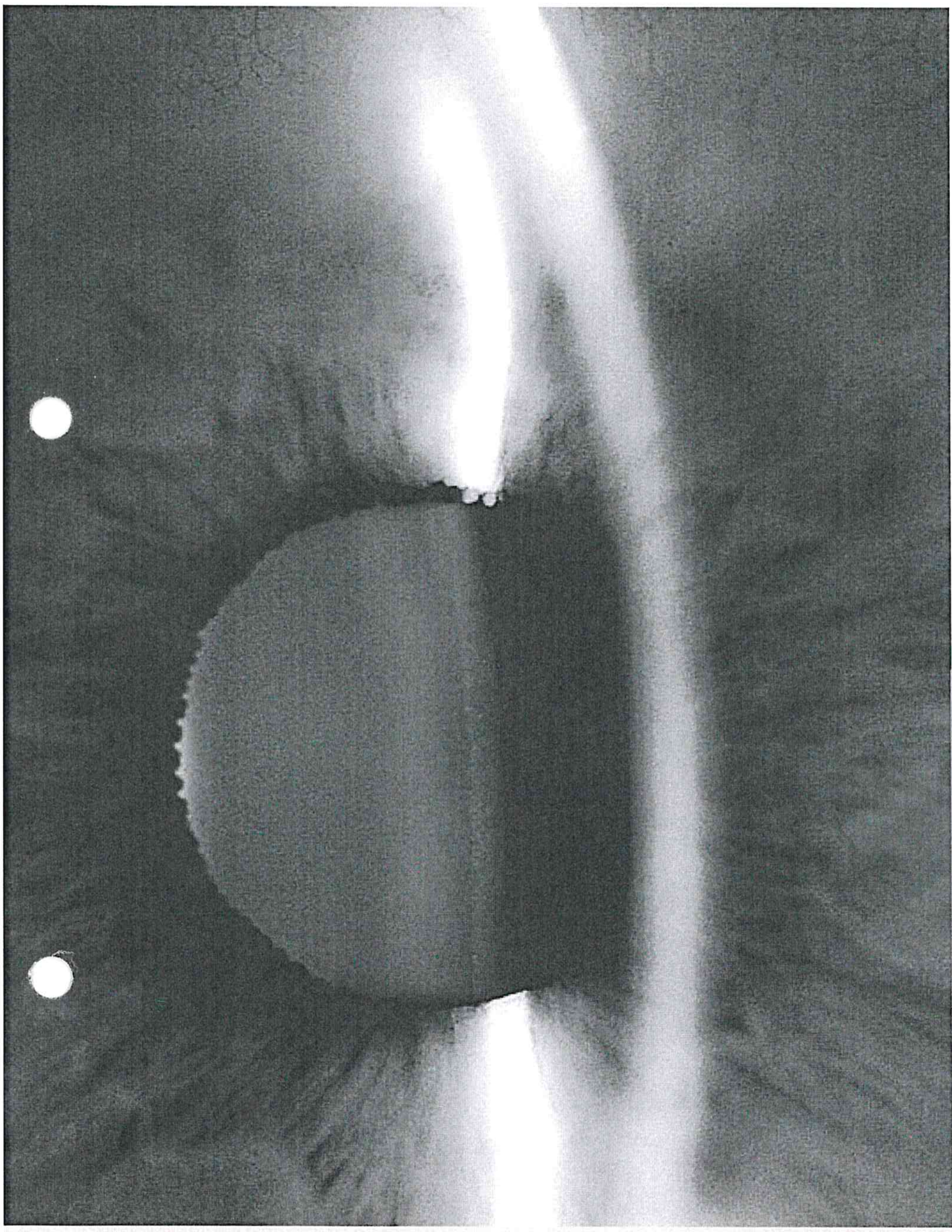
Great performance at an amazing price

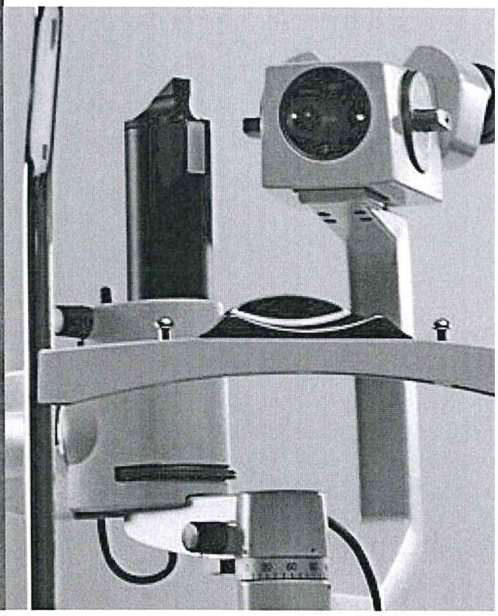
Carl Zeiss: Vision meets competence

With dedication and technical expertise, Carl Zeiss has been meeting even the highest demands on precision engineering and optics for more than 160 years. In 1912 Carl Zeiss developed the first slit lamp together with the Swedish ophthalmologist and Nobel Laureate Allvar Gullstrand. Generations of leading ophthalmologists have played a key role in perfecting this unique eye examination system.

Ophthalmic Instruments from Carl Zeiss

Eye Examination with the Slit Lamp.





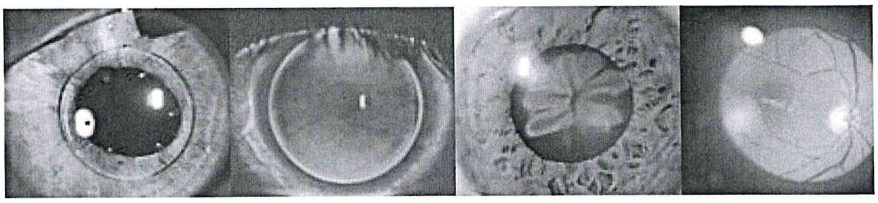
ZEISS

In memory

of Prof. Allvar Gullstrand
Nobel Prize Winner in Physiology and Medicine

05.06.1862 – 28.07.1930

Eye Examination with the Slit Lamp.



Contents

1. Overview of applications.

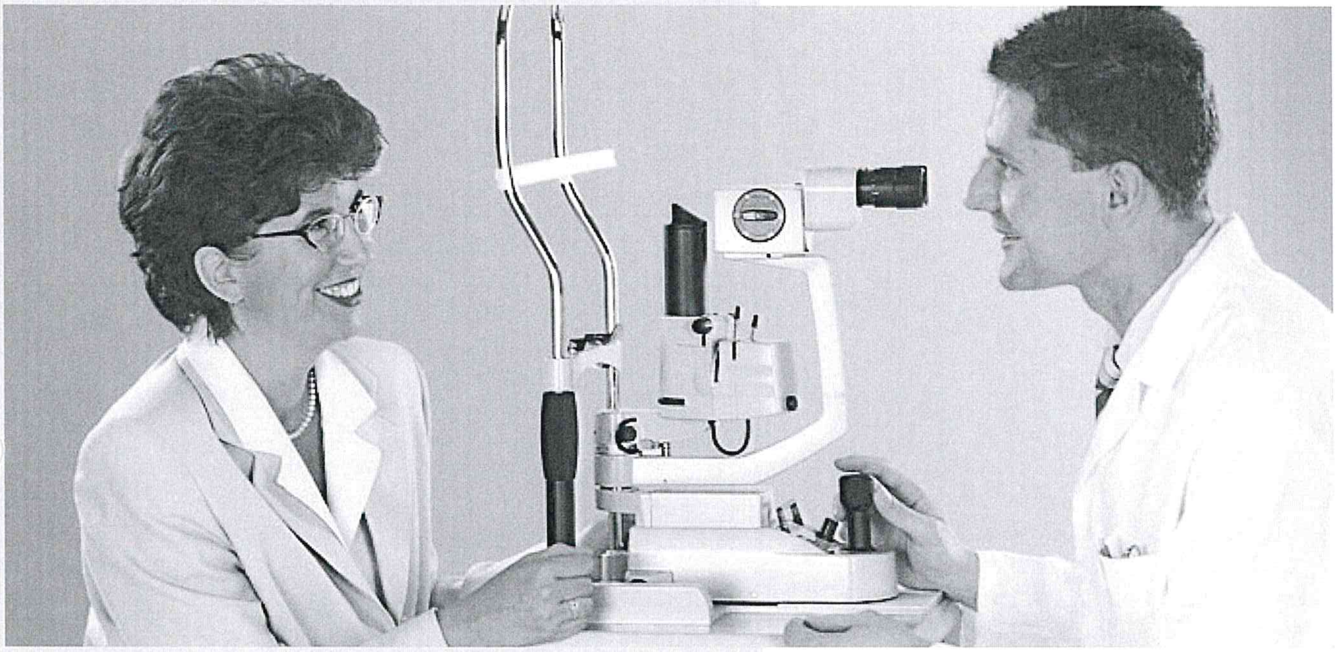


Fig. 1
Application of
SL 120 Slit Lamp

Today the slit lamp is the ophthalmologist's most frequently used and most universally applicable examination instrument. The most important field of application is the examination of the anterior segment of the eye including the crystalline lens and the anterior vitreous body.

Supplementary optics such as contact lenses and additional lenses permit observation of the posterior segments and the iridocorneal angle that are not visible in the direct optical path.

A number of accessories have been developed for slit lamps extending their range of application from pure observation to measurement, such as for measuring the intraocular pressure.

The documentation of findings on electronic media is increasingly gaining importance as it provides a convenient medium for keeping track of a disease's progress. It also facilitates the communication between physician and patient or between physicians.

The use of the slit lamp in contact lens fitting is an important recent application worth mentioning. The modern instrument has increasingly gained applications beyond the traditional ophthalmologist's practice.

2. Design principles.

2.1 Slit illumination system

The illumination system is intended to produce a slit image that is as bright as possible, at a defined distance from the instrument with its length, width, and position being variable. Today this is achieved using optical imaging with the so-called *Köhler illumination* (Fig. 2). The light source **L** is imaged in the objective **O** by the collector system **K**. The objective in turn produces an image at **S** in the mechanical slit located next to the collector system. The image of the light source at **O** is the exit pupil of the system. Köhler illumination provides a very homogeneous slit image even with a structured light source. This is an advantage over illumination systems imaging the light source in the slit and projecting the latter into the eye together with the image of the light source. This method was used in 1911 in the first *Gullstrand slit lamp* and is therefore only of historical importance.

The brightness of the slit image is characterised by the illuminance of the slit image which depends on the luminance of the light source, the transmission of imaging optics, the size of the exit pupil, and the distance between exit pupil and slit.

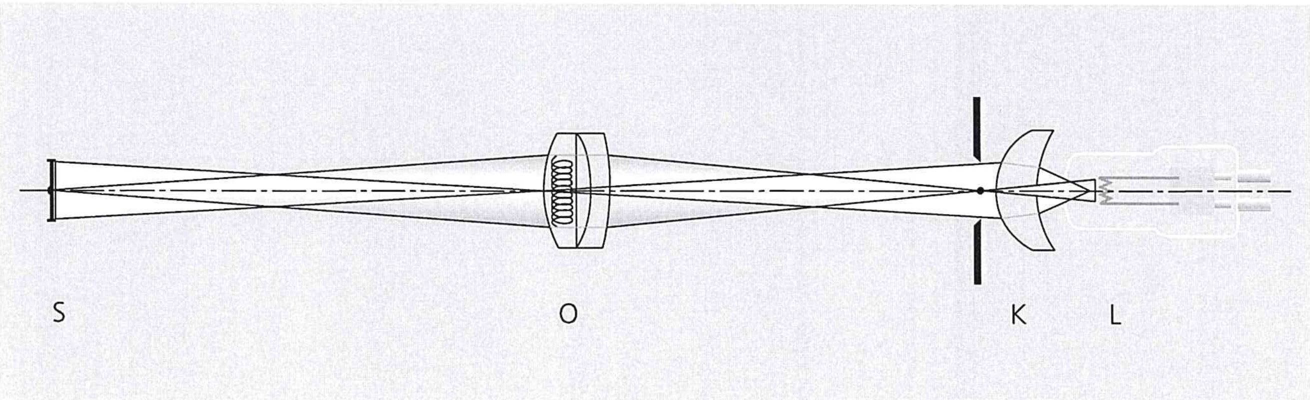
The standard slit lamp is comprised of three elements:

1. **Slit illumination system**
   Giving the instrument its name

2. **Stereomicroscope**
   Similar to that used on other ophthalmic instruments, e.g. surgical microscopes

3. **Mechanical system**
   Connecting the microscope to the illumination system and allowing for positioning of the instrument

Fig. 2
Principle of Köhler illumination



The optical transmission is increased by antireflection coatings on all glass surfaces. The light loss caused by reflections is subsequently reduced to 1.5% or even down to 0.5% in the case of high-grade antireflection coatings. The total gain in brightness of the slit illumination compared to an uncoated system is about 20%, thus demonstrating the advantages offered by modern specially coated optics.

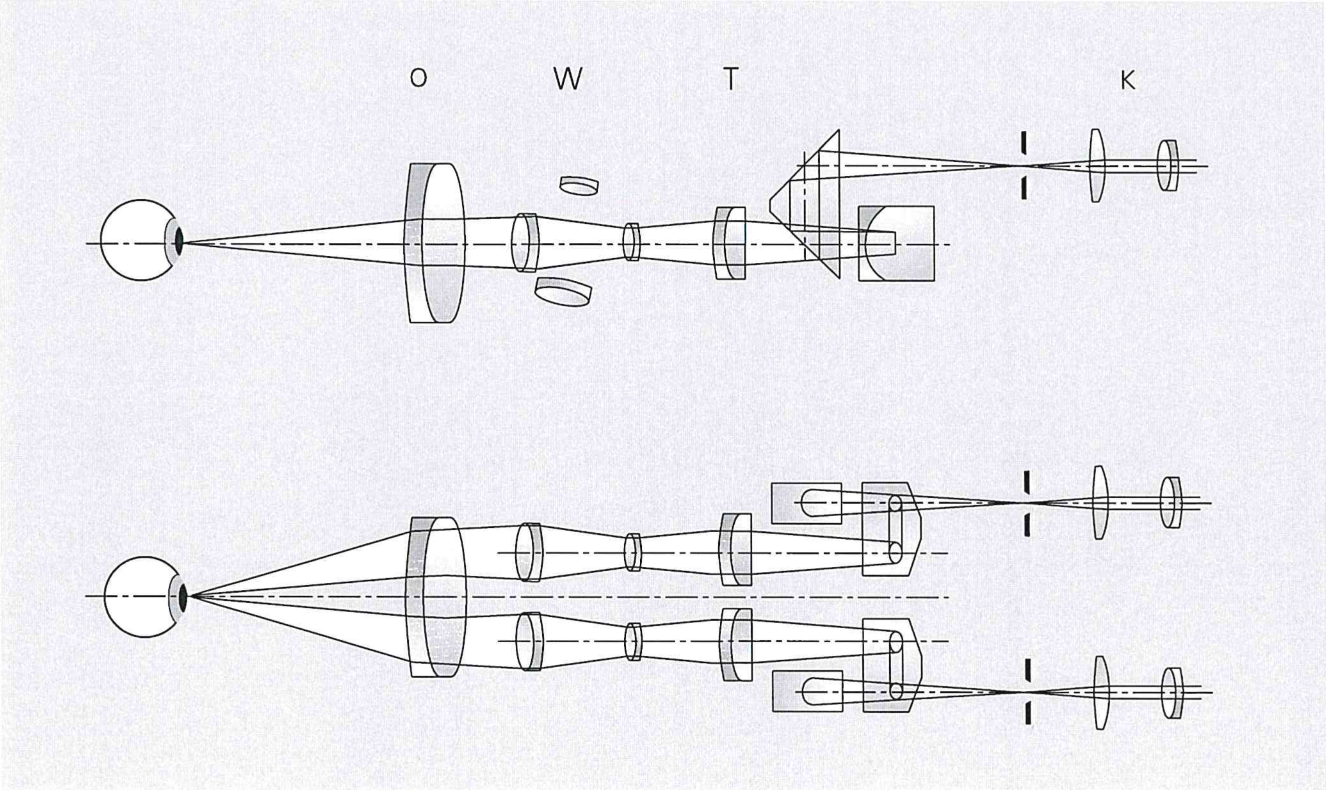
The light source used on a slit lamp is either a low-voltage incandescent lamp or a halogen lamp. The latter being preferred because of its high luminance and colour temperature.

According to physical laws the light scattering ability and fluorescence of transparent media is enhanced by such high luminance and colour temperature, allowing diagnostically important changes in colour to yellow to be much more easily recognised. Modern slit lamps (see Figs. 7 - 10) therefore employ halogen light sources.

For certain examinations it is not so much an intense slit illumination that is required but a large-field diffuse illumination. For this reason some instruments provide an insertable ground glass screen at the plane of the exit pupil and of the filament image. The optical path is thus interrupted with the ground glass screen acting as a secondary source.

Other examination methods require the spectral composition of the light to be changed (e.g. for fluorescence observation in contact lens fitting). For this purpose various filters are provided in the illumination system which can be easily swung into the beam path. The range of filters include exciter filters for fluorescence, green filters for contrast enhancement, and sometimes grey filters for reducing the illumination intensity while maintaining colour temperature.

Fig. 3
Optical path in the stereomicroscope of a slit lamp



2.2 Slit lamp microscope

The user expects the slit lamp microscope to provide optimum stereoscopic observation with selectable magnification. The size of the field of view and the depth of field are expected to be as large as possible, and there should be enough space in front of the microscope for manipulation on the eye.

Fig. 3 shows the optical path of a stereomicroscope designed on the principle of the telescopic lens.

With telescopic lens systems, larger working distances can be achieved when compared to simple magnifying systems. These systems consist of a telescope and an object-side magnifying lens. The object is located in the object-side focal point of the magnifying lens that magnifies the object image projecting it virtually to infinity. This image is then viewed with the respective magnification through the telescope.

Explanation of Fig. 3:

Between objective **O** (focal length f_1) and tube lenses **T** (f_2) there is a separate, parallel optical path for each eye. Hence, the object is located in the focal plane of **O**. Between **O** and **T** a telescopic system **W** each may be fitted (magnification factor g) to vary the total magnification.

Stereoscopic vision requires a defined convergence angle between the two visual axes. This convergence angle is obtained by a prismatic power in the objective transmitted off axis by both beams. The intermediate images produced by tube lenses **T** through rotatable prisms are viewed with eyepieces **K** (f_3).

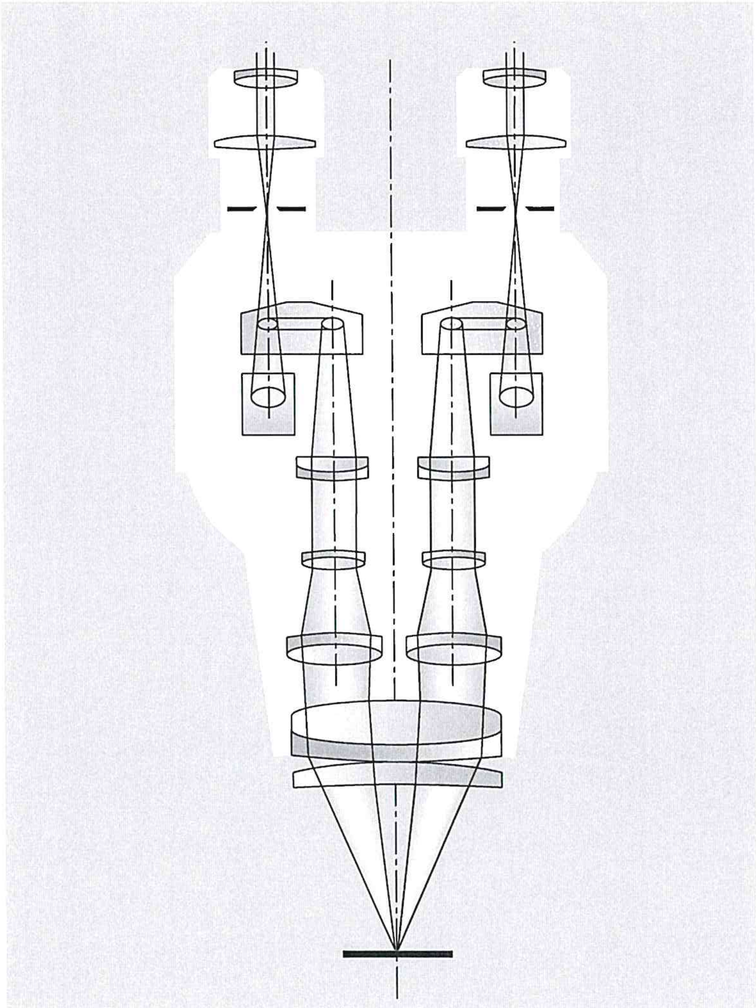


Fig. 4
Optical diagram of telescopic system

The total angular magnification G of the system is calculated by the following formula:

$$G = \frac{f_2}{f_1} \times g \times \frac{250\ \text{mm}}{f_3\ (\text{mm})}$$

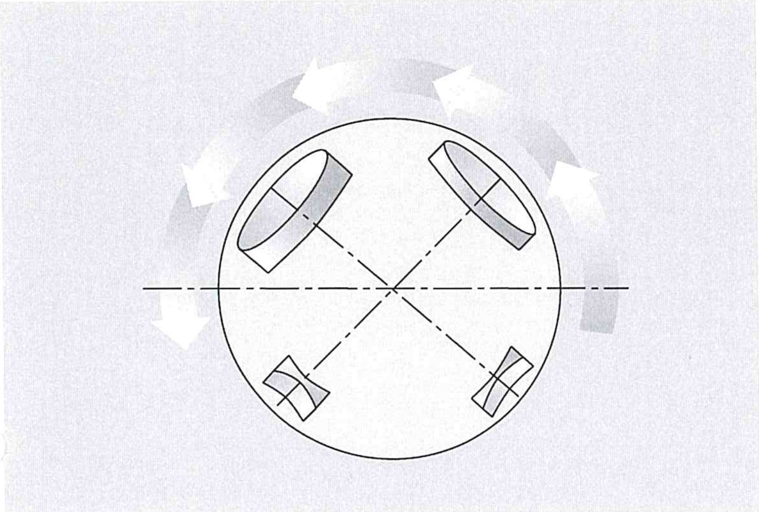


Fig. 5
Galilean system

Mūsų plyšinių lempų stereomikroskopuose naudojamas šie instrumentiniai principai.

The stereomicroscopes of our slit lamps use the following instrument principle:

Teleskopinė sistema

1. **Telescopic system**

Galilean system with telecentric optical path (Fig. 4)

Galilėjo sistema su telecentriniu optiniu keliu

On this system, both optical paths have a common or main objective. This objective projects the object image to infinity which is viewed by a stereo tube that is basically a pair of telescopes. In practice the slit lamp requires magnifications of between 5x and 50x, the most commonly used being 10x, 16x, and 25x. The microscope magnification can be varied by changing the eyepieces, but a simpler and more elegant solution is however, a magnification changer using variable optical elements. When the magnification is changed, the position of the object plane must of course not change. A tried and tested means of changing the magnification is a Galilean telescope. Here, in a rotatable drum whose axis is perpendicular to the optical axes, two small Galilean telescopes are arranged that are inclined to each other and can be looked through in either direction. Thus, they provide four different magnifications. A fifth magnification results from the free aperture available on the drum.

Plyšinių lempų SL 115 Classic, SL 120 ir SL 130 didinimo keitikliai yra pagrįsti šiuo principu.

The magnification changers of the SL 115 Classic, SL 120 and SL 130 Slit Lamps are based on this principle.

The binocular tube of the slit lamp holds the eyepieces at the same time ensuring a defined distance between them and the main objective (= mechanical tube length).

In recent years, slit lamps that employ a stereomicroscope combined with a telescopic system have been successful. These stereomicroscopes have a straight binocular tube (parallel tube) that enables fatigue-free viewing through the slit lamp when used over longer periods.

rekomenduojamas konverguojantis šviesos kelias (konverguojantis tubusas)

For examinations where the ophthalmologist observes the patient's eye alternately through the slit lamp and with the unaided eye (accommodated!), a convergent light path is recommended (convergent tube). It is known that there is a relationship between the focal distance of the observers adjusted eye to the viewed object, i.e. the accommodation, and the convergence of their eyes to that object.

The standard SL 120 and SL 130 Slit Lamps are supplied with a convergent tube of f = 140 mm. Parallel tubes being available as accessories.

Besides the magnification, the user is usually interested in the following optical criteria:

- Resolution
- Brightness
- Depth of field
- Stereo angle or stereo base
- Back focal distance

The **resolution** of a microscope (the smallest distance between two points that can be separated) is determined by its numerical aperture. With a given aperture it is ineffectual to increase the microscope magnification beyond a certain point, the so-called useful magnification, over this the image will just be larger without an increase in resolution. On the other hand it is not advisable to increase the aperture beyond the value specified by a given magnification either, as in this case the resolution is limited by the acuity and pupil size of the observer, also the performance of the optics would not be fully utilised. The exit pupils of a good slit lamp microscope range from 0.8 to 2.7 mm depending on magnification.

The **depth of field** of the microscope is of great importance in the use of the slit lamp. It has three components:

- Depth of focus
- Depth of accommodation
- Depth of resolution

Within the eye there exists a smallest resolvable angle (or minimum angular separation) at which an image point and its circles of least confusion are seen equally sharp. This is the **depth of focus**. The **depth of accommodation**, however, results from the change in refractive power of the eyepiece/eye system, whereby the point of best visual acuity is shifted relative to the eyepiece plane. The **depth of resolution** is due to the diffraction of light at the microscope aperture. As a result of diffraction, object differentiation within the depth range is impossible, the depth of resolution is therefore similar to the depth of field.

As with illumination, the demand for maximum brightness conflicts with that of maximum depth of field. Thus, a "brighter" slit lamp may have the serious drawback of a lower depth of field if its brightness is not based on lamp brightness alone. The aperture of a good slit lamp microscope is near to 0.05 for medium magnifications. The aperture of the new slit lamps ranges from 0.05 to 0.08.

Stereoscopic vision is the basis of slit lamp microscopy. The wish to make the **convergence angle** as large as possible is counteracted by the demand for observation through limited apertures such as the pupil and contact lens mirrors (cf. 3.6 "Fundus observation and gonioscopy"). For this reason good slit lamp microscopes work with a convergence angle of between 10° and 15°. The SL 120 and SL 130 Slit Lamps have a convergence angle of 12.5°, the SL 115 Classic Slit Lamp employs a convergence angle of 10°.

The **backfocal distance** is another parameter of the slit lamp microscope that is of special interest. The back focal distance is the distance of the subject from the front lens surface of the microscope. The back focal distance must have a certain minimum length to give the operator sufficient space for manipulation. If it is too long, manipulations on the eye are difficult, because of the resulting extended and uncomfortable position of the arms. Moreover, with a given objective aperture, the numerical aperture is reduced and thus the brightness. The back focal distance of a slit lamp should range between 90 mm and 120 mm. On the SL 120 and SL 130 Slit Lamps, it is approx. 106 mm; on the SL 115 Classic Slit Lamp it is approx. 118 mm.

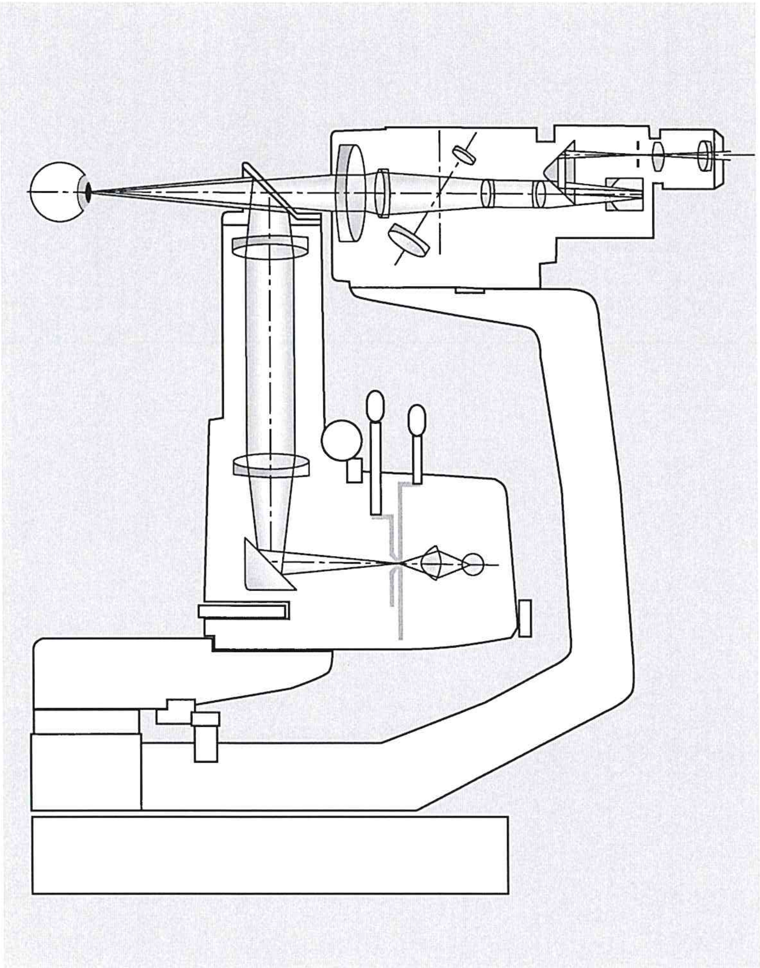


Fig. 6
Optical path of
SL 120 Slit Lamp

2.3 Mechanical system

The mechanical system of the modern slit lamp has developed over 80 years and combines the requirements of operating comfort and universal application.

Fig. 6 shows the functional connections of the illumination system to the stereomicroscope by means of the mechanical support. The illumination system and the microscope can both be swung about a common vertical axis independent of each other. The visual axis is a virtual extension of the mechanical instrument axis, the rotational point being located below the patient's eye. The slit is normally focused to the axial plane and can be seen sharply defined at the microscope focal point. During an examination, this axis of rotation is moved to the position of the object to be observed. This is achieved with the aid of a mechanical instrument base containing a cross-slide system and carrying the mechanical support axis of the illumination system and the microscope. The instrument base is moved horizontally with a single control element - the joystick control. Additionally the instrument base contains a vertical control mechanism allowing the slit and the viewing axis to be adjusted vertically. This vertical control is typically integrated into the joystick and operated by rotating it. Thus, the operator can adjust the instrument to the object in all three space coordinates (3D joystick control lever).

Modern slit lamps not only permit the illumination system to be swung through in front of the microscope, they also have a middle position with a click stop which locates the illuminating prism between the two microscope beams. This prism being extremely narrow, allows stereoscopic observation through the microscope around the prism.

There are a number of other important functions provided by the mechanical system:

a) The slit image which is normally in a vertical position can be rotated continuously through ± 90° to the horizontal position.

b) In the horizontal position the direction of the slit illumination can be changed so that there is a defined angle between the microscope axis and the axis of the slit illumination. On some instruments, this is effected by a tilting prism (15° from below). Other instruments, such as the SL 120, and SL 130 slit lamps, have a vertically adjustable prism head (tiltable between 0 and 20°). This is useful for examinations with mirror contact lenses.

c) For retro-illumination the prism head can be rotated from the central click stop to the right and left. This allows the slit image to travel laterally.

As mentioned above, almost all slit lamp types have a common mechanical axis of rotation. The various makes only differ in the arrangement of the illuminating beam to either below the microscope body or above it, or by the configuration of the illumination beam being folded once or twice by prisms or mirrors.

Two other special types of slit lamp:

- The hand slit lamp is a handy portable unit providing for slit lamp examinations on sitting or recumbent patients in or out of the ophthalmologic practice (Fig. 10, page 11).
- The bedside or surgical slit lamp is a combination of an operating microscope with a swivelling slit illumination system designed for the examination and treatment of recumbent patients. For this reason there is no real axis of rotation of the illumination system but rather a curved mechanical guide with a virtual axis.

2.4 Electrical system

The only electrical unit a slit lamp requires normally is a low-voltage supply (mains power pack) for powering the low-voltage filament lamp or the more modern and brighter halogen lamp.

It is also an advantage to have a rheostat which varies the lamp voltage within a certain range to enable the brightness to be adjusted to the specific requirements.

2.5 Range of Carl Zeiss slit lamps

The slit lamps from Carl Zeiss feature outstanding performance. The optical transmission of the observation system is extremely high. This results in a minimal light loss in observation and documentation, which in turn reduces light levels for the patient. Due to the high resolution, even the finest structures become visible with a high contrast. The stereo angle of 12.5° provides for the improved three-dimensional differentiation of details to assist in obtaining a reliable diagnosis.

Eyepieces with an exit pupil lying far beyond the optical surfaces (super high-eyepoint eyepieces) also allow spectacle wearers to operate the slit lamp without restriction. Practice-oriented operating comfort is ensured by the single-hand joystick control for fast and precise positioning of the instrument in all three coordinates as well as conveniently positioned controls allowing for sensitive adjustment of the slit image. These Carl Zeiss slit lamps have been developed down to the last detail to provide an instrument designed to aid a sound diagnosis.

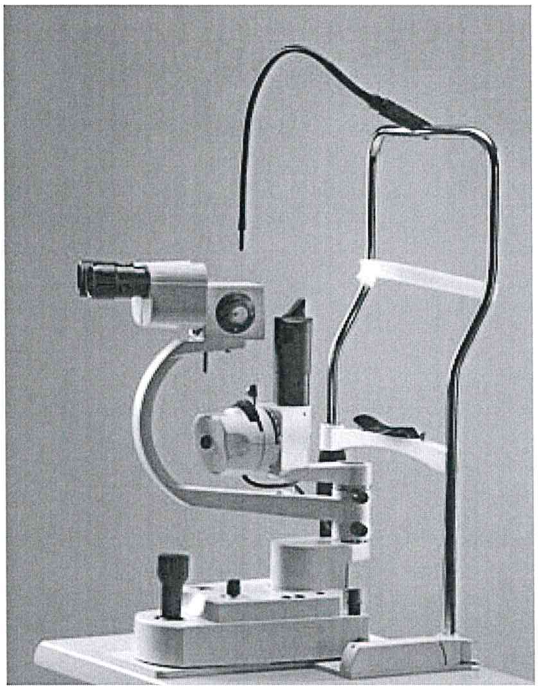


Fig. 7
SL 115 Classic Slit Lamp

The SL 115 Classic Slit Lamp

is the practice-oriented routine instrument for examination and measurement of the eye. The integrated yellow filter and the slit length of 14 mm provide optimum conditions for contact lens fitting. The revolving objective changer allows overall magnifications of 8x, 12x and 20x. The handy plug-and-play concept – the slit lamp is supplied completely mounted – minimizes set-up work. The SL 115 Classic Slit Lamp may, of course, be retrofitted with a compact video camera.

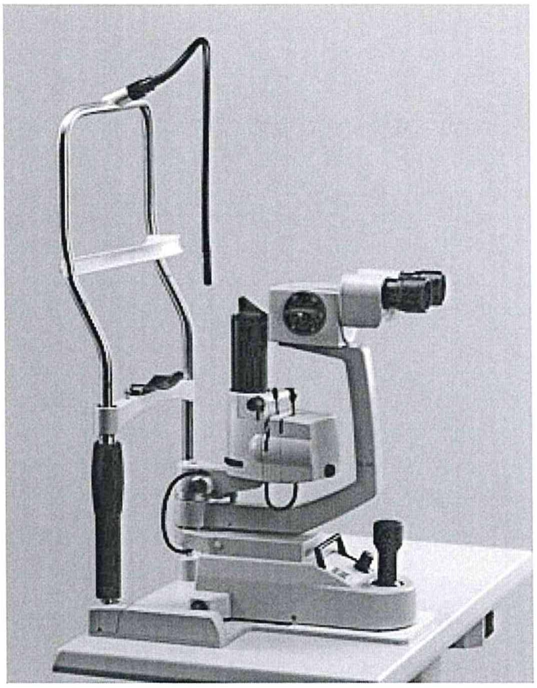


Fig. 8
SL 120 Slit Lamp

The SL 120 Slit Lamp

is the powerful universal instrument with 5-step magnification changer. In combination with 10x eyepieces, the magnification is adjustable from 5x to 32x. As standard the instrument has a convergent tube of f = 140 mm, a parallel tube of f = 140 mm being available as an option. The slit width is continuously adjustable from 0 to 14 mm. The slit length may be varied continuously from 1 – 6 mm and in steps of 0.5, 3.5, 8 and 14 mm.

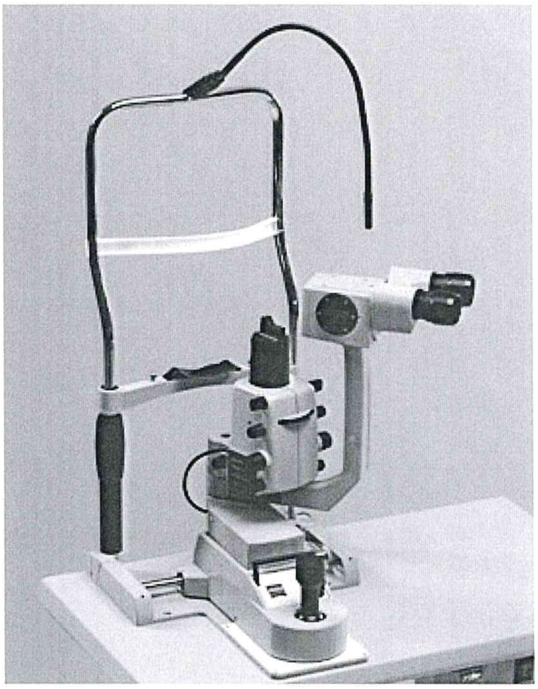


Fig. 9
SL 130 Slit Lamp

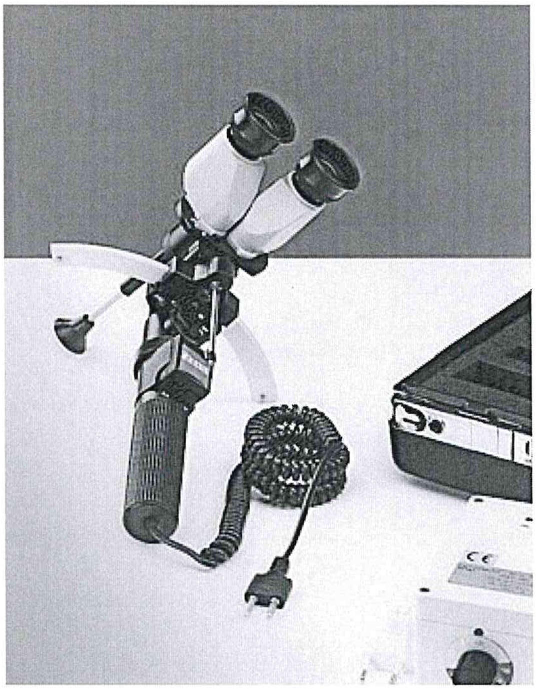


Fig. 10
HSO 10 Hand Slit Lamp

The SL 130 Slit Lamp

is a universal diagnostic instrument with versatile accessories for measurement and documentation.

The slit lamp differs from the previously described models in the different position of slit controls. Slit adjustment is possible from either the right or left and permits viewing with the slit illuminator in the middle position. This enables efficient and sensitive operation particularly when using this slit lamp for laser treatment.

The applications of this slit lamp extend from the anterior segment through the vitreous body to the fundus.

The HSO 10 Hand Slit Lamp

being a portable instrument completes the slit lamp range. It is the ideal combination of a binocular slit lamp with an indirect ophthalmoscope, for the examination of the anterior and posterior eye segment of sitting or recumbent patients. Its special feature is the bilateral lockable arc guide providing true, convenient single hand operation of the instrument. A rechargeable battery further increases the mobility of this slit lamp.

Instrument specifications
Zeiss slit lamps in detail

SL 115 Classic Slit Lamp

Magnifications	8x, 12x, 20x
Field of view	25 mm – 10 mm
Eyepiece magnification	10x high-eyepoint eyepieces, ± 8D compensation of ametropia
Width of slit image	0 – 14 mm, continuously adjustable
Length of slit image	0.5, 3.5, 8, 14 mm, in steps 1 – 14 mm, continuously adjustable
Angle of slit image	± 90°, continuously adjustable
Decentration of slit image	Variable, with click stop at 0°
Swivel range of slit prism	180°, scale for angular difference, click stop at 0°
Angle of incidence	0°, horizontal
Filters	Blue, green (red-free) and swing-in diffusing screen; barrier filter (yellow), swing-in type; UV protection filter, heat-absorbing filter
Free working distance exit prism to patient eye	73 mm
Travel of instrument base	Vertical: 30 mm, X-axis: 110 mm, Y-axis: 90 mm
Vertical travel of headrest	58 mm
Light source	6V 10W halogen lamp
Lamp brightness	Continuously adjustable
Power requirements	100V to 240V ±10%, self-sensing, 50-60 Hz
Weight	Basic unit: 9.75 kg; headrest: 1.25 kg

SL 120 Slit Lamp

Magnifications	5x, 8x, 12x, 20x, 32x (6x, 10x, 16x, 25x, 40x with optional 12.5x eyepiece)
Field of view	40 mm – 6 mm
Eyepiece magnification	10x super high-eyepoint eyepieces, ± 8D compensation of ametropia
Width of slit image	0 – 14 mm, continuously adjustable
Length of slit image	0.5, 3.5, 8, 14 mm, in steps 1 – 6 mm, continuously adjustable
Angle of slit image	± 90°, continuously adjustable, Tabo angle scale
Decentration of slit image	± 4° horizontal, click stop at 0°
Swivel range of slit prism	180°, scale for angular difference
Angle of incidence	0° – 20°, with tiltable prism head (optional)
Filters	Blue, green (red-free) and swing-in diffusing screen; heat-absorbing filter
Free working distance exit prism to patient eye	60 mm
Travel of instrument base	Vertical: 30 mm, X-axis: 110 mm, Y-axis: 90 mm
Vertical travel of headrest	60 mm
Light source	6V 20W halogen lamp
Lamp brightness	Continuously adjustable
Power requirements	100V to 240V ±10%, self-sensing, 50-60 Hz
Weight	Basic unit: 9.25 kg; headrest: 1.25 kg

SL 130 Slit Lamp

Magnifications	5x, 8x, 12x, 20x, 32x (6x, 10x, 16x, 25x, 40x with optional 12.5x eyepiece)
Field of view	40 mm – 6 mm
Eyepiece magnification	10x super high-eyepoint eyepieces, ± 8D compensation of ametropia
Width of slit image	0 – 14 mm, continuously adjustable
Length of slit image	0.3, 2.5, 3.5, 7, 10, 14 mm, triple slit
Angle of slit image	± 90°, continuously adjustable
Decentration of slit image	± 4° horizontal, click stop at 0°
Swivel range of slit prism	180°, scale for angular difference
Angle of incidence	0° – 20°, tiltable
Filters	Blue, green (red-free), grey (neutral) and swing-in diffusing screen; heat-absorbing filter
Free working distance exit prism to patient eye	66 mm
Travel of instrument base	Vertical: 30 mm, X-axis: 110 mm, Y-axis: 90 mm
Vertical travel of headrest	60 mm
Light source	6V 20W halogen lamp
Lamp brightness	Continuously adjustable
Power requirements	100V to 240V ±10%, self-sensing, 50-60 Hz
Weight	Basic unit: 9.85 kg; headrest: 1.25 kg

HSO 10 Hand Slit Lamp

Microscope	Straight binocular tube f = 80 mm with 50 – 75 mm pupillary distance scale
High-eyepoint eyepiece (firmly mounted)	f = 13 mm with +8 to –4D compensation of ametropia
Objective	f = 125 mm
Slit width	Steps of 0.15 and 0.75 mm
Slit length	2 – 12 mm, continuously adjustable
Angle of incidence	0 – 30° to right or left, with clamp
Total weight	850 g (without battery)
Case	Carrying case
Power requirements for battery charger	110V, 220V; 50 – 60 Hz

3. Examination methods – types of illumination.

Biomicroscopy of the living eye is a routine ophthalmologic examination. The slit lamp enables the user to inspect individual eye segments in quick succession to obtain a general impression of the eye and make a diagnosis.

In a slit lamp, the most important type of illumination is the optical section. All other techniques are variations.

For survey examination of the anterior segment the slit is adjusted to full aperture. This results in a circular, very bright and evenly illuminated field that is slightly smaller than the microscope's field of view. By placing a ground glass into the optical path the entire field of view is illuminated.

It is well known that the structure of transparent objects such as the cornea, anterior chamber, eye lens, and vitreous body can only be seen poorly in transmitted or reflected light, as the relative amplitude modulation of light is too weak and the phase modulation is not perceived by the eye. However, such objects can generally be observed well in scattered or fluorescent light.

The basic methods of examination can be classified by the following illumination techniques.

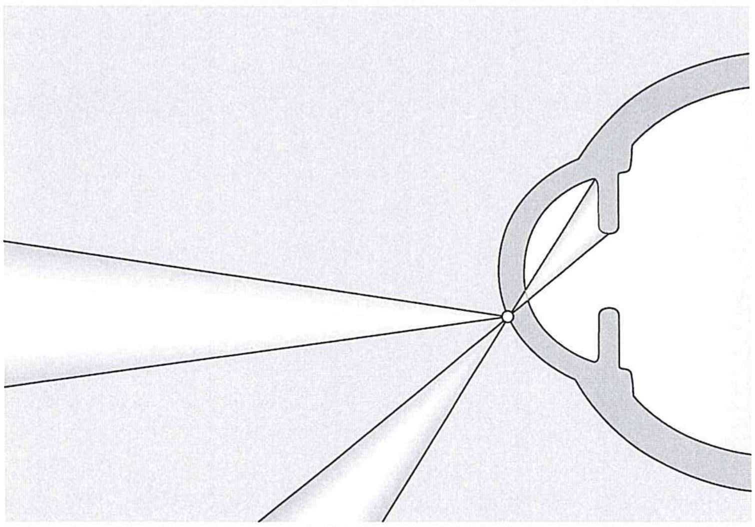


Fig. 11
Direct focal illumination

3.1 Observation by optical section

Observation with an optical section or direct focal illumination (Fig. 11) is the most frequently applied method of examination with the slit lamp. With this method, the axes of illuminating and viewing path intersect in the area of the anterior eye media to be examined, for example, the individual corneal layers.

The angle between illuminating and viewing path should be as large as possible (up to 90°), whereas the slit length should be kept small to minimise dazzling the patient. With a narrow slit (about 0.1 mm to 0.2 mm) and a sufficiently small angular aperture, the illuminating beam takes the form of two knife blades placed edge to edge. Scattered light appears only in this "optical section". The intensity of scattered light depends on the object structures and increases with increasing slit brightness and the higher proportion of short-wave light obtained by an increased colour temperature of the light source.

For good quality observations with a slit lamp it is very important that the light source delivers sufficient short-wave light containing a high as possible blue element, the colour temperature of the lamp therefore should also be high, a requirement normally satisfied by modern halogen lamps.

In conjunction with the stereomicroscope an optical section permits very precise depth information providing precise data of the shape of interfaces of transparent media. With a narrow slit and clear media, the images of slit and object appear sharply focused at the same time. Slit width and magnification may be varied depending on the object to be examined. With this method, brilliant optical section images can be obtained from the cornea through to the rear face of the crystalline lens.

With a narrow slit, the depth and position of different objects (e.g. the penetration depth of foreign bodies, shape of the lens etc.) can be resolved more easily. With a wide slit their extension and shape are visible more clearly (e.g. depth extension of injuries). It is therefore useful to vary the slit width during the examination.

At the cornea an optical section gives a luminous prismatic tissue section. The corneal epithelium is visible in a very thin precisely focused optical section as a thin blue streak right in front of the parenchyma. Examinations of the anterior chamber are performed with wider slit. At low magnification the Tyndall light (Tyndall phenomenon in aqueous humour) is visible in front of the dark pupil. Cells in the aqueous humour, however, are visible only at higher magnifications. During observation it is important that the background always remains as dark as possible.

The crystalline lens is particularly suited for viewing via an optical section. where the discontinuity zones can be made visible with a narrow slit. For examination of the anterior segments of the vitreous body it is advisable to use the smallest possible slit length to avoid dazzling of both patient and examiner. In these examinations, slit brightness should be high.

The slit lamp is specially configured for observation with an optical section. As both microscope and illumination system are mechanically coupled, the slit image is always located in the focal plane and the centre of the field of view of the microscope independent of focusing and selected magnification. Experience has shown that this relationship, if true in air, also applies with sufficient accuracy to the refracting ocular media, provided the operator has adjusted the eyepieces correctly to match his own refraction.

The optical section is rotatable about the slit axis. The slit itself can be aligned vertically or horizontally. Horizontal positioning of the slit however, is an exceptional case in optical section examinations, mainly because stereoscopic vision is restricted if the slit is aligned horizontally. The reason for this is that the slit is no longer perpendicular to the plane in which the viewing axes of the microscope and the lateral disparities of the observer lie.

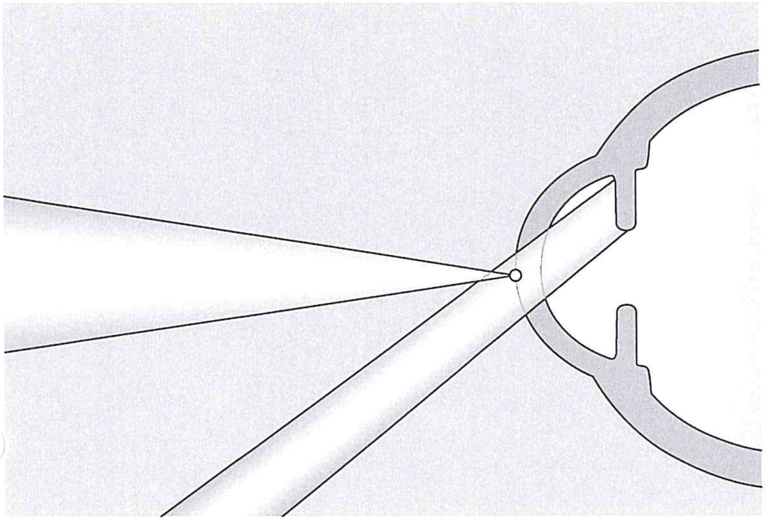


Fig 12
Direct diffuse illumination

Main applications

- Illumination methods for features that stood out in diffuse illumination but could not be observed in detail; particularly suitable for the assessment of cataracts, scars, nerves, vessels, etc.
- Observation by optical section is also of great importance for the determination of the stabilisation axis of toric contact lenses (in connection with a micrometer eyepiece or an appropriately inclined slit).
- Optical sections through the crystalline lens are also particularly good. Capsule, cortex, lens star and cataracts can be observed without difficulty.

Recommended settings
Illumination
- Narrow slit
- Angle of slit illumination system 0° - 45° (for reflected light bright field illumination)
- Angle of slit illumination system 45° - 90° (for reflected light dark field illumination)

For direct focal illumination with wide slit
Slit width: > 0.5 mm
Magnification: approx. 20x - 32x, if necessary, higher
Observation of details, e.g. stromal striae.

For direct focal illumination with narrow slit:
Slit width: 0.1 - 0.3 mm
Magnification: maximum
This is the ideal illumination for minute details providing sufficient contrast and little glare. With this method however, the reduction of the depth of field caused by kerato-ectasia is all too noticeable. In the centre of the image however this effect is not so marked. The narrow slit should also be used for corneal profile observations

3.2 Direct diffuse illumination

If media, especially that of the cornea, are opaque, optical section images are often impossible depending on severity. In these cases, direct diffuse illumination (Fig. 12) may be used to advantage. For this, the slit is opened very wide and a diffuse, attenuated survey illumination is produced by inserting a ground glass screen or diffuser in the illuminating path.

Main applications
This illumination method is applied for:
- general surveys of anterior eye segments
- general observation of the surfaces of crystalline lens and cornea
- assessment of the lachrymal reflex
- assessment of soft contact lenses

Recommended settings
Illumination
- Slit fully opened (annular diaphragm)
- Inserted diffuser
- Microscope positioned at 0°
- Angle of slit illumination system approx. 30° - 50°

Magnification
M = 5x - 12x (for surveys rather less)
M = > 30x (assessment of lachrymal film)

3.3 Indirect illumination

With this method, light enters the eye through a narrow to medium slit (2 to 4 mm) to one side of the area to be examined. The axes of illuminating and viewing path do not intersect at the point of image focus, to achieve this, the illuminating prism is decentred by rotating it about its vertical axis off the normal position (click stop). In this way, reflected, indirect light illuminates the area of the anterior chamber or cornea to be examined (Fig. 13). The observed corneal area then lies between the incident light section through the cornea and the irradiated area of the iris. Observation is thus against a comparatively dark background.

Main applications

- Examination of objects in the direct vicinity of corneal areas of reduced transparency (e.g. infiltrates, corneal scars, deposits, epithelial or stromal defects).

Illumination

- Narrow to medium slit width
- Decentred slit

Magnification

Approx. M = 12x (depending on object size)

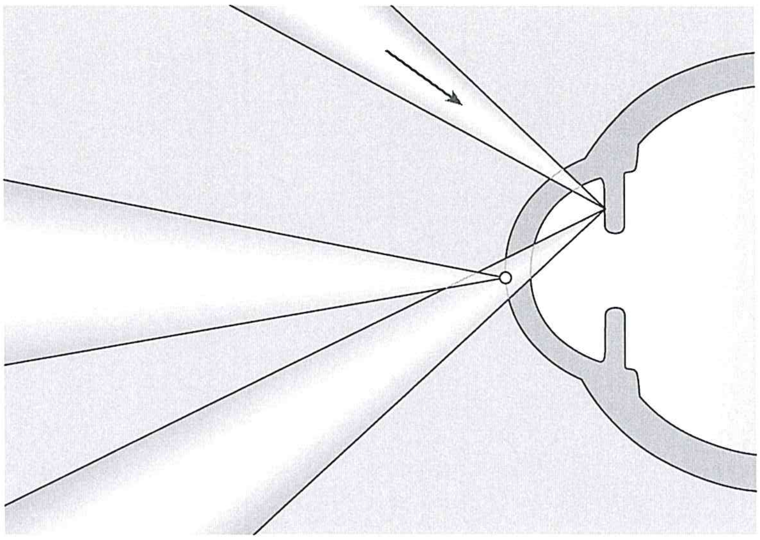


Fig. 13
Indirect illumination

3.4 Retro-illumination

In certain cases, illumination by optical section does not yield sufficient information or is impossible. This is the case, for example, when larger, extensive zones or spaces of the ocular media are opaque. Then the scattered light that is not very bright normally, is absorbed. A similar situation arises when areas behind the crystalline lens are to be observed. In this case the observation beam must pass a number of interfaces that may reflect and attenuate the light.

In such cases, retro-illumination (Fig. 14) often proves to be useful. In his type of illumination, similar to conventional bright-field microscopy, observations are made with transmitted light where the object structures are recognised by differences in absorption. Transmitted light requires a light source on the other side of the object. With retro-illumination, the light is produced secondarily by irradiation. There are two types of retro-illumination. Direct retro-illumination caused by direct reflection at surfaces such as the iris, crystalline lens or the fundus, and indirect retro-illumination caused by diffuse reflection in the medium, i.e. at all scattering media and surfaces in the anterior and posterior segments.

For setting retro-illumination, almost all types of slit lamp have a facility for decentring the slit horizontally. This facility permits lateral adjustment of the slit (which in focal illumination is arranged in the centre of the field) to the left or right of the field of view. The illumination beam is directed past the object onto the fundus.

Retro-illumination from the iris can be used to make visible corneal bedewing and opacity as well as foreign bodies in the cornea. As retro-illumination from the iris is strong, the slit is kept narrow. Structures in the crystalline lens obtain their retro-illumination either through reflection at the back surface of the lens or from the fundus. To utilise the fundus light, the angle between observation and illumination should be

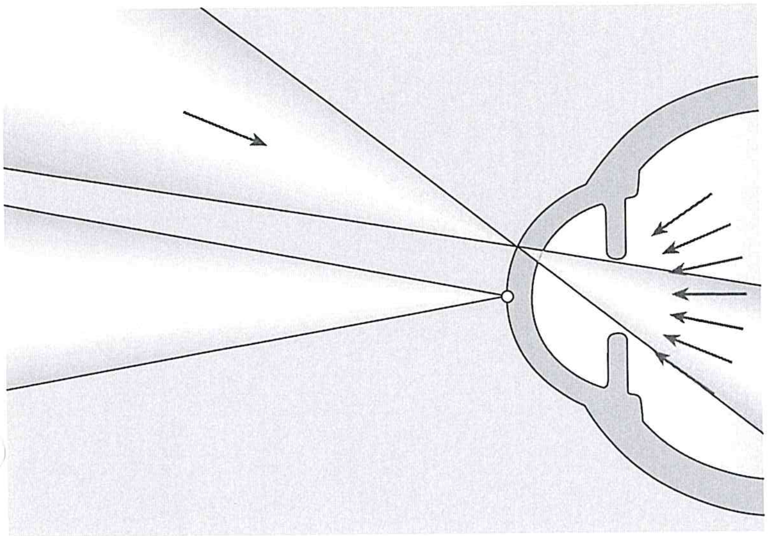


Fig. 14
Indirect retro-illumination

kept small and the passage of the light beam kept far as possible from the object to be observed so that the scattered light from adjacent areas does not disturb observation (Fig. 29). In this way pigmentation, vacuoles and water chinks in the crystalline lens are clearly visible. Indirect illumination is also important for the examination of iris structures.

If the scattered light of the crystalline lens is to be used to make defects in the pigment leaf of the iris visible, the illumination beam of a wide open slit must be shone through the pupil at a wide angle relative to the observation direction without touching the iris.

Adjustment of direct retro-illumination:
Iris reflection (examination in yellow field)

Initially, direct focal illumination is set up, the slit illuminating system is then swung aside temporally until the light reflected by the iris lightens the object to be examined from behind through the cornea. If the microscope remains in the initial position of direct focal illumination (approx. 90° relative to the patient's eye), then this "yellow field illumination" corresponds to transmitted light dark field illumination in normal microscopy. If the viewing background is formed by the pupil, microcysts and vacuoles are seen particularly well via this type of illumination.

If the angle between illumination and observation is increased, by moving the microscope nasally, the resulting illumination corresponds to an examination in transmitted light bright field with the microscope.

- Slit width: 1 - 2 mm
- Magnification: medium to maximum

Observation of

vascularisations, micro cysts, vacuoles, oedemas, particles in lachrymal film, flow rate of lachrymal film, Descemet's membranes.

Lens reflection (examination in white field)

The greyish-white reflected light from the front surface of the crystalline lens lends the name to this type of illumination.

Observation of

superficial corneal defects, scars, particles in the lachrymal film.

Retinal reflection (examination in red field)

Illumination system and observation axis are set to 0°. Similar to skiascopy (or ophthalmoscopy), a reddish corneal reflection appears that is not as bright. This reflection reminds one of the so-called "red eye effect" in normal flash photography. With this type of "red field illumination" it is essential that the pupil is dilated as otherwise the resulting relatively small field of view through a normal size pupil makes observation almost impossible. The colour of the reflection may also "migrate" to yellow if the light is reflected by the papilla.

Observation of

superficial corneal defects, scars, particles in lachrymal film, dystrophy, cataract in neutral corneal area.

3.5 Scattering sclero-corneal illumination

With this type of illumination, a wide light beam is directed onto the limbal region of the cornea at an extremely low angle of incidence and with a laterally decentred illuminating prism. Adjustment must allow the light beam to transmit through the corneal parenchymal layers according to the principle of total reflection allowing the interface with the cornea to be brightly illuminated (Fig. 15). The magnification should be selected so that the entire cornea can be seen at a glance. The slit illumination system is temporarily directed to the scleral region directly adjacent to the limbus.

In its normal physiological state, the cornea is fully transparent and appears completely clear. If the eccentricity of the light is properly adjusted a bright shining ring is visible around the entire limbus.

With irregularities in the structure caused by inclusions, scars, opacities, foreign bodies, etc., light scatter occurs allowing any disturbances, including weak oedemas, small scars and very fine opacities to be located by illumination or shadowing.

- Slit width: > 0.5mm
- Magnification: medium
- Illumination: maximum

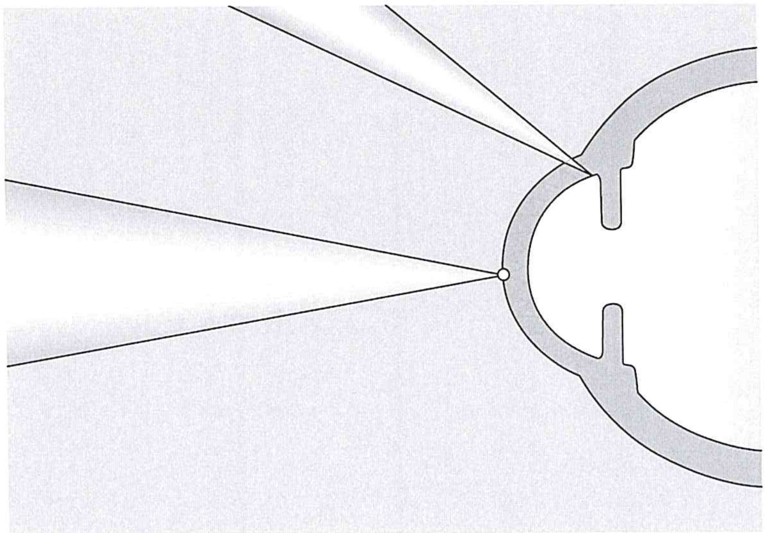


Fig. 15
Scattering sclero-corneal illumination

3.6 Fundus observation and gonioscopy with the slit lamp

Fundus observation is known by ophthalmoscopy and the use of fundus cameras. With the slit lamp, however, direct observation of the fundus is impossible due to the refractive power of the ocular media. In other words: the far point of the eye (punctum remotum) is so distant in front of (myopia) or behind (hyperopia) that the microscope cannot be focussed. The use of auxiliary optics - generally as a lens - makes it possible however to bring the far point within the focusing range of the microscope. For this various auxiliary lenses are in use that range in optical properties and practical application. These lenses are classified in two groups:

- Concave and
- Convex optics.

Concave optics

Concave lenses provide an upright, virtual intermediate image of the fundus. Due to this property, the normal working distance of the slit lamp to the patient is only changed slightly. As the pupil acts like a diaphragm, the stereoscopic field of view is limited with concave lenses.

There are two types of concave lenses widely in use today:

- Fundus contact lens and
- Goldmann 3-mirror or
  4-mirror contact lens = gonioscope.

Concave lenses are divided into negative contact lenses and high-power positive lenses.

The Goldmann fundus contact lens is classified as a negative contact lens. It has a refractive power of - 64 D thus compensating approximately for the refractive power of the cornea and permitting the examination of the posterior pole of the eye to about 30° from the axis.

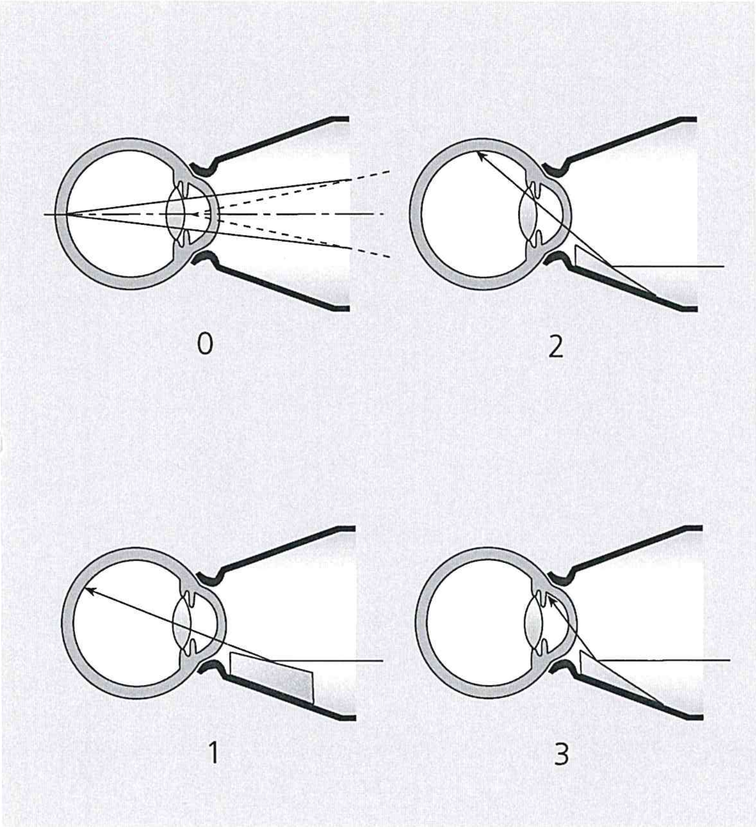


Fig. 16
Scheme of
3-mirror contact lens

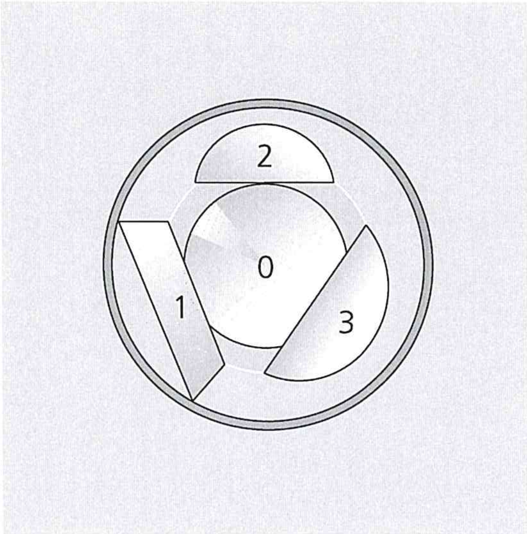


Fig. 17
0 = Observation of central areas of retina
1 = Observation of off-centre areas of retina
2 = Observation of external periphery of retina
3 = Observation of iridocorneal angle

The lateral magnification for the normal eye is 0.91, the axial magnification 0.62. An advantage of the Goldmann fundus lens is that lateral and axial magnification is virtually independent of the patient's refractive power. This is of particular importance when examining the vitreous body. This lens also has a wider monocular and binocular field of view than, for instance, the Hruby lens.

However, contact lenses cannot be used on very sensitive patients and particularly patients just after surgery.

For fundus observation of a myopic patient with one of the concave lenses, the microscope must be moved towards the patient. With myopia of -20 D, the displacement is 18 mm, but only 7 mm for the Goldmann fundus lens.

With a fundus contact lens, only the central region of the fundus can be observed. Therefore, concave lenses are also available with built-in mirrors for observation of the different peripheral fundus regions and sections of the vitreous body or observation of the iridocorneal angle (gonioscopy).

These lenses are available with three mirrors (three-mirror contact lens, Figs. 16 and 17) and also with four (four-mirror contact lens). (Single and double mirror contact lenses being not so popular.) The axial regions of the vitreous body and fundus can be observed by looking through the central area of these lenses (without a mirror), however, a simple fundus contact lens should be preferred in this instance for two reasons. First, it provides better image quality because of its reduced glass thickness, and secondly, the lens is easier to handle than the somewhat larger three-mirror contact lens. The angles of the reflecting surfaces of the Goldmann three-mirror contact lens are 59°, 67° and 73°.

The four-mirror contact lens is a small pyramid, mainly of glass with the vertex removed, in its place is a ground-in recess with a radius of about 8 mm which corresponds to the curvature of an average cornea. The angle of the reflecting surfaces is approximately 62°.

With these lenses, objects are seen as mirror images. Small peripheral holes in the retina that one may fail to see with an ophthalmoscope are easily discerned with a three-mirror contact lens.

Convex optics

Convex lenses produce a reverse, real intermediate image of the fundus. For this reason, a longer distance is necessary between the slit lamp and patient's eye. Most modern instruments however allow for this.

Convex lenses have very large monoscopic or stereoscopic fields of view. This is because the convex lens images the entrance pupil of the microscope at reduced size in the patient's pupil which therefore does not act as a field stop.

Two types of convex lenses are available:
- Contact lens (e.g. contact lens after Schlegel; Panfundoscope) or
- Aspheric plus lens (e.g. auxiliary lens after Bayadi; 90 D Volk lens, aspheric ophthalmoscopic lens AOL 90 D).

The latter are used in indirect ophthalmoscopy where the lens is held by hand about 9 mm in front of the patient's eye. Both slit projector and microscope should be set to a middle position, the slit fully opened, and a medium magnification (about 12x) set on the microscope. The distance between ophthalmoscopic lens and illuminating prism should be about 80 mm. The lens is illuminated in direct focal illumination. It produces a reversed, real image of the fundus that is reduced in size. Without dilation of the pupil the retinal image is visible through the left-hand or right-hand eyepiece. Initially, this image will be obscured by reflections from the cornea. These reflections, however, are eliminated more easily than with the Hruby lens by moving the joystick of the slit lamp laterally. Focusing is as with normal slit image observation. The small fundus image can be further magnified considerably using the magnification changer of the microscope. With a dilated pupil of > 5 mm, the fundus of the eye can be viewed stereoscopically. The field angle is 60° at medium magnification and 40° at a magnification of 20x. With this method even for the inexperienced operator it is relatively easy to see the fundus, its visibility is better than with indirect ophthalmoscopy.

Convex lenses are particularly well suited for the examination of strongly myopic eyes if positioned correctly, lateral and axial magnifications becoming independent of the refractive power of the patient's eye. Simple convex lenses, however, exhibit abnormal field curvatures making them unsuitable for examination of the vitreous body.

Illumination

So far the conditions and methods of fundus observation with the slit lamp have been discussed, but without illumination, observation is impossible. Special requirements have to be met for illumination of the fundus through auxiliary lenses. For all types of auxiliary lens, the size of the pupil limits the maximum adjustable angle between observation and illumination though to a varying degree. This means it will not be possible in every case to bring both observation path and the illuminating beam together in the patient's pupil.

The assessment of peripheral fundus areas that must be viewed under the widest possible angle involves particular difficulties. This is because the entrance pupil of the eye takes a vertically oval form because of the oblique viewing direction thus making it impossible to place both observation and the illuminating paths side by side within the pupil.

This can be remedied by positioning the illuminating beam between the observation beams. This configuration does not allow observation by optical section, but this is not important in fundus examination.

Another practical solution is to examine the peripheral fundus areas with horizontal slit illumination. To achieve focal illumination, it is necessary to rotate the slit to the horizontal plane and then swivel it vertically.

This feature is not provided by all slit lamps on the market.

With concave auxiliary lenses, homocentricity of observation and illumination beams on the fundus can no longer be achieved as strong spherical aberration displaces the slit laterally and vertically. Lateral displacement is generally not disturbing as it can be compensated for by lateral decentration of the slit. Vertical displacement, however, results in an unsharp slit image. It can be brought into focus again by readjustment of both eyepieces.

For concave lenses, the maximum illumination angle (for a given pupil diameter) is wider the higher the refractive power of the auxiliary lens and the shorter its distance from the eye. The maximum adjustable illumination angle becomes smaller with increasing myopia. Convex lenses permit comparatively larger illumination angles with smaller pupils and higher myopia than concave lenses. Convex lenses with their real intermediate image plane, the homocentricity on the fundus between observation and illumination beams is better than with concave lenses.

With all methods of examining the peripheral areas of the vitreous body and the fundus the regions above and below are more easily examined than the lateral regions. This is a result of perspective distortion of the pupil. When observed from above or below, the pupil appears as a horizontal oval through which the two observation paths of the binocular microscope and the illumination path can easily pass but when viewing through the pupil from the side, it appears as a vertical oval, and the three beams cannot pass through together, for this reason the side regions are seen only monocularly. The same refers to gonioscopy (Fig. 18).

Gonioscopy

The iridocorneal angle of the anterior chamber is not visible without additional optical aids as a result of total reflection at the corneal surface. If, however, the eye were immersed in water or the anterior chamber filled with air, the iridocorneal angle would become visible. The same effect is achieved with contact lenses of which different types have been seen in the past. Most of them, however, did not find a general acceptance. Today only the mirror contact lenses as introduced by GOLDMANN are of major importance in slit lamp examinations. Fig. 16 shows the beam paths in a mirror contact lens.

Meanwhile this examination method has become a standard. Its importance having grown since the introduction of laser trabeculoplasty for glaucoma treatment (laser mirrored contact lens).

The mirror contact lens is either held by hand or with a special holder. With this lens the region of the retina or the iridocorneal angle that is opposite the mirror used, becomes visible as a mirror image. By rotating the lens about its axis the complete iridocorneal angle can be seen. To view the angle more from the iris plane or along the inner corneal surface, the lens must either be slightly tilted relative to the corneal axis or the patient must slightly change the direction of vision. Illumination is by means of the slit illuminator. For good reflex-free illumination it is useful to rotate the slit so that it is perpendicular to the iridocorneal angle. It may be necessary to set an appropriate angle between the illumination and observation beams. With a horizontal slit this is not possible on all instruments. The examination of the iridocorneal angle requires good stereoscopic observation through the microscope. In optical section, the iridocorneal angle can best be seen at the 12 and 6 o'clock position.